



DESIGN TARGET DETAILS

+N-S	+E-W	Ground Level:	1160.0
0.0	0.0	Northing	1705007.27
		Easting	1705007.27
		Latitude	40° 15' 28.000 N
		Longitude	80° 33' 24.900 W

NAME

NAME	TV/D	+N/S	+E/W	Northing	Easting	Latitude	Longitude
Russell Hervey 5H PBHL P3 5.5		-1310.2	647988.18	1705007.03	1705007.03	40° 16' 27.200 N	80° 33' 42.700 W
- Survey misses target center by 10.5 usft at 11638.0 usft MD (8825.4 TVD, 5915.4 N, -1305.9 E)							

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WV GEOLOGICAL SURVEY
MORGANTOWN, WV

Cathedral Energy Services
Survey Report

Company:	Chesapeake Energy Corp	Local Co-ordinate Reference:	Well Russell Hervey BRK 5H
Project:	Brooke County, WV	TVD Reference:	WELL @ 1178.0usft (Original Well Elev)
Site:	Russell Hervey	MD Reference:	WELL @ 1178.0usft (Original Well Elev)
Well:	Russell Hervey BRK 5H	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	Russell Hervey				
Site Position:		Northing:	642,082.72 usft	Latitude:	40° 15' 29.000 N
From:	Lat/Long	Easting:	1,705,007.27 usft	Longitude:	80° 33' 24.900 W
Position Uncertainty:	0.0 usft	Slot Radius:	13-3/16"	Grid Convergence:	-0.67 °

Well	Russell Hervey BRK 5H					
Well Position	+N/-S	0.0 usft	Northing:	642,082.72 usft	Latitude:	40° 15' 29.000 N
	+E/-W	0.0 usft	Easting:	1,705,007.27 usft	Longitude:	80° 33' 24.900 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	10/30/2012	-8.80	67.69	52,954

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	342.00	

Survey Program	Date	12/20/2012			
From (usft)	To (usft)	Survey (Wellbore)	Tool Name	Description	
100.0	5,223.0	Gyro (HZ)	Gyro	Gyro	
5,242.0	11,638.0	Survey #2 (HZ)	MWD	Geolink MWD	

Survey									
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usf)	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	0.47	17.81	100.0	0.4	0.1	0.3	0.47	0.47	
200.0	0.26	349.07	200.0	1.0	0.2	0.9	0.27	-0.21	
300.0	0.26	234.77	300.0	1.1	0.0	1.0	0.44	0.00	
400.0	0.27	237.13	400.0	0.8	-0.4	0.9	0.01	0.01	
500.0	0.29	225.70	500.0	0.5	-0.8	0.7	0.06	0.02	
600.0	0.16	222.70	600.0	0.3	-1.1	0.6	0.13	-0.13	
700.0	0.38	223.88	700.0	-0.1	-1.4	0.3	0.22	0.22	
800.0	0.29	220.89	800.0	-0.5	-1.8	0.1	0.09	-0.09	
900.0	0.48	222.67	900.0	-1.0	-2.2	-0.3	0.19	0.19	
1,000.0	0.56	223.91	1,000.0	-1.7	-2.9	-0.7	0.08	0.08	
1,100.0	0.56	226.64	1,100.0	-2.4	-3.5	-1.2	0.03	0.00	

