

# BLACK HILLS PLATEAU PRODUCTION COMPANY

## DRILLING PROGRAM

### Homer Deep Unit #7-23CH

SHL: 1894' FSL, 2648' FWL, NESW Sect. 7 T8S R98W

BHL: 750' FNL, 1665' FEL NWNE Sect. 20 T8S R98W

Garfield & Mesa Counties, Colorado

**NOTE:** This drilling program is as of January 15, 2015. Well is being proposed as a horizontal in the Mancos/Niobrara formation.

#### 1) Estimated Formation Tops of Important Geological Markers:

Location GL: 5,669.0' (Graded), KB: 5,693.0' (Estimated)

Formation	MD	TVD	Subsea TVD	Lithology	Oil/Gas/Water
Wasatch	Surface	Surface	Surface	Sandstone & Shale	No Potential Gas
Mesaverde	859	859	4,825	Sandstone	Gas or Water
Cameo Coal	2,897	2,895	2,789	Coal, Silt & Sandstone	Oil, Gas or Water
Rollins	3,216	3,214	2,470	Sandstone	Oil, Gas or Water
Cozzette	3,385	3,383	2,301	Sandstone & Silt	Oil, Gas or Water
Corcoran	3,591	3,589	2,095	Sandstone & Silt	Oil, Gas or Water
Mancos	3,799	3,797	1,877	Shale & Silt	Oil, Gas or Water
Mancos 'A'*	4,266	4,264	1,420	Shale & Silt	Oil, Gas or Water
Moab	5,002	5,000	684	Bentonite Marker	
Mancos 'B'*	5,456	5,454	230	Shale & Silt	Oil, Gas or Water
Niobrara*	6,473	6,470	-786	Calcareous Shale & Silt	Oil, Gas or Water
Target/Landing*	7,576	7,069	-1,385	Calcareous Shale & Silt	Oil, Gas or Water
Permit TD	16,711	6,824	-1,140		

\* Projected completion intervals.

#### 2) Proposed Casing and Cementing Program

Hole Size (in)	Casing Size (in)	Depth Set MD	Wt./Ft., Grade, & Joint	Cement
30	20	120	Line Pipe	To surface w/ Class 3; 320 sx
14-3/4	10-3/4	1,000	40.5#, J55, ST&C	Cemented to surface w/ Lead: 170 sx Class G (12.3 ppg) Tail: 250 sx Class G (12.8 ppg)
9-7/8	7-5/8 (DV Tool @ ±3,800')	6,350	29.7#, N-80, LTC	Cemented 200' into surface casing w/ Stage 1 - Lead: 125 sx Class G (12.5 ppg) Tail: 325 sx Class G (13.5 ppg) Stage 2 - Tail: 500 sx Class G (12.5 ppg)
6-3/4	4-1/2 x 5-1/2 Tapered String (XO @ ±6,000')	16,711	4-1/2: 11.6#, P-110, LTC 5-1/2: 17#, P-110, LTC	Cemented 200' into intermediate casing w/ Lead: 125 sx HALCEM (12.6 ppg) Tail: 1400 sx HALCEM (13.5 ppg)

#### Yields **Surface:**

Surface Lead

Class G

Yield = 2.35 ft<sup>3</sup>/sk (12.3 ppg)

Surface Tail

Class G

Yield = 2.08 ft<sup>3</sup>/sk (12.8 ppg)

#### **Intermediate - Stage 1:**

Intermediate Lead

Class G

Yield = 1.77 ft<sup>3</sup>/sk (12.5 ppg)

Intermediate Tail

Class G

Yield = 1.50 ft<sup>3</sup>/sk (13.5 ppg)

#### **Intermediate - Stage 2:**

Intermediate Tail

Class G

Yield = 2.27 ft<sup>3</sup>/sk (12.5 ppg)

**Production:**

Longstring Lead

Class G

Yield = 1.75 ft<sup>3</sup>/sk (12.6 ppg)

Longstring Tail

Class G

Yield = 1.51 ft<sup>3</sup>/sk (13.5 ppg)

- 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 pressures 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 set at 1,000' and cemented back to surface either during the primary cement job or by remedial cementing. Cementing to surface will isolate all potential fresh water zones. Slurry designed for full coverage with 50% excess.
- Intermediate casing is designed to have cement lifted at least 200' above TOG. Actual cement volumes will be determined by caliper log plus 10% excess. If caliper logs are not available, volume will be assumed hole size to TD plus 25% excess.
- Production casing is designed to have cement lifted at least 200' into the intermediate shoe. Actual cement volumes will be determined by caliper log plus 10% excess. If caliper logs are not available cement volumes will be calculated at 25% excess.
- Centralizers will be installed per approved centralizer program from cement vendor.
- All waiting on cement times will be adequate to achieve a minimum of 500 psi compressive strength at the casing shoe prior to drilling out. 2,500 psi compressive strength in 72 hours.

