

## Appendix C

### MASTER DRILLING PLAN (MDP) DOTY MOUNTAIN PLAN OF DEVELOPMENT (POD)

#### OPERATORS (The Companies):

Warren E & P, Inc. (Warren)

Double Eagle Petroleum Company (Double Eagle)

Anadarko E & P Company (Anadarko)

Sections 14 & 22, T17N R91W, 6th PM, Carbon County, Wyoming

BLM Leases: WYW116179, WYW133658, WYW137692, WYW141686

#### Drilling Plan for the subject wells listed below:

##### Gas Wells in Section 14

- |                                      |                                       |
|--------------------------------------|---------------------------------------|
| 1. AR Federal 17-91-1-14 (WYW133658) | 5. AR Federal 17-91-9-14 (WYW116179)  |
| 2. AR Federal 17-91-3-14 (WYW133658) | 6. AR Federal 17-91-11-14 (WYW116179) |
| 3. AR Federal 17-91-5-14 (WYW133658) | 7. AR Federal 17-91-13-14 (WYW116179) |
| 4. AR Federal 17-91-7-14 (WYW133658) | 8. AR Federal 17-91-15-14 (WYW116179) |

##### Gas Wells in Section 22

- |                                       |  |
|---------------------------------------|--|
| 9. AR Federal 17-91-1-22 (WYW137692)  | 13. AR Federal 17-91-9-22 (WYW116179)  |
| 10. AR Federal 17-91-3-22 (WYW141686) | 14. AR Federal 17-91-11-22 (WYW141686) |
| 11. AR Federal 17-91-5-22 (WYW141686) | 15. AR Federal 17-91-13-22 (WYW141686) |
| 12. AR Federal 17-91-7-22 (WYW141686) | 16. AR Federal 17-91-15-22 (WYW141686) |

##### Deep Injection Well in Section 22

AR Federal 17-91-22I (WYW141686)

**1. ESTIMATED TOPS OF IMPORTANT GEOLOGIC MARKERS**

<b>Formation</b>	<b>Depth</b>
Lewis Shale	Surface
Isolated Sands in Lewis Shale	1000'
Almond	1490' – 1995'
Pine Ridge	1940' – 2445'
Allen Ridge	2065' – 2570'
TD (Gas Wells)	2275' – 2790'
Cherokee/Deep Creek Sandstones	3800' - 4600'

**2. ESTIMATED DEPTH OF ANTICIPATED WATER, OIL, GAS OR MINERAL FORMATIONS**

Almond	Methane gas
Pine Ridge	Methane gas
Allen Ridge	Methane gas

The Lewis Shale is not anticipated to contain any zones capable of producing water. There are several zones within the Mesaverde Group capable of producing fresh water, including the coal seams. The Companies propose to test the productive formations between 1,490' and 2,570.' Several coal seams may be tested for gas production to total depth. All shallow water zones will be protected with casing and cement. Cement will be brought above the base of the Lewis Shale to isolate all formations in the Mesaverde Group.

**Planned Objective for CBM Wells: Mesaverde**

**3. MINIMUM BLOW OUT PREVENTOR (BOP) REQUIREMENTS (refer to attached schematics)**

1. The BOPE will conform to Onshore Shore Order #2. The blowout preventer equipment will consist of a 2000 psi W.P. Double Ram, Hydraulic Preventer (enclosed). All fill and kill lines will be 2000 psi W.P. From 0-160' there will be no pressure control. From 160'-1,600' the 2,000# system will provide control. Note: These wells are proposed as coal bed natural gas (CBNG) wells. Data from a number of wells drilled in the area to test for CBNG indicate that the maximum anticipated surface pressure will not exceed 250 psi, thus the BOP will be tested to 1,000 psi. (see attached schematic).
2. The BOP shall be pressure tested when initially installed, whenever any seal subject to pressure testing is broken, after repairs, or every 30 days.
3. The Companies shall notify the Rawlins BLM office 24 hours prior to the BOP test.

**4. SUPPLEMENTAL INFORMATION**

The primary objective of this project is to drill, stimulate, and produce natural gas from coal seams in recognized gas-producing formations of the Mesaverde Group. The coal seams are overpressured and are very unlikely to be in communication with overlying layers. Produced water will be injected in one of two deep injection wells completed in the Cherokee/Deep Creek Sandstones. The coal seams will be perforated and stimulated by hydraulic enhancement or fracturing during testing. Fresh water, gelled water, and/or foam fracturing techniques will be used.

The following schematics that show typical facilities, operating standards, and methodologies, are attached to this MDP: [B.O.P.](#); [Bottom Flange](#); [Configuration Options](#); [Completed Well](#); and [Injection Well](#). Additional schematics for this POD are attached to the [Master Surface Use Program \(MSUP\)](#): [Drill Site Layout](#); [Well Site](#); [Water Disposal Facility](#); [Water Transfer Facility](#); and [Compressor Station](#).

