



Vanguard Natural Resources

Garfield County, CO

GGU 13-28

Federal GGU 24B-28-691

Wellbore #1

Design: Actual

End of Well Report

14 December, 2017





Payzone Directional

End of Well Report



Company:	Vanguard Natural Resources	Local Co-ordinate Reference:	Well Federal GGU 24B-28-691
Project:	Garfield County, CO	TVD Reference:	Federal GGU 24B-28-691 @ 6147.6usft (Est KB)
Site:	GGU 13-28	MD Reference:	Federal GGU 24B-28-691 @ 6147.6usft (Est KB)
Well:	Federal GGU 24B-28-691	North Reference:	True
Wellbore:	Wellbore #1	Survey Calculation Method:	Minimum Curvature
Design:	Actual	Database:	EDM 5000.1 Single User Db

Project		Garfield County, CO	
Map System:	US State Plane 1983	System Datum:	Mean Sea Level
Geo Datum:	North American Datum 1983		
Map Zone:	Colorado Central Zone		Using geodetic scale factor

Site	GGU 13-28					
Site Position:			Northing:	1,611,635.73 usft	Latitude:	39° 29' 40.232 N
From:	Lat/Long		Easting:	2,416,896.90 usft	Longitude:	107° 33' 59.065 W
Position Uncertainty:	0.0 usft		Slot Radius:	13-3/16 "	Grid Convergence:	-1.30 °

Well		Federal GGU 24B-28-691				
Well Position	+N/-S	0.0 usft	Northing:	1,611,622.41 usft	Latitude:	39° 29' 40.095 N
	+E/-W	0.0 usft	Easting:	2,416,873.45 usft	Longitude:	107° 33' 59.360 W
Position Uncertainty		0.0 usft	Wellhead Elevation:	6,147.6 usft	Ground Level:	6,130.6 usft

Wellbore	Wellbore #1				
Magnetics	Model Name	Sample Date	Declination (°)	Dip Angle (°)	Field Strength (nT)
	IGRF2015	12/14/2017	9.45	65.65	51,526

Design		Actual			
Audit Notes:					
Version:	1.0	Phase:	ACTUAL	Tie On Depth:	0.0
Vertical Section:		Depth From (TVD) (usft)	+N/-S (usft)	+E/-W (usft)	Direction (°)
		0.0	0.0	0.0	106.26

Survey Program		Date	12/14/2017		
From (usft)	To (usft)	Survey (Wellbore)	Tool Name	Description	
167.0	7,700.0	Actual (Wellbore #1)	MWD	MWD v3:standard declination	



Payzone Directional End of Well Report



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Well:	Federal GGU 24B-28-691	North Reference:	True
Wellbore:	Wellbore #1	Survey Calculation Method:	Minimum Curvature
Design:	Actual	Database:	EDM 5000.1 Single User Db

