



Vanguard Natural Resources

Garfield County, CO

GGU 13-28

Federal GGU 24A-28-691

Wellbore #1

Design: Actual

End of Well Report

29 November, 2017





Payzone Directional

End of Well Report



Company: Vanguard Natural Resources	Local Co-ordinate Reference: Well Federal GGU 24A-28-691
Project: Garfield County, CO	TVD Reference: Federal GGU 24A-28-691 @ 6147.6usft (Est KB)
Site: GGU 13-28	MD Reference: Federal GGU 24A-28-691 @ 6147.6usft (Est KB)
Well: Federal GGU 24A-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 24A-28-691			
Well Position	+N/-S 0.0 usft	Northing: 1,611,596.73 usft	Latitude: 39° 29' 39.843 N
	+E/-W 0.0 usft	Easting: 2,416,881.34 usft	Longitude: 107° 33' 59.252 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	11/29/2017	9.46	65.65	51,531

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	116.64

Survey Program Date 11/29/2017				
From (usft)	To (usft)	Survey (Wellbore)	Tool Name	Description
136.0	7,760.0	Actual (Wellbore #1)	MWD	MWD v3:standard declination



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Well: Federal GGU 24A-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	0.00
136.0	0.33	283.45	136.0	-0.4	0.1	-0.4	0.24	0.24	0.00	
167.0	0.48	300.34	167.0	-0.6	0.2	-0.6	0.61	0.48	54.48	
197.0	0.53	291.91	197.0	-0.9	0.3	-0.8	0.30	0.17	-28.10	
227.0	0.57	313.88	227.0	-1.1	0.4	-1.1	0.71	0.13	73.23	
256.0	0.40	314.80	256.0	-1.4	0.6	-1.2	0.59	-0.59	3.17	
286.0	0.13	160.77	286.0	-1.5	0.7	-1.3	1.73	-0.90	-513.43	
316.0	0.18	153.61	316.0	-1.4	0.6	-1.3	0.18	0.17	-23.87	
347.0	0.18	120.34	347.0	-1.3	0.5	-1.2	0.33	0.00	-107.32	
377.0	0.44	124.65	377.0	-1.1	0.4	-1.1	0.87	0.87	14.37	
407.0	0.39	103.74	407.0	-0.9	0.3	-0.9	0.53	-0.17	-69.70	
437.0	0.36	117.87	437.0	-0.7	0.3	-0.7	0.32	-0.10	47.10	
467.0	0.35	76.27	467.0	-0.6	0.2	-0.5	0.84	-0.03	-138.67	
497.0	0.31	104.44	497.0	-0.4	0.3	-0.3	0.55	-0.13	93.90	
527.0	0.31	89.63	527.0	-0.3	0.2	-0.2	0.27	0.00	-49.37	
557.0	0.22	102.99	557.0	-0.1	0.2	0.0	0.36	-0.30	44.53	
587.0	0.13	91.34	587.0	-0.1	0.2	0.0	0.32	-0.30	-38.83	
617.0	0.13	12.68	617.0	0.0	0.2	0.1	0.55	0.00	-262.20	
648.0	0.31	18.00	648.0	-0.1	0.4	0.1	0.58	0.58	17.16	
678.0	0.22	19.58	678.0	-0.1	0.5	0.2	0.30	-0.30	5.27	
708.0	0.22	69.46	708.0	0.0	0.6	0.2	0.62	0.00	166.27	
738.0	0.31	31.79	738.0	0.0	0.6	0.3	0.64	0.30	-125.57	
768.0	0.44	53.11	768.0	0.1	0.8	0.5	0.63	0.43	71.07	
785.0	0.40	58.51	785.0	0.1	0.9	0.6	0.33	-0.24	31.76	
Last PZD Surface Survey										
852.0	0.40	14.26	852.0	0.2	1.2	0.8	0.45	0.00	-66.04	
895.0	0.40	33.90	895.0	0.2	1.5	0.9	0.32	0.00	45.67	



