

GEOLOGIC & DRILLING PROGNOSIS

Prepared: 18-Feb-21 DC

WELL NAME: RG 543-7-297
Directional from the pad RG 41-18-297

API: 05-103-12467-00
STATE: CO
COUNTY: RIO BLANCO
BOTTOM HOLE LOCATION: Sec. 7 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	971	984	Potentially Useable Water
A Groove	1131	1153	Potentially Useable Water
B Groove	1316	1350	Potentially Useable Water
Dissolution Surface	1631	1687	Possible Lost Circ Zone
Orange Marker	2556	2674	Potentially Useable Water
Wasatch	2761	2893	Potentially Useable Water
Top of "G" Sand	5221	5518	Possible Lost Circ Zone
Fort Union	6661	5870	Gas and Limited Use and Quality Water
Ohio Creek	6961	7375	Possible Lost Circ Zone
Mesaverde	6961	7375	Gas and Limited Use and Quality Water
Approx. Top Gas	8051	8519	Gas and Limited Use and Quality Water
Cameo Coals	10401	10872	Gas, Coal, and Limited Use and Quality Water
Rollins SS	10981	11452	Gas and Limited Use and Quality Water
Cozzette	11131	11602	Gas and Limited Use and Quality Water
Corcoran	11351	11822	Gas and Limited Use and Quality Water
Upper Sego	11711	12182	Gas and Limited Use and Quality Water
Lower Sego	12011	12482	Gas and Limited Use and Quality Water
TD	12131	12602	

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	1431	1487	17.5	N/A	N/A	N/A	1136	2.34	486	
Intermediate	9.625	3261	3393	12.25	172	2.10	82	172	2.40	72	
Liner or Production:	4.5	12131	12602	8.75/7.875	1447	1.85	784	387	2.00	193	
					Surface (sacks): 486		Intermediate (sacks):	154	Prod. (sacks): 978		

ANTICIPATED PRESSURES (psi)

MASP	Prod Csg Test Pressure	Anticipated BHP	Prod. Csg. Grade
2,972	8,500	5,641	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	3393	WBM	8.33-9.0	45-50	7-15	Bentonite/PHPA
3393	12602	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
(note: if there are questions concerning TD or logging, please call Geologist)

CASING & CEMENTING PLAN

Operator: Terra Energy Partners
Well Name & Number: RG 543-7-297
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	0-1487	1,487	1,431	1130	2735	853,000
Intermediate	12.250	9.625	36.0	J-55	LTC	0-3393	3,393	3,261	2,020	3,520	453,000
Production	8.750	4.500	11.6	P-110	DWC/C	0-12602	12,602	12,131	8,860	12,150	417,000

Surface Casing Shoe	Intermediate Casing Shoe	Production Casing Shoe
Max MW = 9.2 ppg HP = 685 psi	Max MW = 9.2 ppg HP = 1,560 psi	Max MW = 10.0 ppg HP = 6,308 psi

True Vertical Depth = 12,131
Bottom Hole Pressure = 5,641
Pore Pressure Gradient = 0.465
Max. Sur. Pressure = 2,972
BOP Required = 3M
5M system will be used as per A

Bottom Hole Temperature = 230 degrees Fahrenheit

Casing Safety Factors			
Surface Casing	Pb = 3.42	Min = 1.100	Pass
	Pc = 1.65	Min = 1.125	Pass
	Sj = 10.53	Min = 1.500	Pass
Intermediate Casing	Pb = 1.18	Min = 1.100	Pass
	Pc = 1.29	Min = 1.125	Pass
	Sj = 3.71	Min = 1.500	Pass
Production Casing	Pb = 4.09	Min = 1.100	Pass
	Pc = 1.40	Min = 1.125	Pass
	Sj = 2.85	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	1,487 ft
Intermediate Casing	3,393 ft
Top of Mesaverde	7,375 ft
Top of Gas	8,519 ft
Total Depth	12,602 ft

Production Cement Tops (Permitting Purposes Only)	
Cement Slurry	TOC - Measured Depth
Scavenger	3,193 ft
Lead	7,175 ft
Tail	8,319 ft

Surface Cement	Lead
Cement Tops	Surface
Volume, bbls	184
Annular vol w/ excess, ft ³	1136
Volume, sacks	486
Slurry Weight, ppg	12.3
Slurry Yield, ft ³ /sk	2.340
Mixwater, gal/sk	13.40
Annular Capacity (BB1)	0.1237
Annular Capacity (CF)	0.6947
Excess	0.1
Total Sacks	486
Total Cubic Ft.	1,136