Survey										
MD (usft)	Inc (°)	Azi (azimuth) (°)	TVD (usft)	V. Sec (usft)	N/S (usft)	E/W (usft)	DLeg (°/100usft)	Build (°/100usft)	Turn (°/100usft)	
0.0	0.00	0.00	0.0	0.0	0.0	0.0	0.00	0.00	0.00	
167.0	0.79	242.68	167.0	-0.8	-0.5	-1.0	0.47	0.47	0.00	
197.0	0.83	213.85	197.0	-1.0	-0.8	-1.3	1.35	0.13	-96.10	
227.0	1.23	185.24	227.0	-1.1	-1.3	-1.5	2.13	1.33	-95.37	
257.0	1.58	186.43	257.0	-0.9	-2.0	-1.6	1.17	1.17	3.97	
286.0	1.45	185.07	286.0	-0.8	-2.8	-1.6	0.47	-0.45	-4.69	
316.0	1.41	171.40	316.0	-0.6	-3.5	-1.6	1.14	-0.13	-45.57	
346.0	1.14	150.26	346.0	-0.2	-4.2	-1.4	1.79	-0.90	-70.47	
376.0	1.41	136.77	375.9	0.3	-4.7	-1.0	1.34	0.90	-44.97	
407.0	1.89	120.60	406.9	1.2	-5.2	-0.3	2.14	1.55	-52.16	
438.0	2.77	116.42	437.9	2.4	-5.8	0.8	2.89	2.84	-13.48	
468.0	3.12	121.39	467.9	3.9	-6.6	2.2	1.44	1.17	16.57	
498.0	3.82	121.04	497.8	5.7	-7.5	3.7	2.33	2.33	-1.17	
527.0	4.56	121.44	526.7	7.7	-8.6	5.5	2.55	2.55	1.38	
558.0	4.92	121.26	557.6	10.2	-9.9	7.7	1.16	1.16	-0.58	
587.0	5.45	120.29	586.5	12.7	-11.3	10.0	1.85	1.83	-3.34	
618.0	5.58	122.79	617.4	15.6	-12.8	12.5	0.88	0.42	8.06	
647.0	5.93	120.82	646.2	18.4	-14.4	15.0	1.39	1.21	-6.79	
678.0	6.59	118.49	677.0	21.7	-16.0	17.9	2.28	2.13	-7.52	
708.0	7.56	123.41	706.8	25.3	-18.0	21.1	3.81	3.23	16.40	
738.0	8.57	119.15	736.5	29.3	-20.1	24.7	3.91	3.37	-14.20	
768.0	9.62	117.17	766.1	34.0	-22.4	28.8	3.65	3.50	-6.60	
798.0	10.68	114.05	795.7	39.2	-24.6	33.6	3.98	3.53	-10.40	
Last PZD Surface Survey										
854.0	12.57	112.12	850.5	50.4	-29.0	44.0	3.45	3.37	-3.45	
938.0	15.07	108.61	932.1	70.4	-36.0	62.8	3.14	2.98	-4.18	
1,022.0	18.02	104.56	1,012.6	94.3	-42.7	85.8	3.77	3.51	-4.82	



Payzone Directional End of Well Report



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Site:	GGU 13-28	MD Reference:	Federal GGU 24B-28-691 @ 6147.6usft (Est KB)
Well:	Federal GGU 24B-28-691	North Reference:	True
Wellbore:	Wellbore #1	Survey Calculation Method:	Minimum Curvature
Design:	Actual	Database:	EDM 5000.1 Single User Db