Payzone Directional

End of Well Report



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Site:	GGU 13-28	MD Reference:	Federal GGU 24A-28-691 @ 6147.6usft (Est KB)
Well:	Federal GGU 24A-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)	
981.0	5.76	106.59	980.8	4.5	0.5	5.3	6.57	6.23	84.52	
1,065.0	9.10	106.55	1,064.1	15.2	-2.6	15.7	3.98	3.98	-0.05	
1,107.0	9.27	111.42	1,105.6	21.8	-4.8	22.0	1.89	0.40	11.60	
1,149.0	9.58	114.59	1,147.0	28.7	-7.5	28.3	1.44	0.74	7.55	
1,192.0	9.84	120.70	1,189.4	35.9	-10.8	34.7	2.47	0.60	14.21	
1,234.0	10.85	120.52	1,230.7	43.4	-14.7	41.2	2.41	2.40	-0.43	
1,276.0	12.26	117.71	1,271.9	51.8	-18.8	48.6	3.61	3.36	-6.69	
1,318.0	14.02	116.65	1,312.8	61.4	-23.1	57.1	4.23	4.19	-2.52	
1,360.0	15.78	116.30	1,353.4	72.2	-27.9	66.7	4.20	4.19	-0.83	
1,402.0	17.58	115.69	1,393.6	84.2	-33.2	77.6	4.31	4.29	-1.45	
1,445.0	19.03	116.83	1,434.4	97.7	-39.2	89.7	3.47	3.37	2.65	
1,487.0	20.52	118.59	1,473.9	111.9	-45.8	102.3	3.82	3.55	4.19	
1,529.0	22.10	119.55	1,513.1	127.2	-53.2	115.6	3.85	3.76	2.29	
1,573.0	23.77	118.01	1,553.6	144.3	-61.5	130.6	4.03	3.80	-3.50	
1,617.0	25.31	116.74	1,593.6	162.6	-69.9	146.9	3.70	3.50	-2.89	
1,660.0	26.67	117.44	1,632.3	181.4	-78.5	163.6	3.24	3.16	1.63	
1,702.0	28.30	117.27	1,669.5	200.8	-87.4	180.9	3.89	3.88	-0.40	
1,744.0	29.62	116.83	1,706.3	221.2	-96.6	199.0	3.18	3.14	-1.05	
1,828.0	29.22	117.14	1,779.4	262.4	-115.3	235.7	0.51	-0.48	0.37	
1,916.0	28.30	116.65	1,856.6	304.8	-134.5	273.5	1.08	-1.05	-0.56	
2,000.0	29.64	116.14	1,930.1	345.4	-152.6	309.9	1.62	1.60	-0.61	
2,087.0	29.36	115.86	2,005.8	388.3	-171.3	348.4	0.36	-0.32	-0.32	
2,174.0	28.56	115.47	2,081.9	430.4	-189.6	386.4	0.94	-0.92	-0.45	
2,261.0	29.49	116.83	2,158.0	472.6	-208.2	424.3	1.31	1.07	1.56	
2,345.0	29.49	116.13	2,231.1	514.0	-226.6	461.3	0.41	0.00	-0.83	
2,430.0	28.78	115.99	2,305.3	555.3	-244.8	498.5	0.84	-0.84	-0.16	
2,514.0	29.91	116.40	2,378.6	596.5	-263.0	535.4	1.37	1.35	0.49	