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Well:	Russell Hervey BRK 5H	North Reference:	Grid
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 (°/100usf)	Build Rate (°/100u)	Formations / Comments
1,200.0	0.56	229.09	1,200.0	-3.0	-4.3	-1.6	0.02	0.00	
1,300.0	0.46	231.63	1,300.0	-3.6	-5.0	-1.9	0.10	-0.10	
1,400.0	0.36	238.56	1,400.0	-4.0	-5.5	-2.1	0.11	-0.10	
1,500.0	0.37	242.37	1,500.0	-4.3	-6.1	-2.2	0.03	0.01	
1,600.0	0.30	244.54	1,600.0	-4.6	-6.6	-2.3	0.07	-0.07	
1,700.0	0.31	252.80	1,700.0	-4.8	-7.1	-2.3	0.05	0.01	
1,800.0	0.36	278.92	1,800.0	-4.8	-7.7	-2.2	0.16	0.05	
1,900.0	0.60	275.46	1,900.0	-4.7	-8.5	-1.8	0.24	0.24	
2,000.0	0.53	276.37	1,999.9	-4.6	-9.5	-1.4	0.07	-0.07	
2,100.0	0.55	281.04	2,099.9	-4.5	-10.4	-1.0	0.05	0.02	
2,200.0	0.58	280.40	2,199.9	-4.3	-11.4	-0.5	0.03	0.03	
2,300.0	0.52	285.66	2,299.9	-4.1	-12.3	-0.1	0.08	-0.06	
2,400.0	0.50	301.06	2,399.9	-3.7	-13.1	0.5	0.14	-0.02	
2,500.0	0.67	301.97	2,499.9	-3.2	-14.0	1.3	0.17	0.17	
2,600.0	0.69	306.30	2,599.9	-2.5	-15.0	2.2	0.06	0.02	
2,700.0	0.71	307.64	2,699.9	-1.8	-16.0	3.2	0.03	0.02	
2,800.0	0.69	302.04	2,799.9	-1.1	-17.0	4.2	0.07	-0.02	
2,900.0	0.57	307.16	2,899.9	-0.5	-17.9	5.1	0.13	-0.12	
3,000.0	0.49	304.34	2,999.9	0.1	-18.6	5.8	0.08	-0.08	
3,100.0	0.48	306.16	3,099.9	0.6	-19.3	6.5	0.02	-0.01	
3,200.0	0.60	308.71	3,199.9	1.1	-20.1	7.3	0.12	0.12	
3,300.0	0.65	307.09	3,299.9	1.8	-20.9	8.2	0.05	0.05	
3,400.0	0.46	304.91	3,399.9	2.4	-21.7	9.0	0.19	-0.19	
3,500.0	0.50	315.24	3,499.9	2.9	-22.3	9.7	0.10	0.04	
3,600.0	0.34	348.13	3,599.9	3.5	-22.7	10.4	0.28	-0.16	
3,700.0	0.65	355.79	3,699.9	4.4	-22.8	11.2	0.32	0.31	
3,800.0	0.60	346.98	3,799.9	5.5	-23.0	12.3	0.11	-0.05	
3,900.0	0.34	11.95	3,899.9	6.3	-23.0	13.1	0.33	-0.26	
4,000.0	0.59	13.55	3,999.8	7.0	-22.8	13.8	0.25	0.25	
4,100.0	0.71	4.38	4,099.8	8.2	-22.7	14.8	0.16	0.12	
4,200.0	0.47	7.89	4,199.8	9.2	-22.6	15.7	0.24	-0.24	
4,300.0	0.79	19.02	4,299.8	10.2	-22.3	16.6	0.34	0.32	
4,400.0	0.50	22.47	4,399.8	11.3	-21.9	17.5	0.29	-0.29	
4,500.0	0.78	37.27	4,499.8	12.2	-21.3	18.2	0.32	0.28	
4,600.0	0.33	32.76	4,599.8	13.0	-20.7	18.8	0.45	-0.45	
4,700.0	0.62	34.65	4,699.8	13.7	-20.3	19.3	0.29	0.29	
4,800.0	0.33	39.01	4,799.8	14.4	-19.8	19.8	0.29	-0.29	
4,900.0	0.62	43.27	4,899.8	15.0	-19.2	20.2	0.29	0.29	
5,000.0	0.54	43.44	4,999.8	15.7	-18.6	20.7	0.08	-0.08	
5,100.0	0.52	36.26	5,099.8	16.4	-18.0	21.2	0.07	-0.02	
5,200.0	0.61	34.56	5,199.8	17.3	-17.4	21.8	0.09	0.09	
5,223.0	0.71	36.41	5,222.8	17.5	-17.2	21.9	0.44	0.43	Last Gyro Survey @ 5223' MD
5,242.0	0.40	56.70	5,241.8	17.6	-17.1	22.0	1.91	-1.63	
5,305.0	3.70	15.50	5,304.7	19.7	-16.4	23.8	5.41	5.24	
5,336.0	7.70	8.50	5,335.6	22.7	-15.8	26.5	13.07	12.90	
5,367.0	11.90	6.70	5,366.1	27.9	-15.1	31.2	13.58	13.55	
5,399.0	16.10	4.90	5,397.2	35.6	-14.4	38.3	13.19	13.13	
5,430.0	19.50	1.80	5,426.7	45.1	-13.8	47.2	11.38	10.97	
5,462.0	22.50	357.10	5,456.5	56.5	-14.0	58.1	10.74	9.38	
5,494.0	26.60	352.60	5,485.6	69.8	-15.2	71.1	14.07	12.81	
5,525.0	30.40	351.20	5,512.9	84.4	-17.3	85.6	12.45	12.26	
5,557.0	34.00	352.20	5,540.0	101.3	-19.8	102.4	11.37	11.25	
5,588.0	37.50	351.40	5,565.1	119.2	-22.3	120.3	11.39	11.29	