Survey										
MD (usft)	Inc (°)	Azi (azimuth) (°)	TVD (usft)	V. Sec (usft)	N/S (usft)	E/W (usft)	DLeg (°/100usft)	Build (°/100usft)	Turn (°/100usft)	
1,107.0	21.01	103.90	1,092.7	122.7	-49.7	113.3	3.53	3.52	-0.78	
1,191.0	21.45	103.81	1,171.0	153.0	-57.0	142.8	0.53	0.52	-0.11	
1,275.0	23.51	105.66	1,248.6	185.2	-65.2	173.9	2.59	2.45	2.20	
1,359.0	23.64	105.26	1,325.6	218.7	-74.1	206.2	0.25	0.15	-0.48	
1,443.0	23.55	105.04	1,402.6	252.4	-82.9	238.7	0.15	-0.11	-0.26	
1,530.0	25.22	105.30	1,481.8	288.3	-92.3	273.4	1.92	1.92	0.30	
1,616.0	26.89	106.01	1,559.1	326.0	-102.5	309.7	1.98	1.94	0.83	
1,700.0	26.38	105.92	1,634.2	363.7	-112.9	345.9	0.61	-0.61	-0.11	
1,788.0	25.53	105.61	1,713.3	402.2	-123.3	383.0	0.98	-0.97	-0.35	
1,874.0	24.83	105.57	1,791.1	438.8	-133.2	418.2	0.81	-0.81	-0.05	
1,959.0	24.52	105.96	1,868.3	474.3	-142.8	452.4	0.41	-0.36	0.46	
2,043.0	23.91	105.35	1,945.0	508.7	-152.1	485.6	0.78	-0.73	-0.73	
2,127.0	23.68	105.12	2,021.8	542.6	-161.0	518.3	0.30	-0.27	-0.27	
2,216.0	23.20	105.22	2,103.5	578.0	-170.3	552.4	0.54	-0.54	0.11	
2,300.0	22.64	105.71	2,180.8	610.7	-179.0	584.0	0.70	-0.67	0.58	
2,386.0	21.97	104.73	2,260.4	643.4	-187.6	615.5	0.89	-0.78	-1.14	
2,472.0	21.31	104.43	2,340.3	675.1	-195.6	646.1	0.78	-0.77	-0.35	
2,557.0	22.32	106.67	2,419.3	706.6	-204.0	676.6	1.54	1.19	2.64	
2,641.0	22.10	106.49	2,497.0	738.4	-213.1	707.0	0.27	-0.26	-0.21	
2,725.0	23.47	105.92	2,574.5	770.9	-222.2	738.2	1.65	1.63	-0.68	
2,810.0	23.16	105.44	2,652.5	804.6	-231.3	770.6	0.43	-0.36	-0.56	
2,896.0	22.88	104.89	2,731.7	838.2	-240.1	803.1	0.41	-0.33	-0.64	
2,980.0	22.46	103.94	2,809.2	870.5	-248.1	834.4	0.66	-0.50	-1.13	
3,064.0	22.18	102.98	2,886.9	902.4	-255.6	865.5	0.55	-0.33	-1.14	
3,151.0	23.20	105.09	2,967.2	935.9	-263.7	898.0	1.50	1.17	2.43	
3,237.0	23.07	105.74	3,046.2	969.7	-272.7	930.6	0.33	-0.15	0.76	
3,321.0	22.32	104.51	3,123.7	1,002.1	-281.1	961.9	1.06	-0.89	-1.46	



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Well:	Federal GGU 24B-28-691	North Reference:	True
Wellbore:	Wellbore #1	Survey Calculation Method:	Minimum Curvature
Design:	Actual	Database:	EDM 5000.1 Single User Db