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Well:	Federal GGU 24A-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)	
2,600.0	29.79	116.87	2,453.1	639.3	-282.2	573.7	0.31	-0.14	0.55	
2,684.0	29.05	116.04	2,526.3	680.6	-300.6	610.6	1.01	-0.88	-0.99	
2,769.0	28.21	115.73	2,600.9	721.3	-318.3	647.3	1.00	-0.99	-0.36	
2,853.0	29.33	115.98	2,674.5	761.7	-336.0	683.6	1.34	1.33	0.30	
2,937.0	29.00	115.86	2,747.9	802.6	-353.9	720.5	0.40	-0.39	-0.14	
3,023.0	30.10	116.30	2,822.7	845.1	-372.5	758.6	1.30	1.28	0.51	
3,108.0	29.84	116.26	2,896.3	887.5	-391.3	796.6	0.31	-0.31	-0.05	
3,192.0	29.86	118.56	2,969.2	929.3	-410.6	833.7	1.36	0.02	2.74	
3,276.0	29.53	114.59	3,042.2	970.9	-429.2	870.9	2.37	-0.39	-4.73	
3,365.0	30.20	118.40	3,119.4	1,015.2	-449.0	910.6	2.26	0.75	4.28	
3,453.0	29.49	118.66	3,195.7	1,059.0	-469.9	949.0	0.82	-0.81	0.30	
3,540.0	28.78	115.38	3,271.7	1,101.3	-489.1	986.8	2.01	-0.82	-3.77	
3,624.0	28.34	113.93	3,345.5	1,141.4	-505.9	1,023.2	0.98	-0.52	-1.73	
3,710.0	28.92	114.15	3,421.0	1,182.6	-522.7	1,060.9	0.69	0.67	0.26	
3,795.0	28.21	118.19	3,495.6	1,223.2	-540.6	1,097.3	2.42	-0.84	4.75	
3,881.0	29.14	120.17	3,571.1	1,264.5	-560.7	1,133.4	1.55	1.08	2.30	
3,967.0	27.25	118.37	3,646.9	1,305.0	-580.6	1,168.8	2.41	-2.20	-2.09	
4,054.0	25.49	116.65	3,724.8	1,343.7	-598.4	1,203.1	2.21	-2.02	-1.98	
4,139.0	25.18	115.16	3,801.6	1,380.0	-614.3	1,235.8	0.83	-0.36	-1.75	
4,223.0	24.65	114.54	3,877.8	1,415.4	-629.2	1,267.9	0.70	-0.63	-0.74	
4,307.0	23.25	112.96	3,954.6	1,449.5	-642.9	1,299.1	1.83	-1.67	-1.88	
4,392.0	21.97	111.91	4,033.0	1,482.0	-655.4	1,329.3	1.58	-1.51	-1.24	
4,476.0	19.91	114.54	4,111.5	1,512.0	-667.2	1,356.9	2.70	-2.45	3.13	
4,560.0	18.17	117.81	4,190.9	1,539.4	-679.3	1,381.5	2.43	-2.07	3.89	
4,645.0	16.13	117.40	4,272.1	1,564.5	-690.9	1,403.7	2.40	-2.40	-0.48	
4,729.0	12.61	118.63	4,353.5	1,585.3	-700.7	1,422.1	4.21	-4.19	1.46	
4,813.0	10.42	119.25	4,435.8	1,602.0	-708.8	1,436.8	2.61	-2.61	0.74	



