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WV GEOLOGICAL SURVEY
MORGANTOWN, WV

Cathedral Energy Services
Survey Report

Company:	Chesapeake Energy Corp	Local Co-ordinate Reference:	Well Gerald Gourley BRK 3H
Project:	Brooke County, WV	TVD Reference:	WELL @ 1178.0usft (Original Well Elev)
Site:	Gerald Gourley	MD Reference:	WELL @ 1178.0usft (Original Well Elev)
Well:	Gerald Gourley BRK 3H	North Reference:	Grid
Wellbore:	HZ	Survey Calculation Method:	Minimum Curvature
Design:	HZ	Database:	USA EDM 5000 Multi Users DB

Project	Brooke County, WV		
Map System:	US State Plane 1927 (Exact solution)	System Datum:	Mean Sea Level
Geo Datum:	NAD 1927 (NADCON CONUS)		
Map Zone:	West Virginia North 4701		Using geodetic scale factor

Site	Gerald Gourley				
Site Position:		Northing:	664,030.25 usft	Latitude:	40° 19' 5.800 N
From:	Lat/Long	Easting:	1,704,413.33 usft	Longitude:	80° 33' 35.900 W
Position Uncertainty:	0.0 usft	Slot Radius:	13-3/16"	Grid Convergence:	-0.68 °

Well	Gerald Gourley BRK 3H					
Well Position	+N/-S	0.0 usft	Northing:	664,059.06 usft	Latitude:	40° 19' 6.085 N
	+E/-W	0.0 usft	Easting:	1,704,417.07 usft	Longitude:	80° 33' 35.856 W
Position Uncertainty		0.0 usft	Wellhead Elevation:	usft	Ground Level:	1,160.0 usft

Wellbore	HZ				
Magnetics	Model Name	Sample Date	Declination (°)	Dip Angle (°)	Field Strength (nT)
	IGRF2010	11/14/2012	-8.81	67.73	52,979

Design	HZ				
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	343.40	

Survey Program	Date	12/4/2012			
From (usft)	To (usft)	Survey (Wellbore)	Tool Name	Description	
100.0	5,020.0	Gyro 2 (HZ)	Gyro	Gyro	
5,114.0	11,110.0	Survey #4 (HZ)	MWD	Geolink MWD	

Survey										
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100u)	Formations / Comments	
0.0	0.00	0.00	0.0	0.0	0.0	0.0	0.00	0.00		
100.0	0.76	196.93	100.0	-0.6	-0.2	-0.6	0.76	0.76		
200.0	0.73	190.41	200.0	-1.9	-0.5	-1.7	0.09	-0.03		
300.0	0.48	189.14	300.0	-2.9	-0.7	-2.6	0.25	-0.25		
400.0	0.13	190.29	400.0	-3.5	-0.8	-3.1	0.35	-0.35		
500.0	0.52	122.07	500.0	-3.8	-0.4	-3.5	0.49	0.39		
600.0	0.48	138.39	600.0	-4.4	0.3	-4.3	0.15	-0.04		
700.0	1.08	261.30	700.0	-4.8	-0.4	-4.5	1.40	0.60		
800.0	3.26	269.20	799.9	-5.0	-4.2	-3.6	2.20	2.18		
900.0	6.38	278.38	899.5	-4.2	-12.5	-0.5	3.20	3.12		
1,000.0	8.80	276.21	998.6	-2.6	-25.6	4.8	2.44	2.42		
1,100.0	10.13	262.42	1,097.3	-2.9	-41.9	9.2	2.62	1.33		

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Wellbore:	HZ	Survey Calculation Method:	Minimum Curvature
Design:	HZ	Database:	USA EDM 5000 Multi Users DB