Survey										
MD (usft)	Inc (°)	Azi (azimuth) (°)	TVD (usft)	V. Sec (usft)	N/S (usft)	E/W (usft)	DLeg (°/100usft)	Build (°/100usft)	Turn (°/100usft)	
3,408.0	21.93	104.03	3,204.3	1,034.9	-289.2	993.6	0.49	-0.45	-0.55	
3,492.0	22.74	106.32	3,282.0	1,066.8	-297.6	1,024.4	1.42	0.96	2.73	
3,576.0	22.02	105.66	3,359.7	1,098.8	-306.4	1,055.2	0.91	-0.86	-0.79	
3,662.0	22.68	104.69	3,439.2	1,131.5	-315.0	1,086.7	0.88	0.77	-1.13	
3,749.0	21.31	107.59	3,519.9	1,164.0	-324.0	1,118.0	2.01	-1.57	3.33	
3,833.0	22.28	104.03	3,597.9	1,195.2	-332.5	1,148.0	1.95	1.15	-4.24	
3,917.0	21.75	104.12	3,675.8	1,226.7	-340.1	1,178.6	0.63	-0.63	0.11	
4,002.0	22.68	105.88	3,754.5	1,258.8	-348.4	1,209.6	1.35	1.09	2.07	
4,088.0	22.59	105.30	3,833.9	1,291.9	-357.3	1,241.5	0.28	-0.10	-0.67	
4,174.0	21.45	104.51	3,913.6	1,324.1	-365.6	1,272.6	1.37	-1.33	-0.92	
4,260.0	19.25	106.93	3,994.2	1,354.0	-373.7	1,301.4	2.74	-2.56	2.81	
4,345.0	17.53	105.83	4,074.9	1,380.8	-381.3	1,327.2	2.06	-2.02	-1.29	
4,430.0	15.73	104.91	4,156.3	1,405.2	-387.7	1,350.6	2.14	-2.12	-1.08	
4,514.0	14.99	103.81	4,237.3	1,427.4	-393.3	1,372.2	0.95	-0.88	-1.31	
4,598.0	12.74	105.44	4,318.9	1,447.5	-398.3	1,391.6	2.72	-2.68	1.94	
4,682.0	10.77	106.10	4,401.1	1,464.6	-403.0	1,408.1	2.35	-2.35	0.79	
4,767.0	8.87	108.42	4,484.8	1,479.1	-407.2	1,422.0	2.28	-2.24	2.73	
4,851.0	6.08	102.23	4,568.1	1,490.0	-410.2	1,432.5	3.45	-3.32	-7.37	
4,935.0	5.19	102.62	4,651.7	1,498.2	-412.0	1,440.5	1.06	-1.06	0.46	
5,019.0	4.72	104.55	4,735.4	1,505.5	-413.7	1,447.6	0.59	-0.56	2.30	
5,031.0	4.73	104.25	4,747.4	1,506.5	-413.9	1,448.5	0.21	0.04	-2.50	
GGU 24B-28-691 TGT										
5,104.0	4.76	102.44	4,820.1	1,512.5	-415.3	1,454.4	0.21	0.05	-2.48	
5,188.0	4.35	99.15	4,903.8	1,519.1	-416.6	1,460.9	0.58	-0.49	-3.92	
5,272.0	3.69	99.77	4,987.6	1,525.0	-417.6	1,466.7	0.79	-0.79	0.74	
5,356.0	3.25	101.83	5,071.5	1,530.1	-418.5	1,471.7	0.54	-0.52	2.45	
5,443.0	3.18	105.62	5,158.3	1,534.9	-419.7	1,476.5	0.26	-0.08	4.36	



Payzone Directional End of Well Report



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Well:	Federal GGU 24B-28-691	North Reference:	True
