

## Garden Creek 21-32H

SHL: NENE Section 32-T11N-R62W

BHL: NWNW Section 29-T11N-R62W

Weld County, Colorado

### Drilling Plan

#### THIS PLAN INCLUDES TWO WELL DESIGN OPTIONS:

- Option #1: 5½" Production Casing (No 7" Intermediate Casing)
- Option #2: 7" Intermediate Casing will be run

The primary plan is Option #1; however, if hole conditions dictate, Option #2 will be utilized.

#### **1. ESTIMATED TOPS OF IMPORTANT GEOLOGIC MARKERS & ANTICIPATED WATER, OIL, GAS OR MINERAL FORMATIONS:**

Formation	TVD @ 0' VS (ft)	MD (ft)	TV Thickness (ft)	Hydrocarbon / Water Bearing Zones
White River	0	0	694	
Fox Hills	694	694	243	Fresh Water
Pierre Shale	937	937	2484	
Terry SS	3421	3421	640	
Hygiene	4061	4061	2934	
<b>KOP (start curve)</b>	<b>6663</b>	<b>6663</b>		
Sharon Springs	6995	7029	71	Oil / Gas
Niobrara	7055	7122	15	Oil / Gas
Codell	<b>7126</b>	<b>7293</b>	179	Oil / Gas
<b>Land Curve / ICP (Option #2)</b>	7141	7413		Oil / Gas
<b>TD Lateral @ BHL</b>	7141	<b>13630</b>		Oil / Gas

- All shows of fresh water and minerals will be adequately protected and reported.
- Gas detection to be operational prior to drilling out surface casing.

#### **2. PRESSURE CONTROL EQUIPMENT**

All well control equipment shall be in accordance with Onshore Order #2 for 3M systems. Well control equipment will be rigged up after setting surface casing.

The minimum specifications for pressure control equipment that will be provided are included on the attached schematic diagram showing size and pressure ratings.

5000# BOP with 4" or 4½" Pipe Rams

5000# BOP with Blind Rams

3000# or 5000# Annular

Auxiliary equipment to be used:

- Upper kelly cock with handle available.
- Stabbing Valve

The choke manifold will include appropriate valves and adjustable chokes. The kill line will have one check valve.

Ram type preventers will be pressure tested to full working pressure (utilizing a tester and test plug) at:

- Initial installation
- Whenever any seal subject to test pressure is broken
- Follow related repairs
- 30-day intervals

The annular preventer will be pressure tested to 50 percent of the rated working pressure.

All pressure tests shall be maintained at least 10 minutes or until provisions of the test are met, whichever is longer.

Annular preventers shall be functionally operated at least weekly.

Pipe and blind rams shall be activated each trip, however, not more than once each day.

A BOPE pit level drill will be conducted weekly for each drilling crew.

All tests and drills will be recorded in the drilling log.

The accumulator will have sufficient capacity to open the HCR valve, close all rams plus the annular preventer, and retain 200 psi above pre-charge pressure without the use of closing unit pumps. The system will have two independent power sources to close the prevents in accordance with 3M system requirements outlined in Onshore Order #2

Remote controls shall be readily accessible to the driller. Master controls shall be at the accumulator.

### 3. CASING & CEMENTING PROGRAM:

A. The proposed casing program will be as follows:

#### OPTION 1

Section	MD (ft)	Hole Size (")	Csg Size (")	Grade	Weight	Thread	Condition
Surface	0 - 1087'	13 1/2"	9 5/8"	J-55	36.0	STC	New
Production	0 - 13630'	8 3/4"-7 7/8"	5 1/2"	P-110	17.0	LTC	New

**\*\*NOTE - 8 3/4" hole from surface down through curve and 7 7/8" hole in lateral**

Size (")	Grade	Weight (lbs/ft)	Thread	Collapse (psi)	Burst (psi)	Pressure Gradient Collapse (psi/ft)	Pressure Gradient Burst (psi/ft)
9 5/8"	J-55	36.0	STC	2020	3520	0.47	0.50
5 1/2"	P-110	17.0	LTC	7460	10640	0.50	0.50

## OPTION 2

Section	MD (ft)	Hole Size ( " )	Csg Size ( " )	Grade	Weight	Thread	Condition
Surface	0 - 1087'	13 1/2"	9 5/8"	J-55	36.0	STC	New
Intermediate	0 - 7413'	8 3/4"	7	P-110	23.0	LTC	New
Production	KOP- 13630'	6 1/8"	4 1/2"	HCP-110	11.6	LTC	New

**\*\*NOTE - 4 1/2" production string will be a liner, utilizing a liner hanger with pack-off assembly**

Size (")	Grade	Weight (lbs/ft)	Thread	Collapse (psi)	Burst (psi)	Pressure Gradient Collapse (pst/ft)	Pressure Gradient Burst (psi/ft)
9 5/8"	J-55	36.0	STC	2020	3520	0.47	0.50
7"	P-110	23.0	LTC	5650	8720	0.50	0.50
4 1/2"	P-110	11.6	LTC	7580	10690	0.50	0.50

All casing strings below the conductor shall be pressure tested to 0.22 psi/ft of casing string length or 1500 psi, whichever is greater, but not to exceed 70% minimum internal yield.