Survey

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100u)	Formations / Comments
1,200.0	8.72	258.81	1,195.9	-5.6	-58.1	11.3	1.53	-1.41	
1,300.0	6.65	261.90	1,295.0	-7.8	-71.3	12.8	2.11	-2.07	
1,400.0	5.50	278.48	1,394.5	-8.0	-81.7	15.7	2.09	-1.15	
1,500.0	3.96	291.34	1,494.1	-6.0	-89.7	19.9	1.86	-1.54	
1,600.0	3.58	294.13	1,593.9	-3.5	-95.8	24.0	0.42	-0.38	
1,700.0	2.61	289.00	1,693.8	-1.4	-100.8	27.4	1.01	-0.97	
1,800.0	1.96	292.37	1,793.7	-0.1	-104.5	29.8	0.66	-0.65	
1,900.0	1.09	297.49	1,893.7	1.0	-106.9	31.5	0.88	-0.87	
2,000.0	1.01	299.55	1,993.6	1.9	-108.5	32.8	0.09	-0.08	
2,100.0	0.77	311.07	2,093.6	2.8	-109.8	34.0	0.30	-0.24	
2,200.0	0.54	315.94	2,193.6	3.6	-110.6	35.0	0.24	-0.23	
2,300.0	0.75	328.34	2,293.6	4.5	-111.3	36.1	0.25	0.21	
2,400.0	0.76	329.91	2,393.6	5.6	-112.0	37.4	0.02	0.01	
2,500.0	0.74	334.11	2,493.6	6.7	-112.6	38.6	0.06	-0.02	
2,600.0	0.82	337.24	2,593.6	8.0	-113.2	40.0	0.09	0.08	
2,700.0	0.52	339.56	2,693.6	9.1	-113.6	41.2	0.30	-0.30	
2,800.0	0.33	347.18	2,793.6	9.8	-113.8	41.9	0.20	-0.19	
2,900.0	0.33	351.14	2,893.6	10.3	-113.9	42.5	0.02	0.00	
3,000.0	0.63	357.66	2,993.6	11.2	-114.0	43.3	0.30	0.30	
3,100.0	0.70	352.29	3,093.6	12.3	-114.1	44.4	0.09	0.07	
3,200.0	0.39	354.63	3,193.6	13.3	-114.2	45.4	0.31	-0.31	
3,300.0	0.60	344.71	3,293.6	14.1	-114.4	46.2	0.23	0.21	
3,400.0	0.74	346.78	3,393.6	15.3	-114.7	47.4	0.14	0.14	
3,500.0	0.56	356.95	3,493.5	16.4	-114.8	48.5	0.21	-0.18	
3,600.0	0.51	7.17	3,593.5	17.3	-114.8	49.4	0.11	-0.05	
3,700.0	0.44	5.24	3,693.5	18.1	-114.7	50.1	0.07	-0.07	
3,800.0	0.37	12.73	3,793.5	18.8	-114.6	50.8	0.09	-0.07	
3,900.0	0.39	8.48	3,893.5	19.5	-114.5	51.4	0.03	0.02	
4,000.0	0.53	355.06	3,993.5	20.3	-114.5	52.1	0.18	0.14	
4,100.0	0.56	344.07	4,093.5	21.2	-114.7	53.1	0.11	0.03	
4,200.0	0.47	343.04	4,193.5	22.1	-114.9	54.0	0.09	-0.09	
4,300.0	0.50	336.07	4,293.5	22.9	-115.2	54.8	0.07	0.03	
4,400.0	0.49	334.98	4,393.5	23.6	-115.6	55.7	0.01	-0.01	
4,500.0	0.30	330.56	4,493.5	24.3	-115.9	56.4	0.19	-0.19	
4,600.0	0.69	313.39	4,593.5	24.9	-116.4	57.1	0.41	0.39	
4,700.0	0.69	297.68	4,693.5	25.6	-117.4	58.1	0.19	0.00	
4,800.0	0.51	323.67	4,793.5	26.2	-118.2	58.9	0.32	-0.18	
4,900.0	0.58	332.30	4,893.5	27.0	-118.7	59.8	0.11	0.07	
5,000.0	0.48	338.97	4,993.5	27.9	-119.1	60.7	0.12	-0.10	
5,020.0	0.38	337.07	5,013.5	28.0	-119.1	60.9	0.50	-0.50	Last Gyro Survey @ 5020' MD
5,114.0	2.60	18.90	5,107.4	30.3	-118.6	62.9	2.48	2.36	
5,145.0	6.50	18.90	5,138.3	32.6	-117.8	64.9	12.58	12.58	
5,177.0	10.20	24.10	5,170.0	36.9	-116.0	68.6	11.79	11.56	
5,209.0	13.80	29.80	5,201.3	42.8	-113.0	73.3	11.83	11.25	
5,241.0	17.00	27.50	5,232.1	50.3	-108.9	79.3	10.18	10.00	
5,273.0	20.30	23.30	5,262.5	59.6	-104.6	87.0	11.13	10.31	
5,304.0	23.10	17.50	5,291.3	70.3	-100.6	96.1	11.37	9.03	
5,335.0	25.20	9.60	5,319.6	82.6	-97.7	107.1	12.42	6.77	
5,367.0	27.30	1.80	5,348.3	96.7	-96.3	120.2	12.61	6.56	
5,398.0	28.90	354.20	5,375.6	111.2	-96.8	134.3	12.64	5.16	
5,430.0	29.70	345.50	5,403.5	126.6	-99.6	149.8	13.53	2.50	
5,462.0	31.50	337.90	5,431.1	142.0	-104.7	166.0	13.32	5.63	
5,494.0	34.50	337.20	5,457.9	158.1	-111.4	183.4	9.45	9.38	

