

**GEOLOGIC & DRILLING PROGNOSIS**

Prepared: 18-Feb-21 DC

**WELL NAME:** RG 42-18-297  
Directional from the pad RG 41-18-297

**API:** 05-103-12460-00  
**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	931	940	Potentially Useable Water
A Groove	1091	1104	Potentially Useable Water
B Groove	1276	1294	Potentially Useable Water
Dissolution Surface	1591	1617	Possible Lost Circ Zone
Orange Marker	2476	2524	Potentially Useable Water
Wasatch	2681	2734	Potentially Useable Water
Top of "G" Sand	5061	5174	Possible Lost Circ Zone
Fort Union	5391	5512	Gas and Limited Use and Quality Water
Ohio Creek	6721	6875	Possible Lost Circ Zone
Mesaverde	6721	6875	Gas and Limited Use and Quality Water
Approx. Top Gas	7811	7978	Gas and Limited Use and Quality Water
Cameo Coals	10161	10328	Gas, Coal, and Limited Use and Quality Water
Rollins SS	10741	10908	Gas and Limited Use and Quality Water
Cozzette	10891	11058	Gas and Limited Use and Quality Water
Corcoran	11111	11278	Gas and Limited Use and Quality Water
Upper Segó	11471	11638	Gas and Limited Use and Quality Water
Lower Segó	11771	11938	Gas and Limited Use and Quality Water
<b>TD</b>	<b>11891</b>	<b>12058</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 (tvd)	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
Conductor:	20	84	84	30	228	199				
Surface	13.375	1391	1417	17.5	N/A	N/A	N/A	1083	2.34	463
Intermediate	9.625	3181	3234	12.25	172	2.10	82	172	2.40	72
Liner or Production:	4.5	11891	12058	8.75/7.875	1446	1.85	784	373	2.00	186
					<b>Surface (sacks): 463</b>		<b>Intermediate (sacks):</b>	<b>154</b>	<b>Prod. (sacks): 970</b>	

**ANTICIPATED PRESSURES (psi)**

MASP	Prod Csg Test Pressure	Anticipated BHP	Prod. Csg. Grade
2,913	8,500	5,529	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	3234	WBM	8.33-9.0	45-50	7-15	Bentonite/PHPA
3234	12058	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.

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(note: if there are questions concerning TD or logging, please call Geologist)

## CASING & CEMENTING PLAN

Operator: Terra Energy Partners  
 Well Name & Number: RG 42-18-297  
 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	0-1417	1,417	1,391	1130	2735	853,000
Intermediate	12.250	9.625	36.0	J-55	LTC	0-3234	3,234	3,181	2,020	3,520	453,000
Production	8.750	4.500	11.6	P-110	DWC/C	0-12058	12,058	11,891	8,860	12,150	417,000

Surface Casing Shoe	Intermediate Casing Shoe	Production Casing Shoe
Max MW = 9.2 ppg HP = 665 psi	Max MW = 9.2 ppg HP = 1,522 psi	Max MW = 10.0 ppg HP = 6,183 psi

True Vertical Depth = 11,891  
 Bottom Hole Pressure = 5,529  
 Pore Pressure Gradient = 0.465  
 Max. Sur. Pressure = 2,913  
 BOP Required = 3M  
 5M system will be used as per A

Bottom Hole Temperature = 230 degrees Fahrenheit

Casing Safety Factors			
Surface Casing	Pb = 3.51	Min = 1.100	Pass
	Pc = 1.70	Min = 1.125	Pass
	Sj = 11.05	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 = 4.17	Min = 1.100	Pass
	Pc = 1.43	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	1,417 ft
Intermediate Casing	3,234 ft
Top of Mesaverde	6,875 ft
Top of Gas	7,978 ft
Total Depth	12,058 ft

Production Cement Tops (Permitting Purposes Only)	
Cement Slurry	TOC - Measured Depth
Scavenger	4,151 ft
Lead	6,675 ft
Tail	7,778 ft

Surface Cement	Lead
<b>Cement Tops</b>	<b>Surface</b>
Volume, bbls	175
Annular vol w/ excess, ft <sup>3</sup>	1083
Volume, sacks	463
Slurry Weight, ppg	12.3
Slurry Yield, ft <sup>3</sup> /sk	2.340
Mixwater, gal/sk	13.40
Annular Capacity (BBJ)	0.1237
Annular Capacity (CF)	0.6947
Excess	0.1
<b>Total Sacks</b>	<b>463</b>
<b>Total Cubic Ft.</b>	<b>1,083</b>

Intermediate Cement	Lead	Tail
<b>Cement Tops</b>	<b>2,234</b>	<b>2,734</b>
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 (BBJ)	0.0558	0.0558
Annular Capacity (CF)	0.3132	0.3132
Excess	0.1	0.1
<b>Total Sacks =</b>	<b>154</b>	
<b>Total Cubic Ft. =</b>	<b>345</b>	