**5. CASING PROGRAM**

<u>Hole Size</u>	<u>Casing Size</u>	<u>Casing Wt.</u>	<u>Grade</u>	<u>Joint</u>	<u>Depth Set</u>	<u>New/Used</u>	<u>Rng</u>	
12 ¼"	9 "	32.3#	H-40	ST&C	10% of well depth	New	3	
9 "	7"	23#	MC-50	LT&C	0-TD	New	3	
<b>Surface Casing:</b>		9 "	32.3 ppf.	H-40	STC	Collapse	Burst	Tension
					<b>Ratings:</b>	1370	2270	2254M

- A.  $Burst = [0.052 * FG * TVD (shoe)] - [Gas Gradient * TVD]$   
 $= [0.052 * 9.3ppg * 280'] - [0.1psi/ft * 280']$   
 $= 107.4psi$   
 Safety Factor = Rating/Burst  
 $= 2270/107.4$   
 $= 21.14$
  
- B.  $Collapse = 0.052 * MW * TVD (shoe)$   
 $= 0.052 * 8.8ppg * 280'$   
 $= 128psi$   
 Safety Factor = Rating/Collapse  
 $= 1370/128$   
 $= 10.70$
  
- C.  $Tension = Weight * MD * [1 - (MW/65.5ppg)]$   
 $= 32.3ppf * 280' * [1 - (8.8ppg/65.5ppg)]$   
 $= 10447 lbs.$

$$\begin{aligned} \text{Safety Factor} &= \text{Rating/Tension} \\ &= 254,000/10447 \\ &= 24.31 \end{aligned}$$

Surface casing shall have centralizers on the bottom 3 joints of the casing, starting with the shoe joint.

<b>Production Casing:</b>	7"	23 ppg.	MC-50	STC	Collapse	Burst	Tension
				<b>Ratings:</b>	3110	3960	273M

$$\begin{aligned} \text{A. Burst} &= [0.052 * 8.4\text{ppg} * 2700'] - [0.1\text{psi/ft} * 2700'] \\ &= 909.4\text{psi} \\ \text{Safety Factor} &= \text{Rating/Burst} \\ &= 3960/909.4 \\ &= 4.35 \end{aligned}$$

$$\begin{aligned} \text{B. Collapse} &= 0.052 * 12.5\text{ppg} * 2700' \\ &= 1755\text{psi} \\ \text{Safety Factor} &= \text{Rating/Collapse} \\ &= 3110/1755 \\ &= 1.77 \end{aligned}$$

$$\begin{aligned} \text{C. Tension} &= 23\text{lbs./ft} * 2700' * [1 - (12.5\text{ppg}/65.5\text{ppg})] \\ &= 23\text{lbs./ft} * 2700' * .8092 \\ &= 50,248.8 \text{ lbs.} \\ \text{Safety Factor} &= \text{Rating/Tension} \\ &= 273,000/50,248.8 \\ &= 5.43 \end{aligned}$$

## 6. MUD PROGRAM

Drilling mud will be used as the circulation medium. A fresh water, polymer, gel drilling mud will be used and visual monitoring will be done from spud to total depth. The anticipated mud weight will be between 8.5–13 ppg. Sufficient quantities of lost circulation material and barite will be available at the well site at all times for the purpose of assuring well control.

## 7. CEMENTING PROGRAM

The following is the proposed procedure for cementing the 9" surface pipe and 7" long string:

### Surface Casing:

Lead: Class "C" Type III, 14.4 ppg, yield 1.44ft<sup>3</sup>/sk @ 101% excess. Compressive strength in 24 hours at 80°F 3100psi.

The surface casing shall be cemented back to surface. In the event cement does not circulate to surface or fall back of the cement column occurs, remedial cementing shall be done to cement the casing back to surface.

**Long String:**

Lead: Class "C" Type III, 14.4 ppg, yield 1.44ft<sup>3</sup>/sk @ 35% excess. Compressive strength in 24 hours at 95°F 3200psi.

Estimated top of cement back to surface.

**8. LOGGING PROGRAM**

**Cores:** Rotary Cores will be taken as needed to evaluate the coal seams.

**DSTs:** None Planned

**Logs:** Induction, GR, SP, Density, Neutron and Caliper – From surface to TD  
Cement Bond Log – From 9" casing shoe to TD  
Mud Logger – As needed.

**9. PRESSURE DATA AND POTENTIAL HAZARDS**

Bottom hole pressures anticipated @ 1000 – 1100 psi.  
There is no history of hydrogen sulfide gas in the area and none is anticipated.

**10. ANTICIPATED STARTING DATES AND NOTIFICATION OF OPERATIONS**

**A. Anticipated Starting Dates:**

Anticipated Commencement Date	- Fall 2003, or upon approval
Drilling	- Approximately 7 days per well
Completion	- Approximately 2 days per well
Initial Testing	- Approximately 7-14 days per well
Production Testing	- Approximately 6-12 months per well

Note: Drilling operations will commence as soon as practical after approval of all necessary permits including the Applications for Permits to Drill (APDs).

**B. Notification of Operations:**

Rawlins Field Office, BLM  
1300 North Third St.  
Rawlins, Wyoming 82301  
(307) 328-4200