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Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100u)	Formations / Comments
5,526.0	37.00	338.30	5,483.9	175.4	-118.5	202.0	8.07	7.81	
5,556.0	39.60	338.60	5,507.4	192.7	-125.3	220.5	8.69	8.66	
5,588.0	43.90	337.20	5,531.3	212.5	-133.3	241.7	13.75	13.44	
5,620.0	47.90	336.10	5,553.6	233.6	-142.4	264.5	12.74	12.50	
5,651.0	52.70	335.00	5,573.4	255.3	-152.3	288.2	15.72	15.48	
5,684.0	56.70	335.00	5,592.4	279.7	-163.7	314.8	12.12	12.12	
5,716.0	61.70	335.80	5,608.8	304.7	-175.1	342.0	15.77	15.62	
5,747.0	66.40	336.10	5,622.4	330.1	-186.5	369.6	15.19	15.16	
5,779.0	70.10	336.70	5,634.2	357.3	-198.4	399.1	11.69	11.56	
5,811.0	73.20	337.70	5,644.3	385.3	-210.2	429.3	10.13	9.69	
5,843.0	75.40	338.00	5,653.0	413.9	-221.8	460.0	6.93	6.87	
5,873.0	77.20	338.20	5,660.1	440.9	-232.6	489.0	6.03	6.00	
5,904.0	80.30	339.10	5,666.1	469.2	-243.7	519.3	10.40	10.00	
5,936.0	83.50	339.20	5,670.6	498.8	-255.0	550.9	10.00	10.00	
5,967.0	86.90	339.30	5,673.2	527.7	-265.9	581.7	10.97	10.97	
5,998.0	90.10	338.70	5,674.0	556.6	-277.0	612.6	10.50	10.32	
6,061.0	91.30	338.30	5,673.3	615.3	-300.1	675.3	2.01	1.90	
6,124.0	91.50	338.40	5,671.7	673.8	-323.4	738.1	0.35	0.32	
6,187.0	91.50	338.00	5,670.1	732.3	-346.7	800.8	0.63	0.00	
6,251.0	90.50	337.50	5,669.0	791.5	-371.0	864.5	1.75	-1.56	
6,314.0	90.40	338.70	5,668.5	849.9	-394.5	927.2	1.91	-0.16	
6,377.0	88.60	339.70	5,669.0	908.8	-416.8	990.0	3.27	-2.86	
6,440.0	89.20	340.60	5,670.2	968.1	-438.2	1,052.9	1.72	0.95	
6,504.0	89.20	340.50	5,671.1	1,028.4	-459.5	1,116.8	0.16	0.00	
6,566.0	89.40	340.50	5,671.9	1,086.9	-480.2	1,178.8	0.32	0.32	
6,629.0	89.90	341.10	5,672.3	1,146.3	-500.9	1,241.7	1.24	0.79	
6,691.0	89.60	340.40	5,672.5	1,204.9	-521.4	1,303.6	1.23	-0.48	
6,754.0	89.60	340.30	5,673.0	1,264.2	-542.6	1,366.5	0.16	0.00	
6,816.0	89.90	340.50	5,673.2	1,322.6	-563.4	1,428.4	0.58	0.48	
6,879.0	90.00	340.20	5,673.3	1,381.9	-584.6	1,491.4	0.50	0.16	
6,942.0	90.00	340.40	5,673.3	1,441.2	-605.8	1,554.2	0.32	0.00	
7,005.0	89.80	340.40	5,673.4	1,500.6	-626.9	1,617.2	0.32	-0.32	
7,068.0	90.80	342.00	5,673.1	1,560.2	-647.2	1,680.1	2.99	1.59	
7,131.0	90.80	342.40	5,672.2	1,620.2	-666.5	1,743.1	0.63	0.00	
7,194.0	90.80	342.60	5,671.3	1,680.3	-685.4	1,806.1	0.32	0.00	
7,255.0	90.70	342.90	5,670.5	1,738.5	-703.5	1,867.1	0.52	-0.16	
7,318.0	90.80	344.00	5,669.7	1,798.9	-721.5	1,930.1	1.75	0.16	
7,443.0	91.20	341.40	5,667.5	1,918.2	-758.6	2,055.0	2.10	0.32	
7,505.0	91.40	342.30	5,666.1	1,977.1	-777.9	2,117.0	1.49	0.32	
7,569.0	91.50	342.60	5,664.5	2,038.1	-797.2	2,181.0	0.49	0.16	
7,694.0	91.80	342.40	5,660.9	2,157.3	-834.8	2,305.9	0.29	0.24	
7,817.0	90.90	341.70	5,658.0	2,274.3	-872.7	2,428.8	0.93	-0.73	
7,944.0	89.70	340.70	5,657.3	2,394.5	-913.6	2,555.7	1.23	-0.94	
8,070.0	90.00	340.50	5,657.6	2,513.3	-955.5	2,681.6	0.29	0.24	
8,196.0	89.80	340.60	5,657.9	2,632.2	-997.4	2,807.4	0.18	-0.16	
8,323.0	91.80	344.40	5,656.1	2,753.2	-1,035.6	2,934.3	3.38	1.57	
8,450.0	90.90	345.00	5,653.1	2,875.7	-1,069.1	3,061.3	0.85	-0.71	
8,574.0	90.90	345.50	5,651.2	2,995.6	-1,100.7	3,185.2	0.40	0.00	
8,701.0	90.00	342.60	5,650.2	3,117.7	-1,135.6	3,312.2	2.39	-0.71	
8,827.0	88.30	340.40	5,652.0	3,237.2	-1,175.5	3,438.1	2.21	-1.35	
8,954.0	87.20	339.50	5,657.0	3,356.4	-1,219.0	3,564.7	1.12	-0.87	
9,080.0	92.30	340.30	5,657.6	3,474.6	-1,262.3	3,690.5	4.10	4.05	
9,204.0	92.20	342.40	5,652.7	3,592.0	-1,301.9	3,814.3	1.69	-0.08	

