

**GEOLOGIC & DRILLING PROGNOSIS**

Prepared: 18-Feb-21 DC

**WELL NAME:** RG 342-18-297  
Directional from the pad RG 41-18-297

**API:** 05-103-12462-00  
**STATE:** CO  
**COUNTY:** RIO BLANCO  
**BOTTOM HOLE LOCATION:** Sec. 18 T 2S R 97W  
**TYPE OF UNIT:** FED  
**FEDERAL EA:** Yes  
**HARDLINE:** No

Unspaced

**ELEVATION (ft):**  
**PAD (ft):** 6621  
**GROUND (ft):** 6620  
**KELLY BUSHING (ft):** 6651

**RIG INFORMATION:**  
**RIG NAME:** HP 329  
**KB HEIGHT (ft):** 30

**ESTIMATE TOPS:**

Formation	TVD	MD	Formation Resource Notes
Green River	926	936	Potentially Useable Water
A Groove	1086	1102	Potentially Useable Water
B Groove	1271	1293	Potentially Useable Water
Dissolution Surface	1586	1618	Possible Lost Circ Zone
Orange Marker	2466	2527	Potentially Useable Water
Wasatch	2671	2738	Potentially Useable Water
Top of "G" Sand	5041	5186	Possible Lost Circ Zone
Fort Union	5371	5527	Gas and Limited Use and Quality Water
Ohio Creek	6691	6890	Possible Lost Circ Zone
Mesaverde	6691	6890	Gas and Limited Use and Quality Water
Approx. Top Gas	7781	7994	Gas and Limited Use and Quality Water
Cameo Coals	10131	10344	Gas, Coal, and Limited Use and Quality Water
Rollins SS	11711	10924	Gas and Limited Use and Quality Water
Cozzette	10861	11074	Gas and Limited Use and Quality Water
Corcoran	11081	11294	Gas and Limited Use and Quality Water
Upper Sego	11441	11654	Gas and Limited Use and Quality Water
Lower Sego	11741	11954	Gas and Limited Use and Quality Water
<b>TD</b>	<b>11861</b>	<b>12074</b>	

**MUD LOGGING:** Type: (Optional) Remote Gas Unit  
Interval: Base of surface casing to TD with total gas only

**OPEN HOLE LOGS:** Specifics: (Optional) Triple-Combo (DIL-GR-SP-Neutron Density)  
Interval: GR from TD to surface, DIL-SP and Neutron Density from TD to 100' inside surface casing

**CASED HOLE LOGS:** Specifics: Pulsed Neutron Log (e.g. RMTE, RPM, or RST)  
Processing: Emulation Triple Combo Using OH logs and training well  
Cement Evaluation: CBL

**CSG & CEMENT PROGRAM: SHOE TEST REQUIRED**

	Csg Size (in)	Depth Set (ft/d)	Depth Set (md)	Hole Size (in)	Approx. Cmt Tail (ft3)	Tail Yield (ft3/sx)	Approx. Sx Tail	Approx. Cmt Lead (ft3)	Lead Yield (ft3/sx)	Approx. Sx Lead	WOC (hrs)
Conductor:	20	89.5	89.5	30	243	212					
Surface	13.375	1386	1418	17.5	N/A	N/A	N/A	1084	2.34	463	
Intermediate	9.625	3171	3238	12.25	172	2.10	82	172	2.40	72	
Liner or Production:	4.5	11861	12074	8.75/7.875	1446	1.85	784	373	2.00	187	
					<b>Surface (sacks):</b> 463		<b>Intermediate (sacks):</b>	154	<b>Prod. (sacks):</b> 970		

**ANTICIPATED PRESSURES (psi)**

MASP	Prod Csg Test Pressure	Anticipated BHP	Prod. Csg. Grade
2,906	8,500	5,515	P-110

**MUD PROGRAM:** (Do not deviate from mud engineer's recommendation without prior consent from Parachute office)

FROM (md)	TO (md)	TYPE MUD	#/GAL	VIS	WL	CHEMICALS
0	3238	WBM	8.33-9.0	45-50	7-15	Bentonite/PHPA
3238	12074	LSND	8.7-10.0	40-80	6-10	PHPA/Barite

(Write mud added to system on tour sheets and report all mud mixed and daily cost in morning report)

**LOST CIRCULATION:** Report depth and bbls of mud lost on morning report and tour sheet. Any severe lost circulation problems should be reported immediately to well supervisor.