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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)	
4,898.0	8.26	118.63	4,519.6	1,615.8	-715.4	1,448.8	2.54	-2.54	-0.73	
4,982.0	5.45	119.20	4,603.0	1,625.8	-720.3	1,457.6	3.35	-3.35	0.68	
5,066.0	3.30	98.11	4,686.8	1,632.1	-722.6	1,463.5	3.16	-2.56	-25.11	
5,077.7	3.23	96.84	4,698.5	1,632.8	-722.7	1,464.2	0.84	-0.57	-10.86	
GGU 24A-28-691 TGT										
5,150.0	2.86	87.74	4,770.7	1,636.2	-722.8	1,468.0	0.84	-0.52	-12.59	
5,237.0	2.42	99.29	4,857.6	1,639.9	-723.0	1,472.0	0.79	-0.51	13.28	
5,323.0	2.07	104.70	4,943.5	1,643.2	-723.7	1,475.3	0.48	-0.41	6.29	
5,407.0	2.07	97.71	5,027.5	1,646.1	-724.3	1,478.2	0.30	0.00	-8.32	
5,492.0	2.33	103.69	5,112.4	1,649.2	-724.9	1,481.4	0.41	0.31	7.04	
5,576.0	1.10	126.80	5,196.4	1,651.7	-725.8	1,483.7	1.65	-1.46	27.51	
5,660.0	1.14	125.27	5,280.3	1,653.3	-726.8	1,485.1	0.06	0.05	-1.82	
5,745.0	0.62	287.03	5,365.3	1,653.7	-727.1	1,485.3	2.05	-0.61	190.31	
5,829.0	0.53	265.63	5,449.3	1,652.9	-727.0	1,484.5	0.28	-0.11	-25.48	
5,915.0	0.66	239.22	5,535.3	1,652.3	-727.3	1,483.7	0.35	0.15	-30.71	
6,001.0	1.10	233.81	5,621.3	1,651.6	-728.1	1,482.6	0.52	0.51	-6.29	
6,086.0	0.57	249.89	5,706.3	1,651.0	-728.7	1,481.5	0.68	-0.62	18.92	
6,170.0	0.83	8.50	5,790.3	1,650.5	-728.2	1,481.2	1.44	0.31	141.20	
6,254.0	1.27	28.81	5,874.3	1,650.3	-726.8	1,481.8	0.68	0.52	24.18	
6,339.0	1.05	22.39	5,959.3	1,650.3	-725.3	1,482.5	0.30	-0.26	-7.55	
6,423.0	1.23	16.90	6,043.3	1,650.1	-723.7	1,483.1	0.25	0.21	-6.54	
6,507.0	0.62	28.06	6,127.3	1,650.0	-722.4	1,483.5	0.75	-0.73	13.29	
6,592.0	0.06	202.17	6,212.2	1,650.0	-722.1	1,483.7	0.80	-0.66	204.84	
6,678.0	0.97	201.47	6,298.2	1,650.1	-722.8	1,483.5	1.06	1.06	-0.81	
6,762.0	1.33	197.89	6,382.2	1,650.3	-724.4	1,482.9	0.44	0.43	-4.26	
6,847.0	0.75	263.30	6,467.2	1,650.0	-725.4	1,482.0	1.44	-0.68	76.95	
6,931.0	0.75	259.08	6,551.2	1,649.1	-725.5	1,481.0	0.07	0.00	-5.02	



Payzone Directional End of Well Report



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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)	
7,017.0	0.96	249.12	6,637.2	1,648.1	-725.9	1,479.7	0.30	0.24	-11.58	
7,103.0	1.36	252.05	6,723.2	1,646.9	-726.5	1,478.1	0.47	0.47	3.41	
7,187.0	1.26	238.52	6,807.2	1,645.7	-727.3	1,476.3	0.39	-0.12	-16.11	
7,271.0	1.93	233.93	6,891.1	1,644.6	-728.6	1,474.4	0.81	0.80	-5.46	
7,356.0	1.67	263.56	6,976.1	1,642.9	-729.6	1,472.0	1.12	-0.31	34.86	
7,442.0	2.50	272.70	7,062.0	1,640.1	-729.6	1,468.9	1.04	0.97	10.63	
7,529.0	2.99	267.87	7,148.9	1,636.4	-729.6	1,464.7	0.62	0.56	-5.55	
7,615.0	3.12	272.04	7,234.8	1,632.3	-729.6	1,460.2	0.30	0.15	4.85	
7,699.0	2.81	277.80	7,318.7	1,628.3	-729.3	1,455.8	0.51	-0.37	6.86	
Last PZD Survey - GGU 24A-28-691 BHL										
7,760.0	2.81	277.80	7,379.6	1,625.4	-728.8	1,452.9	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)	
785.0	785.0	0.9	0.6	Last PZD Surface Survey
7,699.0	7,318.7	-729.3	1,455.8	Last PZD Survey
7,760.0	7,379.6	-728.8	1,452.9	Straightline Projection to TD

