

GEOLOGIC & DRILLING PROGNOSIS

Prepared: 18-Feb-21 DC

WELL NAME: RG 443-7-297
Directional from the pad RG 41-18-297

API: 05-103-12464-00
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	976	988	Potentially Useable Water
A Groove	1136	1157	Potentially Useable Water
B Groove	1321	1357	Potentially Useable Water
Dissolution Surface	1636	1699	Possible Lost Circ Zone
Orange Marker	2566	2709	Potentially Useable Water
Wasatch	2771	2932	Potentially Useable Water
Top of "G" Sand	5241	5616	Possible Lost Circ Zone
Fort Union	5571	5974	Gas and Limited Use and Quality Water
Ohio Creek	6991	7517	Possible Lost Circ Zone
Mesaverde	6991	7517	Gas and Limited Use and Quality Water
Approx. Top Gas	8081	8667	Gas and Limited Use and Quality Water
Cameo Coals	10431	11021	Gas, Coal, and Limited Use and Quality Water
Rollins SS	11011	11601	Gas and Limited Use and Quality Water
Cozzette	11161	11751	Gas and Limited Use and Quality Water
Corcoran	11381	11971	Gas and Limited Use and Quality Water
Upper Sego	11741	12331	Gas and Limited Use and Quality Water
Lower Sego	12041	12631	Gas and Limited Use and Quality Water
TD	12161	12751	

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	84	84	30	228	199					
Surface	13.375	1436	1499	17.5	N/A	N/A	N/A	1145	2.34	490	
Intermediate	9.625	3271	3432	12.25	172	2.10	82	172	2.40	72	
Liner or Production:	4.5	12161	12751	8.75/7.875	1447	1.85	784	389	2.00	194	
					Surface (sacks): 490		Intermediate (sacks):	154	Prod. (sacks): 979		

ANTICIPATED PRESSURES (psi)

MAASP	Prod Csg Test Pressure	Anticipated BHP	Prod. Csg. Grade
2,979	8,500	5,655	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	3432	WBM	8.33-9.0	45-50	7-15	Bentonite/PHPA
3432	12751	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 443-7-297
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	0-1499	1,499	1,436	1130	2735	853,000
Intermediate	12.250	9.625	36.0	J-55	LTC	0-3432	3,432	3,271	2,020	3,520	453,000
Production	8.750	4.500	11.6	P-110	DWC/C	0-12751	12,751	12,161	8,860	12,150	417,000

Surface Casing Shoe	Intermediate Casing Shoe	Production Casing Shoe
Max MW = 9.2 ppg HP = 687 psi	Max MW = 9.2 ppg HP = 1,565 psi	Max MW = 10.0 ppg HP = 6,324 psi

True Vertical Depth = 12,161
Bottom Hole Pressure = 5,655
Pore Pressure Gradient = 0.465
Max. Sur. Pressure = 2,979
BOP Required = 3M
5M system will be used as per A

Bottom Hole Temperature = 230 degrees Fahrenheit

Casing Safety Factors			
Surface Casing	Pb = 3.41	Min = 1.100	Pass
	Pc = 1.64	Min = 1.125	Pass
	Sj = 10.44	Min = 1.500	Pass
Intermediate Casing	Pb = 1.18	Min = 1.100	Pass
	Pc = 1.29	Min = 1.125	Pass
	Sj = 3.67	Min = 1.500	Pass
Production Casing	Pb = 4.08	Min = 1.100	Pass
	Pc = 1.40	Min = 1.125	Pass
	Sj = 2.82	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	1,499 ft
Intermediate Casing	3,432 ft
Top of Mesaverde	7,517 ft
Top of Gas	8,667 ft
Total Depth	12,751 ft

Production Cement Tops (Permitting Purposes Only)	
Cement Slurry	TOC - Measured Depth
Scavenger	3,232 ft
Lead	7,317 ft
Tail	8,467 ft

Surface Cement	Lead
Cement Tops	Surface
Volume, bbls	185
Annular vol w/ excess, ft ³	1145
Volume, sacks	490
Slurry Weight, ppg	12.3
Slurry Yield, ft ³ /sk	2.340
Mixwater, gal/sk	13.40
Annular Capacity (BBI)	0.1237
Annular Capacity (CF)	0.6947
Excess	0.1
Total Sacks	490
Total Cubic Ft.	1,145