**SURVEYS:** Run every 100' on surface hole and trips unless otherwise instructed.

**TEP GEOLOGIST:** Office Cell  
Stephen Sunnenberg 281-936-0361 303-918-4327 [ssunnenberg@terraep.com](mailto:ssunnenberg@terraep.com)  
(note: if there are questions concerning TD or logging, please call Geologist)

## CASING & CEMENTING PLAN

Operator: Terra Energy Partners  
Well Name & Number: RG 342-18-297  
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	17.5	13.375	54.5	J-55	BTC	0-1418	1,418	1,386	1130	2735	853,000
Intermediate	12.250	9.625	36.0	J-55	LTC	0-3238	3,238	3,171	2,020	3,520	453,000
Production	8.750	4.500	11.6	P-110	DWC/C	0-12074	12,074	11,861	8,860	12,150	417,000

Surface Casing Shoe	Intermediate Casing Shoe	Production Casing Shoe
Max MW = 9.2 ppg HP = 663 psi	Max MW = 9.2 ppg HP = 1,517 psi	Max MW = 10.0 ppg HP = 6,168 psi

True Vertical Depth = 11,861  
Bottom Hole Pressure = 5,515  
Pore Pressure Gradient = 0.465  
Max. Sur. Pressure = 2,906  
BOP Required = 3M  
5M system will be used as per A

Bottom Hole Temperature = 230 degrees Fahrenheit

Casing Safety Factors			
Surface Casing	Pb = 3.52	Min = 1.100	Pass
	Pc = 1.70	Min = 1.125	Pass
	Sj = 11.04	Min = 1.500	Pass
Intermediate Casing	Pb = 1.21	Min = 1.100	Pass
	Pc = 1.33	Min = 1.125	Pass
	Sj = 3.89	Min = 1.500	Pass
Production Casing	Pb = 4.18	Min = 1.100	Pass
	Pc = 1.44	Min = 1.125	Pass
	Sj = 2.98	Min = 1.500	Pass

### Cement Design Calculations

Estimating Cement for Ryan Gulch Wells (Permitting purpose only)

Critical Depths - Permitting Purposes Only	
Casing/Formation	Measured Depth
Surface Casing	1,418 ft
Intermediate Casing	3,238 ft
Top of Mesaverde	6,890 ft
Top of Gas	7,994 ft
Total Depth	12,074 ft

Production Cement Tops (Permitting Purposes Only)	
Cement Slurry	TOC - Measured Depth
Scavenger	3,038 ft
Lead	6,690 ft
Tail	7,794 ft

Surface Cement	Lead
Cement Tops	Surface
Volume, bbls	175
Annular vol w/ excess, ft <sup>3</sup>	1084
Volume, sacks	463
Slurry Weight, ppg	12.3
Slurry Yield, ft <sup>3</sup> /sk	2.340
Mixwater, gal/sk	13.40
Annular Capacity (BB1)	0.1237
Annular Capacity (CF)	0.6947
Excess	0.1
Total Sacks	463
Total Cubic Ft.	1,084

Intermediate Cement	Lead	Tail
Cement Tops	2,238	2,738
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 (BB1)	0.0558	0.0558
Annular Capacity (CF)	0.3132	0.3132
Excess	0.1	0.1
Total Sacks =	154	
Total Cubic Ft. =	345	

Production Cement	Scavenger	Lead
Cement Tops	3,038	6690
Volume, bbls	200	60
Annular vol w/excess, ft <sup>3</sup>	1,234	373
Volume, sacks	401	187
Slurry Weight, ppg	11.0	12.7
Slurry Yield, ft <sup>3</sup> /sk	3.074	1.999
Mixwater, gal/sk	18.830	11.000
Annular Capacity (BB1)	0.0547	0.0547
Annular Capacity (CF)	0.3072	0.3072
Excess	0.1	0.1
Total Sacks =		
Total Cubic Ft. =		