**Casing Design** (All casing will be new or reconditioned and tested to meet or exceed API standards):

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/K-55	STC	1,580	3,130	420	1.10	1.10	1.80
7-5/8	29.7	N-80	LTC	4,790	6,890	575	1.10	1.10	1.80
5-1/2	17.0	P-110	LTC	7,460	10,640	546	1.10	1.10	1.80
4-1/2	11.6	P-110	LTC	7,560	10,690	367	1.10	1.10	1.80

**Casing Design Considerations/Safety Factors:**

**A. Surface Casing @ 1,000' MD; 10-3/4" 40.5# J/K-55**

Purpose: Protect shallow fresh water and contain MASP to TD

Maximum anticipated mud weight at surface casing depth:

9.0 ppg

Maximum anticipated mud weight at intermediate TD:

9.8 ppg

Maximum anticipated equivalent formation pressure at TD:

11.0 ppg

TVD at production casing point:

6,350 ft

Surface setting depth:

1,000 ft

Max pore pressure:

0.572 psi/ft

**Collapse Design:**

Evacuated casing with 9.0 ppg drilling fluid density

Load = 9.0 ppg \* 0.052 \* 1000 ft

468 psig

Rating

1,580 psig

Safety Factor

3.38

**Burst Design:**

Assume kick with partially evacuated hole and influx gradient of 0.22 psi/ft

(Calculations assume shoe will not break down)

MASP (Load) = 6,350 ft \* (0.572-0.22) psi/ft

2,235 psig

Rating

3,130 psig

Safety Factor

1.40

**Tensile Design:**

Designed on Air Weight \* Buoyancy + OverPull Margin

Load = 1000 ft \* 40.5 lb/ft \* 0.862 + 100,000 lbs (OPM)

Rating

Safety Factor

OverPull with S.F. = 420,000 lbs / 1.8 – 34,911 lbs

134,911 lbs

420,000 lbs

3.11

198,422 lbs

**B. Intermediate Casing @ 6,350' MD; 7-5/8" 29.7# N-80**

Maximum anticipated mud weight at Total Depth:

Maximum anticipated equivalent formation pressure at TD:

TVD at production casing point:

Assumed Gas Gradient for Production Operations:

9.8 ppg

11.0 ppg

7,069 ft

0.22 psi/ft

**Collapse Design:**

Designed on evacuated casing properties with 9.8 ppg drilling fluid density with no internal back-up

Load = 9.8 ppg \* 0.052 \* 7,069 ft

Rating

Safety Factor

3,602 psig

4,790 psig

1.33

**Burst Design:**

Maximum Surface Shut-In Pressure

MASSIP (Load) = 7,069 ft \* (0.572-0.22) psi/ft

Rating

Safety Factor

2,488 psig

6,890 psig

2.77

**Tensile Design:**

Designed on Air Weight \* Buoyancy + OverPull Margin

Load = (6,350 ft \* 29.7 lb/ft \* 0.850) + 100,000 lbs (OPM)

Rating

Safety Factor

OverPull with S.F. = 575,000 lbs / 1.8 – 156,500 lbs

256,500 lbs

575,000 lbs

2.24

162,900 lbs

**C. Production Casing @ 16,711' MD; 5-1/2" 17# P-110 x 4-1/2" 11.6# P-110**

Maximum anticipated mud weight at Total Depth:

Maximum anticipated equivalent formation pressure at TD:

TVD at production casing point:

Cross-Over Location

Maximum Surface Treating Pressure for Fracture Operations

Assumed Gas Gradient for Production Operations:

11.5 ppg

11.0 ppg

7,069 ft

6,000 ft

6,500 psig

0.22 psi/ft

**Collapse Design:**

Designed on evacuated casing properties with 11.5 ppg drilling fluid density with no internal back-up

Load = 11.5 ppg \* 0.052 \* 7,069 ft

Rating

Safety Factor

4,227 psig

7,460 psig

1.76

**Burst Design:****Design Consideration #1: Maximum Surface Shut-In Pressure**

MASSIP (Load) = 7,069 ft \* (0.572-0.22) psi/ft

Rating

Safety Factor

2,488 psig

10,640 psig

4.28

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

MSTP

Rating

Safety Factor

6,500 psig

10,640 psig

1.64

**Tensile Design:**

Designed on Air Weight \* Buoyancy + OverPull Margin

Load = (6,000 ft \* 17.0 lb/ft + 1,069' \* 11.6 lb/ft) \* 0.824 + 100,000 lbs (OPM)

194,300 lbs

Rating

546,000 lbs

Safety Factor

2.81

OverPull with S.F. = 546,000 lbs / 1.8 – 94,300 lbs

209,000 lbs

**3) Operator's Minimum Specifications for Pressure Control:**

Please reference enclosed BOP Diagram.