Wellbore:	Wellbore #1	Survey Calculation Method:	Minimum Curvature
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Survey										
MD (usft)	Inc (°)	Azi (azimuth) (°)	TVD (usft)	V. Sec (usft)	N/S (usft)	E/W (usft)	DLeg (°/100usft)	Build (°/100usft)	Turn (°/100usft)	
5,529.0	2.90	103.84	5,244.2	1,539.5	-420.8	1,480.9	0.34	-0.33	-2.07	
5,613.0	0.92	90.28	5,328.2	1,542.3	-421.3	1,483.6	2.40	-2.36	-16.14	
5,698.0	0.26	70.59	5,413.2	1,543.1	-421.3	1,484.5	0.80	-0.78	-23.16	
5,782.0	0.18	261.71	5,497.2	1,543.1	-421.2	1,484.5	0.52	-0.10	-201.05	
5,866.0	0.53	236.79	5,581.2	1,542.7	-421.5	1,484.1	0.45	0.42	-29.67	
5,952.0	0.83	214.46	5,667.2	1,542.3	-422.2	1,483.4	0.46	0.35	-25.97	
6,037.0	0.70	216.27	5,752.1	1,541.9	-423.1	1,482.7	0.16	-0.15	2.13	
6,123.0	0.97	223.91	5,838.1	1,541.4	-424.1	1,481.9	0.34	0.31	8.88	
6,207.0	1.10	219.04	5,922.1	1,540.8	-425.2	1,480.9	0.19	0.15	-5.80	
6,291.0	1.27	196.40	6,006.1	1,540.4	-426.7	1,480.2	0.59	0.20	-26.95	
6,376.0	1.27	194.38	6,091.1	1,540.5	-428.5	1,479.7	0.05	0.00	-2.38	
6,461.0	1.93	109.66	6,176.1	1,541.9	-429.9	1,480.8	2.60	0.78	-99.67	
6,544.0	0.83	54.15	6,259.0	1,543.7	-430.1	1,482.6	1.94	-1.33	-66.88	
6,629.0	0.83	22.34	6,344.0	1,544.1	-429.1	1,483.3	0.54	0.00	-37.42	
6,713.0	0.48	33.89	6,428.0	1,544.3	-428.3	1,483.7	0.44	-0.42	13.75	
6,797.0	0.13	67.16	6,512.0	1,544.5	-427.9	1,484.0	0.45	-0.42	39.61	
6,883.0	0.79	210.99	6,598.0	1,544.4	-428.4	1,483.8	1.04	0.77	167.24	
6,968.0	0.04	319.23	6,683.0	1,544.2	-428.9	1,483.5	0.95	-0.88	127.34	
7,054.0	0.31	41.63	6,769.0	1,544.3	-428.7	1,483.6	0.36	0.31	95.81	
7,138.0	0.40	359.75	6,853.0	1,544.3	-428.2	1,483.8	0.32	0.11	-49.86	
7,223.0	0.65	292.31	6,938.0	1,543.8	-427.8	1,483.3	0.73	0.29	-79.34	
7,308.0	1.19	259.42	7,023.0	1,542.5	-427.7	1,482.0	0.86	0.64	-38.69	
7,394.0	1.52	254.44	7,109.0	1,540.7	-428.2	1,480.0	0.41	0.38	-5.79	
7,478.0	1.49	257.58	7,193.0	1,538.8	-428.7	1,477.9	0.10	-0.04	3.74	
7,563.0	1.27	260.43	7,277.9	1,537.0	-429.1	1,475.9	0.27	-0.26	3.35	
7,614.6	1.27	261.29	7,329.6	1,536.0	-429.3	1,474.8	0.04	0.00	1.66	
GGU 24B-28-691 BHL										



