GEOLOGIC & DRILLING PROGNOSIS

Prepared: 18-Feb-21 DC

WELL NAME: **RG 541-18-297**
Directional from the pad RG 41-18-297

API: 05-103-12472-00
STATE: CO
COUNTY: RIO BLANCO Unspaced
BOTTOM HOLE LOCATION: Sec. 18 T 2S R 97W
TYPE OF UNIT: FED
FEDERAL EA: Yes
HARDLINE: No

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	936	**945**	Potentially Useable Water
A Groove	1096	**1108**	Potentially Useable Water
B Groove	1281	**1297**	Potentially Useable Water
Dissolution Surface	1596	**1618**	Possible Lost Circ Zone
Orange Marker	2486	**2526**	Potentially Useable Water
Wasatch	2691	**2735**	Potentially Useable Water
Top of "G" Sand	5081	**5174**	Possible Lost Circ Zone
Fort Union	5411	**5511**	Gas and Limited Use and Quality Water
Ohio Creek	6751	**6878**	Possible Lost Circ Zone
Mesaverde	6751	**6878**	Gas and Limited Use and Quality Water
Approx. Top Gas	7841	**7980**	Gas and Limited Use and Quality Water
Cameo Coals	10191	**10330**	Gas, Coal, and Limited Use and Quality Water
Rollins SS	10771	**10910**	Gas and Limited Use and Quality Water
Cozzette	10921	**11060**	Gas and Limited Use and Quality Water
Corcoran	11141	**11280**	Gas and Limited Use and Quality Water
Upper Sego	11501	**11640**	Gas and Limited Use and Quality Water
Lower Sego	11801	**11940**	Gas and Limited Use and Quality Water
TD	11921	**12060**	

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	WOC (hrs)
Conductor:	20	84	84	30	228	199					
Surface	13.375	1396	1418	17.5	N/A	N/A	N/A	1084	2.34	463	
Intermediate	9.625	3191	3235	12.25	172	2.10	82	172	2.40	72	
Liner or Production:	4.5	11921	12060	8.75/7.875	1446	1.85	784	372	2.00	186	
					Surface (sacks): 463		**Intermediate (sacks):**	154	**Prod. (sacks):**	970	

ANTICIPATED PRESSURES (psi)

MASP	Prod Csg Test Pressure	Anticipated BHP	Prod. Csg. Grade
2,921	8,500	5,543	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	3235	WBM	8.33-9.0	45-50	7-15	Bentonite/PHPA
3235	12060	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 541-18-297
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	1,396	1130	2735	853,000
Intermediate	12.250	9.625	36.0	J-55	LTC	0-3235	3,235	3,191	2,020	3,520	453,000
Production	8.750	4.500	11.6	P-110	DWC/C	0-12060	12,060	11,921	8,860	12,150	417,000

Surface Casing Shoe		Intermdiate Casing Shoe		Production Casing Shoe	
Max MW =	9.2 ppg	Max MW =	9.2 ppg	Max MW =	10.0 ppg
HP =	668 psi	HP =	1,527 psi	HP =	6,199 psi

True Vertical Depth =	11,921
Bottom Hole Pressure =	5,543
Pore Pressure Gradient =	0.465
Max. Sur. Pressure =	2,921
BOP Required =	3M

5M system will be used as per N

Bottom Hole Temperature = 230 degrees Farenheit

Casing Safety Factors			
Surface Casing	Pb = 3.50	Min = 1.100	Pass
	Pc = 1.69	Min = 1.125	Pass
	Sj = 11.04	Min = 1.500	Pass
Intermediate Casing	Pb = 1.21	Min = 1.100	Pass
	Pc = 1.32	Min = 1.125	Pass
	Sj = 3.89	Min = 1.500	Pass
Production Casing	Pb = 4.16	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	1,418 ft
Intermediate Casing	3,235 ft
Top of Mesaverde	6,878 ft
Top of Gas	7,980 ft
Total Depth	12,060 ft

Production Cement Tops (Permitting Purposes Only)	
Cement Slurry	TOC - Measured Depth
Scavenger	3,035 ft
Lead	6,678 ft
Tail	7,780 ft

