

## 803.i.(2).: PROPOSED CASING & CEMENTING PLAN

Operator: Terra Energy Partners  
Well Name & Number: Federal RG 921-24-299D  
Location: Ryan Gulch

Casing Design Calculations											
Type of Casing	Size of Hole (inches)	Size of Casing (inches)	Weight per Foot (lbs/ft)	Grade	Thread	Interval (ft - ft)	Length (feet)	Setting Depth (TVD feet)	Collapse (psi)	Burst (psi)	Tension (lbs)
Surface	17.50	13.375	54.5	J-55	BTC	0-1318.03	1,318	1,300	1,130	2,735	853,000
Intermediate	12.25	9.625	36.0	J-55	LTC/BTC	0-2955.42	2,955	2,900	2,020	3,520	453,000
Production	8.75	5.500	17.0	HCP-110	BTC	0-9245.78	9,246	9,140	8,580	10,640	546,000

Surface Casing Shoe	Intermediate Casing Shoe	Production Casing Shoe
MaxMW = 9.0 ppg HP = 608 psi	MaxMW = 9.0 ppg HP = 1,357 psi	MaxMW = 11.0 ppg HP = 5,228 psi

True Vertical Depth = 9,140 ft  
Bottom Hole Pressure = 4,250 psi  
Pore Pressure Gradient = 0.465 psi/ft  
Max. Sur. Pressure = 2,239 psi  
BOP Required = 3M System

Bottom Hole Temperature = 230 degrees Fahrenheit

Casing Safety Factors			
Surface Casing	Pb = 3.85 Pc = 1.86 Sj = 11.87	Min = 1.100 Min = 1.125 Min = 1.500	Pass Pass Pass
Intermediate Casing	Pb = 1.57 Pc = 1.49 Sj = 4.26	Min = 1.100 Min = 1.125 Min = 1.500	Pass Pass Pass
Production Casing	Pb = 4.75 Pc = 1.64 Sj = 3.47	Min = 1.100 Min = 1.125 Min = 1.500	Pass Pass Pass

### Cement Design Calculations

Estimating Cement for Ryan Gulch Wells (Permitting purpose only)

Critical Depths - Permitting Purposes Only	
Casing/Formation	Measured Depth
Surface Casing	1,318 ft
Intermediate Casing	2,955 ft
Top of G Sand	3,723 ft
Top of Gas	6,756 ft
Total Depth	9,246 ft

Production Cement Tops (Permitting Purposes Only)	
Cement Slurry	TOC - Measured Depth
Scavenger	N/A ft
Lead	3,523 ft
Tail	5,004 ft

Surface Cement	Lead
Cement Tops	Surface
Cement Type	Type I/II
Additives (lb/sk)	0.25 IntegraSeal POLI
Volume, bbls	163
Annular vol w/ excess, ft <sup>3</sup>	1007
Volume, sacks	430
Slurry Weight, ppg	12.3
Slurry Yield, ft <sup>3</sup> /sk	2,340
Mixwater, gal/sk	13.40
Annular Capacity (BBB)	0.1237
Annular Capacity (CF)	0.6947
Excess	0.1
Total Sacks	430
Total Cubic Ft.	1,007

Intermediate Cement	Lead	Tail
Cement Tops	1,955	2,455
Cement Type	Type I/II	Type I/II
Additives (lb/sk)	0.25 IntegraSeal POLI	0.25 IntegraSeal POLI
Volume, bbls	28	28
Annular vol w/ excess, ft <sup>3</sup>	172	172
Volume, sacks	72	82
Slurry Weight, ppg	12.3	12.8
Slurry Yield, ft <sup>3</sup> /sk	2,400	2,100
Mixwater, gal/sk	13.30	11.30
Annular Capacity (BBB)	0.0558	0.0558
Annular Capacity (CF)	0.3132	0.3132
Excess	0.1	0.1
Total Sacks	154	154
Total Cubic Ft.	345	345

Production Cement	Scavenger	Lead	Tail
Cement Tops		3523	5004
Cement Type		Type I/II	Class G
Additives (lb/sk)		0.25 IntegraSeal POLI	0.25 IntegraSeal POLI
Volume, bbls		67	191
Annular vol w/ excess, ft <sup>3</sup>		412	1179
Volume, sacks		206	644
Slurry Weight, ppg		13	13.5
Slurry Yield, ft <sup>3</sup> /sk		2,000	1,830
Mixwater, gal/sk		12.190	9.110
Annular Capacity (BBB)		0.0450	0.0450
Annular Capacity (CF)		0.2526	0.2526
Excess		0.1	0.1
Total Sacks		850	850
Total Cubic Ft.		1,590	1,590

### NOTES:

Surface Casing 17-1/2" hole to TD - Cement to surface.  
54.5# 13-3/8" J-55, BTC surface casing will be ran.  
10% excess is included in calculations.  
Normal Surface excess is 40% over gauge hole  
Normal Intermediate excess is 50% over gauge hole  
Normal Production excess is 45% over gauge hole.

## Casing and Cementing Plan

The Federal RG 921-24-299D injection well is designed with three (3) strings of casing and cement to ensure all formations to surface are fully isolated from the proposed disposal zone in the Williams Fork formation. TEP proposes setting a 13-3/8- inch surface casing shoe above the top of the Dissolution zone at 1,318 feet MD and circulating cement to surface per Rule 408.i.(2). Subsequently, TEP proposes setting a 9-5/8-inch intermediate string, 500 feet TVD into the Upper Wasatch formation, which is a confining layer, to isolate all zones above the Wasatch from the injection section of the wellbore. The Dissolution zone in the Green River formation is sub-normally pressured with a low fracture gradient. Setting the 13-3/8-inch surface shoe above the Dissolution zone and the 9-5/8-inch casing from surface to 500' TVD in the Upper Wasatch allows TEP to eliminate the need for a 2-stage cementing tool, which has been utilized historically in the area. Designing our casing program around the under pressured Dissolution zone provides TEP with better control over cement placement in the top-hole sections and coupled with our cement design in the production section, achieves the desired isolation of upper formations that contain usable quality groundwater from deeper zones.