Intermediate Cement	Lead	Tail
Cement Tops	2,393	2,893
Volume, bbls	28	28
Annular vol w/ excess, ft ³	172	172
Volume, sacks	72	82
Slurry Weight, ppg	12.3	12.8
Slurry Yield, ft ³ /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	3,193	7175
Volume, bbls	218	63
Annular vol w/excess, ft ³	1,345	387
Volume, sacks	438	193
Slurry Weight, ppg	11.0	12.7
Slurry Yield, ft ³ /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

Surface Casing - 54.5#	Intermediate Casing - 36#
<p>Burst</p> <p>Bottom Hole Pressure = TVD * Pore Pressure Gradient = 3261 * 0.465 = 1516.365 psi</p> <p>Pburst = Bottom Hole Pressure - (0.22 * TVD) = 1516.365 - (0.22 * 3261) = 798.945 psi</p> <p>Pb = Casing Burst Rating / Pburst = 2735 / 798.945 = 3.42</p> <p>Pb ≥ 1.1 3.42 ≥ 1.1</p> <p>Collapse</p> <p>If: Max MW * Setting TVD * 0.052 ≥ Pore Pressure Gradient * Setting TVD 9.2 * 1431 * 0.052 ≥ 0.465 * 1431 684.5904 ≥ 665.415</p> <p>Pcollapse = Max MW * Setting TVD * 0.052 = 684.5904 psi</p> <p>Else: Pcollapse = Pore Pressure Gradient * Setting TVD = 665.415 psi Pcollapse = 684.5904 psi</p> <p>Pc = Casing Collapse Rating / Pcollapse = 1130 / 684.5904 = 1.65</p> <p>Pc ≥ 1.125 1.65 ≥ 1.125</p> <p>Tensile</p> <p>Tension = (Weight1 * Length1) = (54.5 * 1487) = 81041.5 lbs</p> <p>Sj = Casing Tension Rating / Tension = 853000 / 81041.5 = 10.53</p> <p>Sj ≥ 1.5 10.53 ≥ 1.5</p>	<p>Burst</p> <p>Bottom Hole Pressure = TVD * Pore Pressure Gradient = 12131 * 0.465 = 5640.9 psi</p> <p>Pburst = Bottom Hole Pressure - (0.22 * TVD) = 5640.915 - (0.22 * 12131) = 2972.1 psi</p> <p>Pb = Casing Burst Rating / Pburst = 3520 / 2972.095 = 1.18</p> <p>Pb ≥ 1.1 1.18 ≥ 1.1</p> <p>Collapse</p> <p>If: Max MW * Setting TVD * 0.052 ≥ Pore Pressure Gradient * Setting TVD 9.2 * 3261 * 0.052 ≥ 0.465 * 3261 1560.1 ≥ 1516.365</p> <p>Pcollapse = Max MW * Setting TVD * 0.052 = 1560.1 psi</p> <p>Else: Pcollapse = Pore Pressure Gradient * Setting TVD = 1516.4 psi Pcollapse = 1560.1 psi</p> <p>Pc = Casing Collapse Rating / Pcollapse = 2020 / 1560.0624 = 1.29</p> <p>Pc ≥ 1.125 1.29 ≥ 1.125</p> <p>Tensile</p> <p>Tension = (Weight1 * Length1) = (36 * 3393) = 122148 lbs</p> <p>Sj = Casing Tension Rating / Tension = 453000 / 122148 = 3.71</p> <p>Sj ≥ 1.5 3.71 ≥ 1.5</p>
	<p>Production Casing</p> <p>Burst</p> <p>Bottom Hole Pressure = TVD * Pore Pressure Gradient = 12131 * 0.465 = 5640.9 psi</p> <p>Pburst = Bottom Hole Pressure - (0.22 * TVD) = 5640.915 - (0.22 * 12131) = 2972.1 psi</p> <p>Pb = Casing Burst Rating / Pburst = 12150 / 2972.095 = 4.09</p> <p>Pb ≥ 1.1 4.09 ≥ 1.1</p> <p>Collapse</p> <p>If: Max MW * Setting TVD * 0.052 ≥ Pore Pressure Gradient * Setting TVD 10 * 12131 * 0.052 ≥ 0.465 * 12131 6308.1 ≥ 5640.915</p> <p>Pcollapse = Max MW * Setting TVD * 0.052 = 6308.1 psi</p> <p>Else: Pcollapse = Pore Pressure Gradient * Setting TVD = 5640.9 psi</p> <p>Pcollapse = 6308.1 psi</p> <p>Pc = Casing Collapse Rating / Pcollapse = 8860 / 6308.12 = 1.40</p> <p>Pc ≥ 1.125 1.40 ≥ 1.125</p> <p>Tensile</p> <p>Tension = Weight * Length = 11.6 * 12602 = 146183 lbs</p> <p>Sj = Casing Tension Rating / Tension = 417000 / 146183.2 = 2.85</p> <p>Sj ≥ 1.5 2.85 ≥ 1.5</p>