Payzone Directional End of Well Report



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Project:	Garfield County, CO	TVD Reference:	Federal GGU 24B-28-691 @ 6147.6usft (Est KB)
Site:	GGU 13-28	MD Reference:	Federal GGU 24B-28-691 @ 6147.6usft (Est KB)
Well:	Federal GGU 24B-28-691	North Reference:	True
Wellbore:	Wellbore #1	Survey Calculation Method:	Minimum Curvature
Design:	Actual	Database:	EDM 5000.1 Single User Db

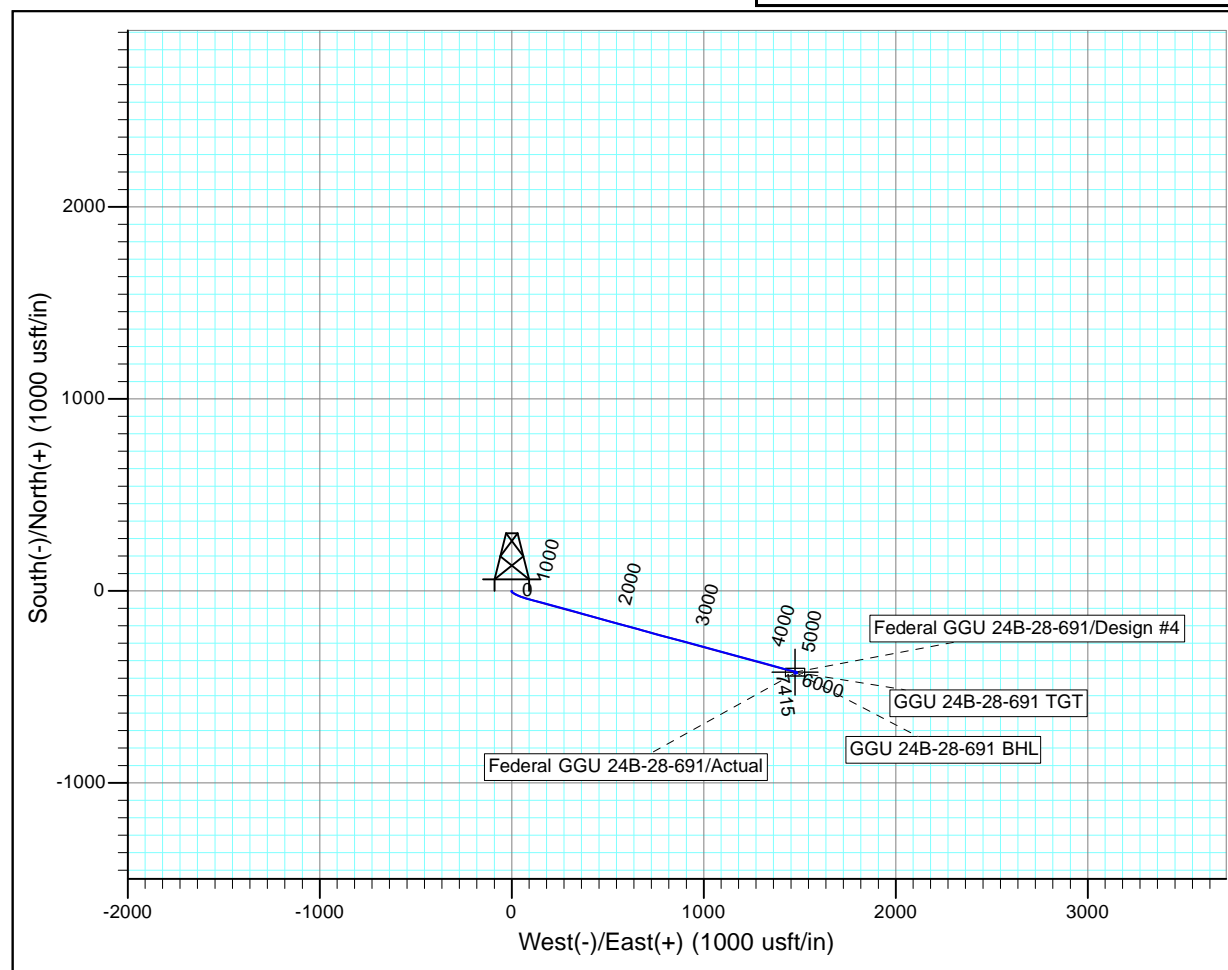
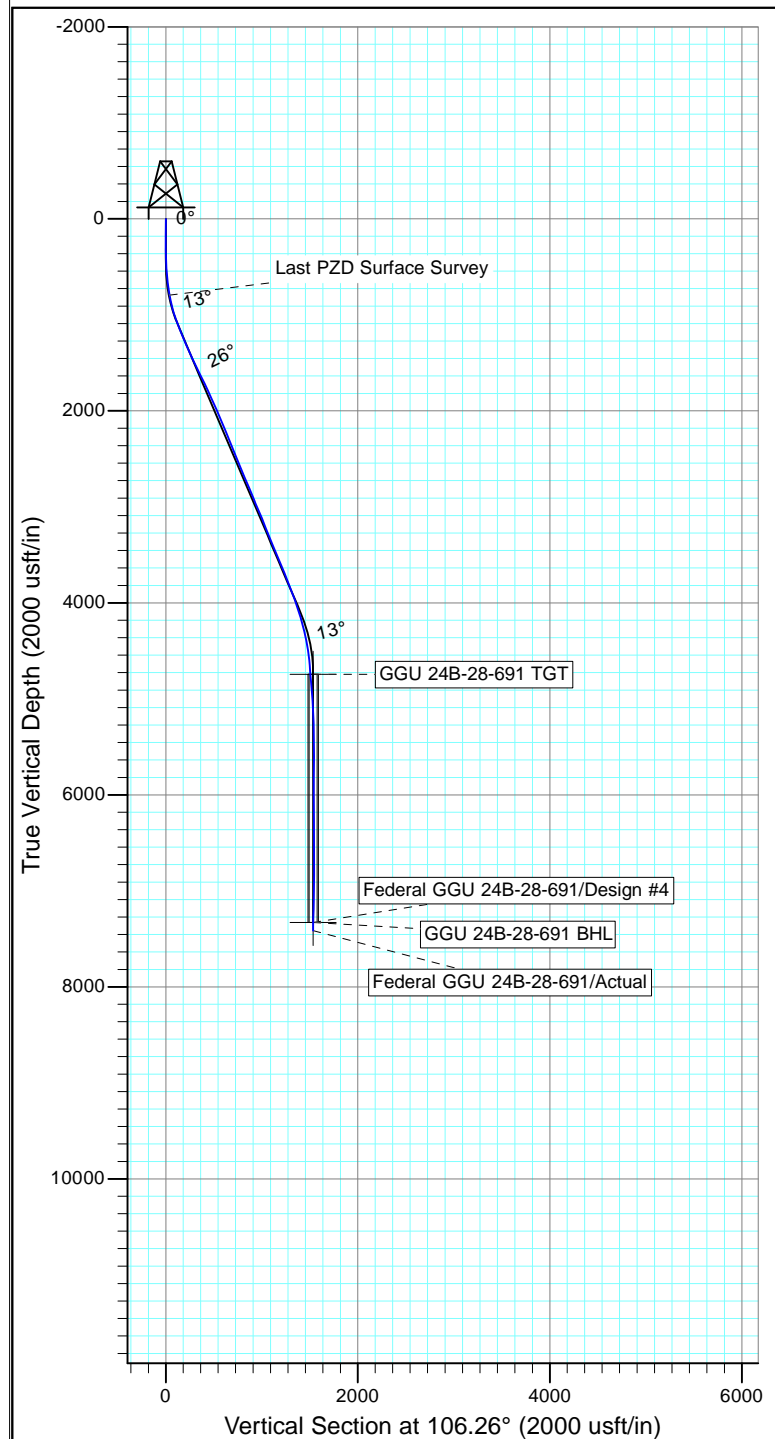
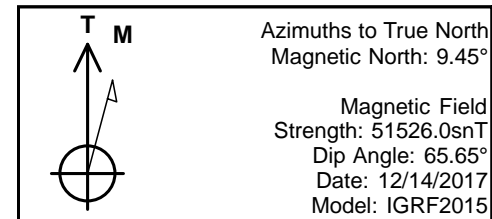
Survey									
MD (usft)	Inc (°)	Azi (azimuth) (°)	TVD (usft)	V. Sec (usft)	N/S (usft)	E/W (usft)	DLeg (°/100usft)	Build (°/100usft)	Turn (°/100usft)
7,645.0	1.27	261.79	7,359.9	1,535.4	-429.4	1,474.1	0.04	0.00	1.66
Last PZD Survey									
7,700.0	1.27	261.79	7,414.9	1,534.2	-429.6	1,472.9	0.00	0.00	0.00
Straightline Projection to TD									

Design Annotations				
Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates		Comment
		+N/-S (usft)	+E/-W (usft)	
798.0	795.7	-24.6	33.6	Last PZD Surface Survey
7,645.0	7,359.9	-429.4	1,474.1	Last PZD Survey
7,700.0	7,414.9	-429.6	1,472.9	Straightline Projection to TD

Checked By: _____	Approved By: _____	Date: _____
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Project: Garfield County, CO
Site: GGU 13-28
Well: Federal GGU 24B-28-691
Wellbore: Wellbore #1
Design: Actual



Design: Actual (Federal GGU 24B-28-691/Wellbore #1)

Created By: Derek Stephens Date: 6:34, December 14 2017

THIS SURVEY IS CORRECT TO THE BEST OF
MY KNOWLEDGE AND IS SUPPORTED
BY ACTUAL FIELD DATA