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9,331.0	90.00	343.00	5,650.3	3,713.3	-1,339.7	3,941.2	1.80	-1.73	
9,458.0	91.30	344.10	5,648.8	3,835.1	-1,375.7	4,068.2	1.34	1.02	
9,584.0	93.40	343.60	5,643.6	3,956.0	-1,410.7	4,194.1	1.71	1.67	
9,709.0	95.20	345.70	5,634.3	4,076.2	-1,443.7	4,318.7	2.21	1.44	
9,835.0	93.10	346.60	5,625.2	4,198.2	-1,473.7	4,444.2	1.81	-1.67	
9,961.0	91.60	345.80	5,620.0	4,320.4	-1,503.8	4,570.0	1.35	-1.19	
10,086.0	91.70	345.40	5,616.4	4,441.4	-1,534.8	4,694.8	0.33	0.08	
10,212.0	90.80	344.60	5,613.6	4,563.1	-1,567.5	4,820.7	0.96	-0.71	
10,337.0	89.80	342.90	5,613.0	4,683.1	-1,602.4	4,945.7	1.58	-0.80	
10,464.0	90.60	342.90	5,612.5	4,804.5	-1,639.8	5,072.7	0.63	0.63	
10,590.0	88.80	343.00	5,613.2	4,925.0	-1,676.7	5,198.7	1.43	-1.43	
10,717.0	89.00	342.60	5,615.6	5,046.3	-1,714.3	5,325.7	0.35	0.16	
10,842.0	89.40	342.80	5,617.4	5,165.6	-1,751.4	5,450.7	0.36	0.32	
10,966.0	90.40	342.50	5,617.6	5,283.9	-1,788.4	5,574.6	0.84	0.81	
11,060.0	91.40	342.80	5,616.1	5,373.7	-1,816.4	5,668.7	1.11	1.06	Last Cathedral Survey @ 11060' MD
11,110.0	91.40	342.80	5,614.9	5,421.4	-1,831.2	5,718.6	0.00	0.00	Projection to Bit @ 11110' MD

Targets									
Target Name	Dip Angle (°)	Dip Dir. (°)	TVD (usft)	+N/-S (usft)	+E/-W (usft)	Northing (usft)	Easting (usft)	Latitude	Longitude
Gerald Gourley BRK 3H - hit/miss target - Shape	0.00	360.00	5,620.1	5,421.7	-1,832.6	669,480.88	1,702,584.46	40° 19' 59.444 N	80° 34' 0.343 W
- actual wellpath misses target center by 5.4usft at 11110.0usft MD (5614.9 TVD, 5421.4 N, -1831.2 E)									
- Point									
Gerald Gourley BRK 3H - hit/miss target - Shape	0.00	360.00	5,590.1	5,421.7	-1,832.6	669,480.88	1,702,584.46	40° 19' 59.444 N	80° 34' 0.343 W
- actual wellpath misses target center by 24.9usft at 11110.0usft MD (5614.9 TVD, 5421.4 N, -1831.2 E)									
- Point									
Gerald Gourley BRK 3H - hit/miss target - Shape	0.00	360.00	5,608.1	5,421.7	-1,832.6	669,480.88	1,702,584.46	40° 19' 59.444 N	80° 34' 0.343 W
- actual wellpath misses target center by 7.0usft at 11110.0usft MD (5614.9 TVD, 5421.4 N, -1831.2 E)									
- Point									

Design Annotations				
Measured Depth (usft)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Comment
5,020.0	5,013.5	28.0	-119.1	Last Gyro Survey @ 5020' MD
11,060.0	5,616.1	5,373.7	-1,816.4	Last Cathedral Survey @ 11060' MD
11,110.0	5,614.9	5,421.4	-1,831.2	Projection to Bit @ 11110' MD

Checked By: _____ Approved By: _____ Date: _____

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