Production Cement	Scavenger	Lead
<b>Cement Tops</b>	<b>4,151</b>	<b>6675</b>
Volume, bbls	138	60
Annular vol w/excess, ft <sup>3</sup>	1,230	373
Volume, sacks	400	186
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 (BBJ)	0.0547	0.0547
Annular Capacity (CF)	0.3072	0.3072
Excess	0.1	0.1
<b>Total Sacks =</b>		
<b>Total Cubic Ft. =</b>		

### 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

Surface Casing - 54.5#	Intermediate Casing - 36#	Production Casing
<p><b>Burst</b></p> <p>Bottom Hole Pressure = TVD * Pore Pressure Gradient                      = 3181 * 0.465                      = 1479.165 psi</p> <p>Pburst = Bottom Hole Pressure - (0.22 * TVD)                      = 1479.165 - (0.22 * 3181)                      = 779.345 psi</p> <p>Pb = Casing Burst Rating / Pburst                      = 2735 / 779.345                      = 3.51</p> <p>Pb ≥ 1.1                      3.51 ≥ 1.1</p> <p><b>Collapse</b></p> <p>If: Max MW * Setting TVD * 0.052 ≥ Pore Pressure Gradient * Setting TVD                      9.2 * 1391 * 0.052 ≥ 0.465 * 1391                      665.4544 ≥ 646.815</p> <p>Pcollapse = Max MW * Setting TVD * 0.052                      = 665.4544 psi</p> <p>Else:                      Pcollapse = Pore Pressure Gradient * Setting TVD                      = 646.815 psi                      Pcollapse = 665.4544 psi</p> <p>Pc = Casing Collapse Rating / Pcollapse                      = 1130 / 665.4544                      = 1.70</p> <p>Pc ≥ 1.125                      1.70 ≥ 1.125</p> <p><b>Tensile</b></p> <p>Tension = (Weight1 * Length1)                      = (54.5 * 1417)                      = 77226.5 lbs</p> <p>Sj = Casing Tension Rating / Tension                      = 853000 / 77226.5                      = 11.05</p> <p>Sj ≥ 1.5                      11.05 ≥ 1.5</p>	<p><b>Burst</b></p> <p>Bottom Hole Pressure = TVD * Pore Pressure Gradient                      = 11891 * 0.465                      = 5529.3 psi</p> <p>Pburst = Bottom Hole Pressure - (0.22 * TVD)                      = 5529.315 - (0.22 * 11891)                      = 2913.3 psi</p> <p>Pb = Casing Burst Rating / Pburst                      = 3520 / 2913.295                      = 1.21</p> <p>Pb ≥ 1.1                      1.21 ≥ 1.1</p> <p><b>Collapse</b></p> <p>If: Max MW * Setting TVD * 0.052 ≥ Pore Pressure Gradient * Setting TVD                      9.2 * 3181 * 0.052 ≥ 0.465 * 3181                      1521.8 ≥ 1479.165</p> <p>Pcollapse = Max MW * Setting TVD * 0.052                      = 1521.8 psi</p> <p>Else:                      Pcollapse = Pore Pressure Gradient * Setting TVD                      = 1479.2 psi                      Pcollapse = 1521.8 psi</p> <p>Pc = Casing Collapse Rating / Pcollapse                      = 2020 / 1521.7904                      = 1.33</p> <p>Pc ≥ 1.125                      1.33 ≥ 1.125</p> <p><b>Tensile</b></p> <p>Tension = (Weight1 * Length1)                      = (36 * 3234)                      = 116424 lbs</p> <p>Sj = Casing Tension Rating / Tension                      = 453000 / 116424                      = 3.89</p> <p>Sj ≥ 1.5                      3.89 ≥ 1.5</p>	<p><b>Burst</b></p> <p>Bottom Hole Pressure = TVD * Pore Pressure Gradient                      = 11891 * 0.465                      = 5529.3 psi</p> <p>Pburst = Bottom Hole Pressure - (0.22 * TVD)                      = 5529.315 - (0.22 * 11891)                      = 2913.3 psi</p> <p>Pb = Casing Burst Rating / Pburst                      = 12150 / 2913.295                      = 4.17</p> <p>Pb ≥ 1.1                      4.17 ≥ 1.1</p> <p><b>Collapse</b></p> <p>If: Max MW * Setting TVD * 0.052 ≥ Pore Pressure Gradient * Setting TVD                      10 * 11891 * 0.052 ≥ 0.465 * 11891                      6183.3 ≥ 5529.315</p> <p>Pcollapse = Max MW * Setting TVD * 0.052                      = 6183.3 psi</p> <p>Else:                      Pcollapse = Pore Pressure Gradient * Setting TVD                      = 5529.3 psi                      Pcollapse = 6183.3 psi</p> <p>Pc = Casing Collapse Rating / Pcollapse                      = 8860 / 6183.32                      = 1.43</p> <p>Pc ≥ 1.125                      1.43 ≥ 1.125</p> <p><b>Tensile</b></p> <p>Tension = Weight * Length                      = 11.6 * 12058                      = 139873 lbs</p> <p>Sj = Casing Tension Rating / Tension                      = 417000 / 139872.8                      = 2.98</p> <p>Sj ≥ 1.5                      2.98 ≥ 1.5</p>