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Design:	HZ	Database:	USA EDM 5000 Multi Users DB

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Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (%/100usf)	Build Rate (%/100u)	Formations / Comments
5,619.0	40.90	350.00	5,589.1	138.5	-25.5	139.6	11.33	10.97	
5,651.0	43.30	349.80	5,612.9	159.7	-29.3	160.9	7.51	7.50	
5,682.0	46.20	350.90	5,634.9	181.2	-32.9	182.5	9.68	9.35	
5,714.0	48.70	352.90	5,656.5	204.5	-36.2	205.7	9.07	7.81	
5,745.0	50.80	353.60	5,676.6	228.0	-39.0	228.9	6.99	6.77	
5,777.0	52.60	354.30	5,696.4	253.0	-41.7	253.5	5.88	5.63	
5,808.0	56.30	354.50	5,714.4	278.1	-44.1	278.1	11.95	11.94	
5,840.0	59.00	354.60	5,731.5	305.0	-46.7	304.5	8.44	8.44	
5,871.0	61.50	354.00	5,746.9	331.8	-49.4	330.8	8.24	8.06	
5,903.0	64.20	353.10	5,761.5	360.0	-52.6	358.7	8.80	8.44	
5,934.0	66.00	352.30	5,774.6	387.9	-56.1	386.3	6.26	5.81	
5,966.0	66.50	352.00	5,787.5	416.9	-60.1	415.1	1.78	1.56	
5,997.0	66.90	352.50	5,799.7	445.2	-64.0	443.1	1.96	1.29	
6,029.0	69.40	353.50	5,811.6	474.6	-67.6	472.3	8.33	7.81	
6,061.0	71.80	354.40	5,822.3	504.6	-70.8	501.8	7.96	7.50	
6,093.0	73.90	354.50	5,831.7	535.1	-73.7	531.7	6.57	6.56	
6,124.0	75.90	355.00	5,839.8	564.9	-76.5	560.9	6.64	6.45	
6,156.0	77.30	355.10	5,847.2	595.9	-79.2	591.2	4.39	4.38	
6,188.0	79.20	354.20	5,853.7	627.1	-82.1	621.8	6.54	5.94	
6,219.0	80.80	354.20	5,859.1	657.5	-85.2	651.6	5.16	5.16	
6,251.0	83.10	354.10	5,863.6	689.0	-88.4	682.6	7.19	7.19	
6,283.0	85.10	353.40	5,866.8	720.6	-91.9	713.7	6.62	6.25	
6,313.0	87.90	352.30	5,868.7	750.3	-95.6	743.1	10.03	9.33	
6,377.0	91.10	351.30	5,869.2	813.7	-104.7	806.2	5.24	5.00	
6,439.0	91.40	350.50	5,867.9	874.9	-114.5	867.4	1.38	0.48	
6,503.0	89.60	349.60	5,867.3	937.9	-125.6	930.8	3.14	-2.81	
6,566.0	89.60	351.20	5,867.8	1,000.0	-136.1	993.1	2.54	0.00	
6,629.0	91.00	353.00	5,867.4	1,062.4	-144.7	1,055.1	3.62	2.22	
6,692.0	91.40	353.00	5,866.1	1,124.9	-152.4	1,117.0	0.63	0.63	
6,756.0	91.30	352.50	5,864.6	1,188.4	-160.5	1,179.8	0.80	-0.16	
6,818.0	91.90	352.30	5,862.9	1,249.8	-168.7	1,240.8	1.02	0.97	
6,943.0	91.00	352.00	5,859.7	1,373.6	-185.8	1,363.8	0.76	-0.72	
7,069.0	90.20	352.10	5,858.4	1,498.4	-203.2	1,487.8	0.64	-0.63	
7,195.0	89.10	353.00	5,859.2	1,623.3	-219.5	1,611.7	1.13	-0.87	
7,321.0	89.20	352.90	5,861.0	1,748.4	-235.0	1,735.4	0.11	0.08	
7,446.0	89.30	352.50	5,862.7	1,872.3	-250.9	1,858.2	0.33	0.08	
7,571.0	90.30	353.50	5,863.1	1,996.4	-266.1	1,980.9	1.13	0.80	
7,696.0	90.60	353.10	5,862.1	2,120.5	-280.7	2,103.5	0.40	0.24	
7,820.0	90.50	351.90	5,860.9	2,243.5	-296.9	2,225.4	0.97	-0.08	
7,947.0	90.20	349.70	5,860.2	2,368.8	-317.2	2,350.9	1.75	-0.24	
8,072.0	91.20	351.80	5,858.6	2,492.2	-337.3	2,474.4	1.86	0.80	
8,198.0	90.60	353.90	5,856.7	2,617.2	-352.9	2,598.1	1.73	-0.48	
8,325.0	89.40	353.00	5,856.7	2,743.3	-367.4	2,722.6	1.18	-0.94	
8,450.0	89.40	351.60	5,858.0	2,867.2	-384.2	2,845.6	1.12	0.00	
8,574.0	89.40	349.80	5,859.3	2,989.6	-404.2	2,968.2	1.45	0.00	
8,699.0	89.30	347.90	5,860.7	3,112.2	-428.4	3,092.2	1.52	-0.08	
8,823.0	91.40	347.40	5,859.9	3,233.3	-454.9	3,215.6	1.74	1.69	
8,948.0	91.40	344.80	5,856.9	3,354.6	-484.9	3,340.3	2.08	0.00	
9,075.0	91.10	343.40	5,854.1	3,476.7	-519.7	3,467.1	1.13	-0.24	
9,199.0	90.80	342.30	5,852.0	3,595.2	-556.3	3,591.1	0.92	-0.24	
9,325.0	91.20	342.40	5,849.8	3,715.2	-594.5	3,717.1	0.33	0.32	
9,450.0	90.60	341.70	5,847.9	3,834.1	-633.0	3,842.1	0.74	-0.48	
9,575.0	88.60	342.40	5,848.8	3,953.0	-671.5	3,967.1	1.70	-1.60	