The blowout preventer assembly shall consist of one 11" 5,000 psi double ram preventer, and an 11" 5,000 psi annular preventer. All will be hydraulically operated. The BOP pipe and blind rams will be hydraulically tested to 100% of working pressure (if isolated from the surface casing with a test plug) or to 70% of the internal yield of the surface casing after nipping up. The annular preventer will be tested to 50% of its' working pressure rating for 10 minutes or until provisions for the test are met. The pipe rams and blind rams will be function tested on each trip out of the hole, but not more than once per day. All such checks will be noted on the daily Tour Sheets.

Accessories to the BOPE include an upper and lower kelly cock, a sub on the floor with a full opening valve to be stabbed into the drill string when the kelly is not in the drill string, a drill pipe float (except for lost circulation conditions), and a choke manifold with a pressure rating equivalent to the BOP stack. An accumulator with a minimum of 1.5 times the volume of fluid necessary to close all BOP equipment will be part of the BOP system.

Remote controls capable of both opening and closing all preventers will be readily accessible to the driller. A manual locking device (i.e., hand wheels) or automatic locking devices shall be installed as part of the system. The BOP will be kept in good mechanical working order. Checks and inspections will be recorded on daily Tour Sheets.

Primary BOP actuating control will be located either in the doghouse or on the rig floor.

Sufficient mud volume and weight material will be maintained on location to overcome any flows.

**Auxiliary Equipment:**

- a) A Kelly Cock will be kept in the drill string at all times.
- b) A float will be used at the bit at all times (except for lost circulation drilling condition).
- c) A full-opening drill pipe stabbing valve (inside BOP) with proper drill pipe connection will be on the rig floor at all times.
- d) The drilling fluids systems will be visually monitored at all times.

**4) Mud Program:**

Hole (in)	Depth (ft)	Type	Weight (ppg)	Viscosity (cps)	Fluid Loss (cc)	Solids (%)
30	120	Spud Mud	8.9-9.4	60 - 80	<10	1 - 5
14-3/4	1,000	Gel/Polymer	9.0-10.0	50 - 65	≤6	≤6
9-7/8	6,350	Gel/Polymer	9.5-11.5	45 - 55	≤5	≤5-6
6-3/4	16,711	Gel/Polymer	10.0-12.0	40 - 45	≤5	≤5-6

\* Sufficient mud material(s) to maintain mud properties, control lost circulation and contain a blowout will be available at the well site during drilling operations.

\*\* A closed loop system will be utilized during drilling operations.

**5) Auxiliary Equipment:**

1. A Kelly Cock will be kept in the drill string at all times.
2. A float will be used at the bit at all times (except for lost circulation drilling condition).
3. A full-opening drill pipe stabbing valve (inside BOP) with proper drill pipe connection will be on the rig floor at all times.
4. The drilling fluids systems will be visually monitored at all times.

**6) Testing, Logging and Core Programs:**

Deviation Surveys:

0' to 1,000'	Totco (7°) – survey every ±200'
1,000' to 5,300'	Totco (7°) – survey every ±300'
5,300' to TD	±90 ft MWD w/ INC, AZM , & GR

Mud Log:

2-Man Unit with chromatograph 3000' to TD

Samples:

100 ft samples	3,000' to 3,500'
30 ft samples	3,500' to 7,000'
10 ft samples	7,000' to 7,600'
10-30 ft samples	7,600' to TD

M/LWD Logging Program:

MWD Gamma Ray and/or Resistivity with surveys from 3,500' – TD

Open Hole Logging Program:

Triple Combo w/Spectral GR/DIL/FDC/CNL-Sonic 1,000' to 6,350' MD

Cores: Possible sidewall cores in Williams Fork and/or Mancos

DST's: None planned

**7) Anticipated Abnormal Pressures or Temperatures:**

1. No abnormal pressures or temperatures are anticipated.
2. No H<sub>2</sub>S gas has been encountered in or known to exist in the general area.
3. Pressures; Mancos pressure 0.57 psi/ft.
4. Estimated bottom-hole pressure is 4,029 psi.

**8) Anticipated Starting Dates and Approximate Duration:**

Starting Date:	April 1, 2015
Spud Date:	April 1, 2015
Drilling Days:	45 days
Completion Days:	30 days

Notes: Per OnShore Order 1, 3/7/07 the former 8 point drilling plan (also referred to as the Subsurface Use Plan)

Due to the voluminous requirements of horizontal drilling, a larger well pad and pit are being proposed. The pit will be lined with 2 synthetic liners, each having a minimum of 24 mil thickness as per COGCC regulation 904.c.(1). The pit will contain freshwater and/or recycled flowback water for makeup water during drilling and fracture stimulation during completions.