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

Intermediate Cement	Lead	Tail
Cement Tops	**2,235**	**2,735**
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 (BBl)	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	**3,035**	**6678**
Volume, bbls	199	60
Annular vol w/excess, ft^3	1,231	372
Volume, sacks	400	186
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 (BBl)	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#

Burst

Bottom Hole Pressure = TVD * Pore Pressure Gradient
= 3191 * 0.465
= 1483.815 psi

Pburst = Bottom Hole Presure - (0.22 * TVD)
= 1483.815 - (0.22 * 3191)
= 781.795 psi

Pb = Casing Burst Rating / Pburst
= 2735 / 781.795
= 3.50

Pb		
3.50	≥	1.1

Collapse

If: Max MW * Setting TVD * 0.052 ≥ Pore Pressure Gradient * Setting TVD
9.2 * 1396 * 0.052 ≥ 0.465 * 1396
667.8464 ≥ 649.14

Pcollapse = Max MW * Setting TVD *0.052
= 667.8464 psi

Else:
Pcollapse = Pore Pressure Gradient * Setting TVD
= 649.14 psi
Pcollapse= 667.8464 psi

Pc = Casing Collapse Rating / Pcollapse
= 1130 / 667.8464
= 1.69

Pc		
1.69	≥	1.125

Tensile

Tension = (Weight1 * Length1)
= (54.5 * 1418)
= 77281 lbs

Sj = Casing Tension Rating / Tension
= 853000 / 77281
= 11.04

Sj		
11.04	≥	1.5

Intermediate Casing - 36#

Burst

Bottom Hole Pressure = TVD * Pore Pressure Gradient
= 11921 * 0.465
= 5543.3 psi

Pburst = Bottom Hole Presure - (0.22 * TVD)
= 5543.265 - (0.22 * 11921)
= 2920.6 psi

Pb = Casing Burst Rating / Pburst
= 3520 / 2920.645
= 1.21

Pb		
1.21	≥	1.1

Collapse

If: Max MW * Setting TVD * 0.052 ≥ Pore Pressure Gradient * Setting TVD
9.2 * 3191 * 0.052 ≥ 0.465 * 3191
1526.6 ≥ 1483.815

Pcollapse = Max MW * Setting TVD *0.052
= 1526.6 psi

Else:
Pcollapse = Pore Pressure Gradient * Setting TVD
= 1483.8 psi
Pcollapse= 1526.6 psi

Pc = Casing Collapse Rating / Pcollapse
= 2020 / 1526.5744
= 1.32

Pc		
1.32	≥	1.125

Tensile

Tension = (Weight1 * Length1)
= (36 * 3235)
= 116460 lbs

Sj = Casing Tension Rating / Tension
= 453000 / 116460
= 3.89

Sj		
3.89	≥	1.5

Production Casing

Burst

Bottom Hole Pressure = TVD * Pore Pressure Gradient
= 11921 * 0.465
= 5543.3 psi

Pburst = Bottom Hole Presure - (0.22 * TVD)
= 5543.265 - (0.22 * 11921)
= 2920.6 psi

Pb = Casing Burst Rating / Pburst
= 12150 / 2920.645
= 4.16

Pb		
4.16	≥	1.1

Collapse

If: Max MW * Setting TVD * 0.052 ≥ Pore Pressure Gradient * Setting TVD
10 * 11921 * 0.052 ≥ 0.465 * 11921
6198.9 ≥ 5543.265

Pcollapse = Max MW * Setting TVD *0.052
= 6198.9 psi

Else:
Pcollapse = Pore Pressure Gradient * Setting TVD
= 5543.3 psi

Pcollapse= 6198.9 psi
Pc = Casing Collapse Rating / Pcollapse
= 8860 / 6198.92
= 1.43

Pc		
1.43	≥	1.125

Tensile

Tension = Weight * Length
= 11.6 * 12060
= 139896 lbs

Sj = Casing Tension Rating / Tension
= 417000 / 139896
= 2.98

Sj		
2.98	≥	1.5