B. The proposed cementing program will be as follows:

After cementing, but not before commencing any test, casing strings will stand cemented until cement has reached a compressive strength of 500 psi at the shoe. WOC times will be recorded in the driller's log.

**Surface String:** Cement will be circulated to surface. Estimated volume (gauge hole + 20% excess):

**LEAD (0-550' above TD):** 128 sx Class C Cement @ 12.0 ppg, 2.46 ft<sup>3</sup>/sx  
**TAIL (550' above TD-TD):** 221 sx Type III Cement @ 14.2 ppg, 1.46 ft<sup>3</sup>/sx  
**Top Out (if required):** Type III Cement + 2% CaCl<sub>2</sub> @ 14.2 ppg, 1.46 ft<sup>3</sup>/sx

## OPTION 1

**Production String:** Cement will be circulated to surface shoe. Estimated volume (gauge hole + 30% excess in open hole):

**LEAD (surface shoe-KOP):** 969 sx Class G Cement @ 12.5 ppg, 1.89 ft<sup>3</sup>/sx  
**TAIL (KOP - TD):** 905 sx Class G Cement @ 13.0 ppg, 1.82 ft<sup>3</sup>/sx

Actual cement volumes used on the production string will be calculated and adjusted based upon openhole caliper logs and/or gauge hole + 30%.

**OR**

Cement will be circulated from LD to surface. Estimated volume (gauge hole + 30% excess in openhole).

**LEAD (0 - KOP):** 1158 sx Class G Cement @ 12.5 ppg, 1.89 ft<sup>3</sup>/sx  
**TAIL (KOP - LD)** 144 sx 50/50 Poz G @ 13.5 ppg, 1.71 ft<sup>3</sup>/sx  
**(LD - TD):** Uncemented with Swell Packers

## OPTION 2

**Intermediate String:** Cement will be circulated to surface shoe. Estimated volume (gauge hole +25% excess):

**LEAD (surface shoe - KOP):** 535 sx Class G Cement @ 12.5 ppg, 1.89 ft<sup>3</sup>/sx  
**TAIL (KOP - ICP):** 77 sx 50/50 Poz G @ 13.5 ppg, 1.71 ft<sup>3</sup>/sx

**Production Liner:** Uncemented with Swell Packers

**OR**

**TAIL (KOP - TD):** 416 sx Class G Cement @ 13.0 ppg, 1.82 ft<sup>3</sup>/sx

Cement will be circulated to the top of the liner (KOP). Estimated volume (gauge hole + 15% excess in open hole), 0% excess in 7"x4½" casing annulus.

Annual cement volumes used on the production liner will be calculated and adjusted based on openhole caliper logs and/or gauge hole + 30%.

## **4. DRILLING FLUIDS PROGRAM:**

Interval	Type	Weight	Viscosity	Ph	Water Loss (cc)	Remarks
Surface	Spud	8.4 - 9.0	30 - 45	8	NC	WBM - Gel / Lime as required
Surface to KOP	Water or LSND or OBM	8.4 - 9.8	28 - 50	8 - 9	NC-6	Fresh Water Or WBM - Polymer system Or OBM - Oil based mud
KOP to TD	LSND or OBM	8.4 - 9.8	30 - 50	8 - 9	NC-6	WBM - Polymer system Or OBM - Oil based mud

**NC = No Control**

Sufficient quantities of mud material will be maintained on site or be readily accessible for the purpose of assuring well control. SPR will be recorded on daily drilling report after mudding up.

**5. EVALUATION PROGRAM:**

<b>OH Logs (while drilling)</b>	MWD-GR GR (Cased Hole)	KOP to TD Surface casing to KOP
<b>OH Logs (wireline):</b>	None Anticipated	
<b>Cores:</b>	None Anticipated	
<b>DST's:</b>	None Anticipated	

**6. ABNORMAL CONDITIONS:**

No anticipated abnormal pressures or temperatures expected to be encountered. No hydrogen sulfide expected.

**7. OTHER INFORMATION:**

The anticipated starting date and duration of the drilling and completion operations will be as follows:

Starting Date:	Upon Approval
Duration:	60-90 Days

The well will be drilled from surface location to bottom hole location per attached directional plan. The proposed well path should not pose any collision or interference concerns with any existing wells along its proposed path.

**OPTION 1**

**Penetrate Codell Formation:**

439' FNL 725' FEL Section 32 -T11N- R62W

**Top Perforation of Productive Interval**

600' FSL 1535' FEL Section 29 -T11N- R62W

**OPTION 2**

**Penetrate Codell Formation:**

439' FNL 725' FEL Section 32 -T11N- R62W

**Top Perforation of Productive Interval**

600' FSL 1535' FEL Section 29 -T11N- R62W