### 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 Design Calculations

Casing Design Calculations				
Surface Casing - 54.5#	<b>Burst</b> Bottom Hole Pressure = TVD * Pore Pressure Gradient = 3171 * 0.465 = 1474.515    psi  Pburst = Bottom Hole Pressure - (0.22 * TVD) = 1474.515 - (0.22 * 3171) = 776.895    psi  Pb = Casing Burst Rating / Pburst = 2735 / 776.895 = 3.52  Pb ≥ 1.1 3.52 ≥ 1.1	Intermediate Casing - 36#	<b>Burst</b> Bottom Hole Pressure = TVD * Pore Pressure Gradient = 11861 * 0.465 = 5515.4    psi  Pburst = Bottom Hole Pressure - (0.22 * TVD) = 5515.365 - (0.22 * 11861) = 2905.9    psi  Pb = Casing Burst Rating / Pburst = 3520 / 2905.945 = 1.21  Pb ≥ 1.1 1.21 ≥ 1.1	
	<b>Collapse</b> If:            Max MW * Setting TVD * 0.052 ≥ Pore Pressure Gradient * Setting TVD 9.2 * 1386 * 0.052 ≥ 0.465 * 1386 663.0624 ≥ 644.49  Pcollapse= Max MW * Setting TVD *0.052 = 663.0624    psi  Else: Pcollapse= Pore Pressure Gradient * Setting TVD = 644.49    psi Pcollapse= 663.0624    psi  Pc = Casing Collapse Rating / Pcollapse = 1130 / 663.0624 = 1.70  Pc ≥ 1.125 1.70 ≥ 1.125		<b>Collapse</b> If:            Max MW * Setting TVD * 0.052 ≥ Pore Pressure Gradient * Setting TVD 9.2 * 3171 * 0.052 ≥ 0.465 * 3171 1517 ≥ 1474.515  Pcollapse= Max MW * Setting TVD *0.052 = 1517    psi  Else: Pcollapse= Pore Pressure Gradient * Setting TVD = 1474.5    psi Pcollapse= 1517    psi  Pc = Casing Collapse Rating / Pcollapse = 2020 / 1517.0064 = 1.33  Pc ≥ 1.125 1.33 ≥ 1.125	
	<b>Tensile</b>  Tension = (Weight1 * Length1) = (54.5 * 1418) = 77281    lbs  Sj = Casing Tension Rating / Tension = 853000 / 77281 = 11.04  Sj ≥ 1.5 11.04 ≥ 1.5		<b>Tensile</b>  Tension = (Weight1 * Length1) = (36 * 3238) = 116568    lbs  Sj = Casing Tension Rating / Tension = 453000 / 116568 = 3.89  Sj ≥ 1.5 3.89 ≥ 1.5	
		<b>Production Casing</b>	<b>Burst</b> Bottom Hole Pressure = TVD * Pore Pressure Gradient = 11861 * 0.465 = 5515.4    psi  Pburst = Bottom Hole Pressure - (0.22 * TVD) = 5515.365 - (0.22 * 11861) = 2905.9    psi  Pb = Casing Burst Rating / Pburst = 12150 / 2905.945 = 4.18  Pb ≥ 1.1 4.18 ≥ 1.1	
			<b>Collapse</b> If:            Max MW * Setting TVD * 0.052 ≥ Pore Pressure Gradient * Setting TVD 10 * 11861 * 0.052 ≥ 0.465 * 11861 6167.7 ≥ 5515.365  Pcollapse= Max MW * Setting TVD *0.052 = 6167.7    psi  Else: Pcollapse= Pore Pressure Gradient * Setting TVD = 5515.4    psi  Pcollapse= 6167.7    psi Pc = Casing Collapse Rating / Pcollapse = 8860 / 6167.72 = 1.44  Pc ≥ 1.125 1.44 ≥ 1.125	
			<b>Tensile</b>  Tension = Weight * Length = 11.6 * 12074 = 140058    lbs  Sj = Casing Tension Rating / Tension = 417000 / 140058.4 = 2.98  Sj ≥ 1.5 2.98 ≥ 1.5	