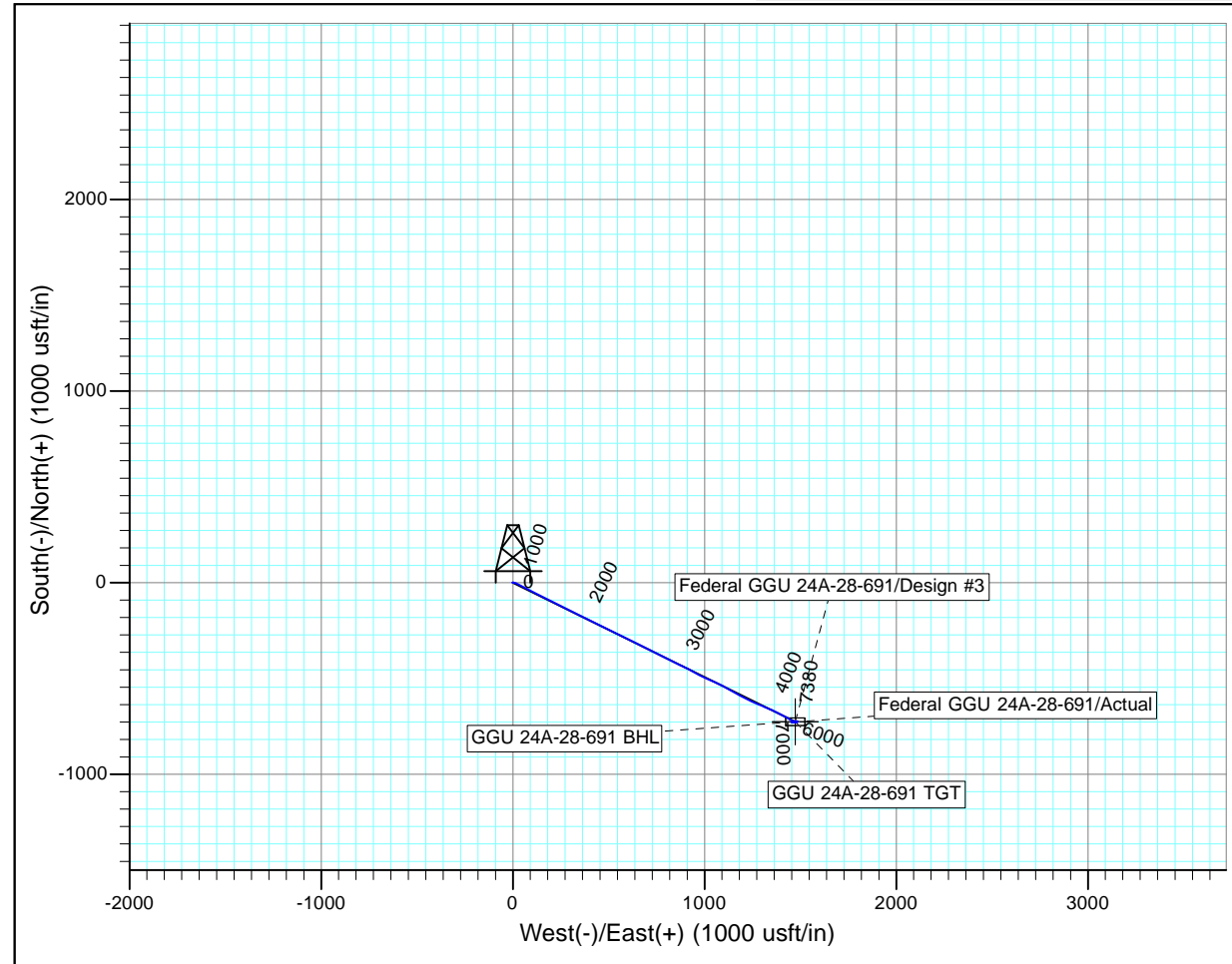
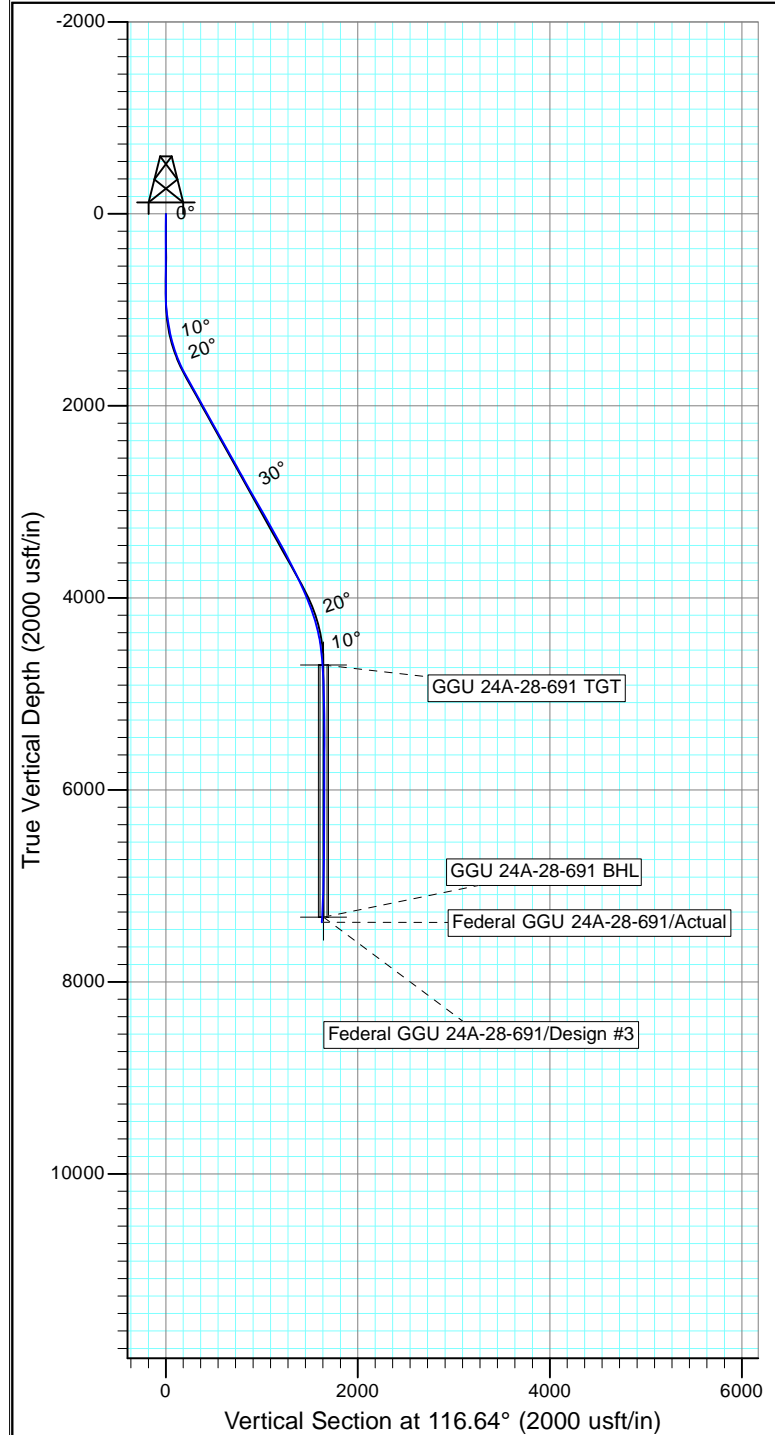
Checked By: _____ Approved By: _____ Date: _____



Project: Garfield County, CO
 Site: GGU 13-28
 Well: Federal GGU 24A-28-691
 Wellbore: Wellbore #1
 Design: Actual

Azimuths to True North
 Magnetic North: 9.46°

Magnetic Field
 Strength: 51530.5snT
 Dip Angle: 65.65°
 Date: 11/29/2017
 Model: IGRF2015



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

Created By: Derek Stephens Date: 6:58, November 29 2017

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