Intermediate Cement	Lead	Tail
Cement Tops	2,432	2,932
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 (BBI)	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	3,232	7317
Volume, bbls	223	63
Annular vol w/excess, ft ³	1,380	389
Volume, sacks	449	194
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 (BBI)	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#	Production Casing
<p>Burst</p> <p>Bottom Hole Pressure = TVD * Pore Pressure Gradient = 3271 * 0.465 = 1521.015 psi</p> <p>Pburst = Bottom Hole Pressure - (0.22 * TVD) = 1521.015 - (0.22 * 3271) = 801.395 psi</p> <p>Pb = Casing Burst Rating / Pburst = 2735 / 801.395 = 3.41</p> <p>Pb ≥ 1.1 3.41 ≥ 1.1</p> <p>Collapse</p> <p>If: Max MW * Setting TVD * 0.052 ≥ Pore Pressure Gradient * Setting TVD 9.2 * 1436 * 0.052 ≥ 0.465 * 1436 686.9824 ≥ 667.74</p> <p>Pcollapse = Max MW * Setting TVD * 0.052 = 686.9824 psi</p> <p>Else: Pcollapse = Pore Pressure Gradient * Setting TVD = 667.74 psi Pcollapse = 686.9824 psi</p> <p>Pc = Casing Collapse Rating / Pcollapse = 1130 / 686.9824 = 1.64</p> <p>Pc ≥ 1.125 1.64 ≥ 1.125</p> <p>Tensile</p> <p>Tension = (Weight1 * Length1) = (54.5 * 1499) = 81695.5 lbs</p> <p>Sj = Casing Tension Rating / Tension = 853000 / 81695.5 = 10.44</p> <p>Sj ≥ 1.5 10.44 ≥ 1.5</p>	<p>Burst</p> <p>Bottom Hole Pressure = TVD * Pore Pressure Gradient = 12161 * 0.465 = 5654.9 psi</p> <p>Pburst = Bottom Hole Pressure - (0.22 * TVD) = 5654.865 - (0.22 * 12161) = 2979.4 psi</p> <p>Pb = Casing Burst Rating / Pburst = 3520 / 2979.445 = 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 * 3271 * 0.052 ≥ 0.465 * 3271 1564.8 ≥ 1521.015</p> <p>Pcollapse = Max MW * Setting TVD * 0.052 = 1564.8 psi</p> <p>Else: Pcollapse = Pore Pressure Gradient * Setting TVD = 1521 psi Pcollapse = 1564.8 psi</p> <p>Pc = Casing Collapse Rating / Pcollapse = 2020 / 1564.8464 = 1.29</p> <p>Pc ≥ 1.125 1.29 ≥ 1.125</p> <p>Tensile</p> <p>Tension = (Weight1 * Length1) = (36 * 3432) = 123552 lbs</p> <p>Sj = Casing Tension Rating / Tension = 453000 / 123552 = 3.67</p> <p>Sj ≥ 1.5 3.67 ≥ 1.5</p>	<p>Burst</p> <p>Bottom Hole Pressure = TVD * Pore Pressure Gradient = 12161 * 0.465 = 5654.9 psi</p> <p>Pburst = Bottom Hole Pressure - (0.22 * TVD) = 5654.865 - (0.22 * 12161) = 2979.4 psi</p> <p>Pb = Casing Burst Rating / Pburst = 12150 / 2979.445 = 4.08</p> <p>Pb ≥ 1.1 4.08 ≥ 1.1</p> <p>Collapse</p> <p>If: Max MW * Setting TVD * 0.052 ≥ Pore Pressure Gradient * Setting TVD 10 * 12161 * 0.052 ≥ 0.465 * 12161 6323.7 ≥ 5654.865</p> <p>Pcollapse = Max MW * Setting TVD * 0.052 = 6323.7 psi</p> <p>Else: Pcollapse = Pore Pressure Gradient * Setting TVD = 5654.9 psi Pcollapse = 6323.7 psi</p> <p>Pc = Casing Collapse Rating / Pcollapse = 8860 / 6323.72 = 1.40</p> <p>Pc ≥ 1.125 1.40 ≥ 1.125</p> <p>Tensile</p> <p>Tension = Weight * Length = 11.6 * 12751 = 147912 lbs</p> <p>Sj = Casing Tension Rating / Tension = 417000 / 147911.6 = 2.82</p> <p>Sj ≥ 1.5 2.82 ≥ 1.5</p>