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9,700.0	89.00	341.70	5,851.4	4,071.9	-710.0	4,092.0	0.64	0.32	
9,827.0	91.40	343.80	5,850.9	4,193.2	-747.7	4,219.0	2.51	1.89	
9,952.0	91.50	342.60	5,847.8	4,312.8	-783.8	4,343.9	0.96	0.08	
10,080.0	89.60	341.40	5,846.5	4,434.5	-823.3	4,471.9	1.76	-1.48	
10,205.0	90.30	341.20	5,846.6	4,552.9	-863.4	4,596.9	0.58	0.56	
10,330.0	90.30	340.80	5,846.0	4,671.1	-904.1	4,721.9	0.32	0.00	
10,454.0	91.10	340.30	5,844.5	4,788.0	-945.4	4,845.8	0.76	0.65	
10,578.0	90.30	340.40	5,843.0	4,904.8	-987.1	4,969.8	0.65	-0.65	
10,706.0	91.90	343.40	5,840.5	5,026.4	-1,026.8	5,097.7	2.66	1.25	
10,830.0	91.40	343.10	5,836.9	5,145.1	-1,062.6	5,221.7	0.47	-0.40	
10,956.0	90.70	343.30	5,834.6	5,265.7	-1,099.0	5,347.6	0.58	-0.56	
11,080.0	89.60	342.80	5,834.3	5,384.3	-1,135.1	5,471.6	0.97	-0.89	
11,206.0	90.30	342.70	5,834.4	5,504.7	-1,172.5	5,597.6	0.56	0.56	
11,332.0	90.60	342.30	5,833.4	5,624.8	-1,210.4	5,723.6	0.40	0.24	
11,457.0	91.10	341.90	5,831.6	5,743.8	-1,248.8	5,848.5	0.51	0.40	
11,584.0	91.90	341.40	5,828.2	5,864.3	-1,288.8	5,975.5	0.74	0.63	
11,588.0	92.00	341.50	5,828.1	5,868.1	-1,290.0	5,979.5	3.51	2.49	Last Cathedral Survey @ 11588' MD
11,638.0	92.00	341.50	5,826.4	5,915.4	-1,305.9	6,029.5	0.00	0.00	Projection to Bit @ 11638' MD

Targets										
Target Name	Dip Angle (°)	Dip Dir. (°)	TVD (usft)	+N/-S (usft)	+E/-W (usft)	Northing (usft)	Easting (usft)	Latitude	Longitude	
Russell Hervey 5H PBHI - hit/miss target - Shape	0.00	0.00	5,816.8	5,915.5	-1,310.2	647,998.18	1,703,697.03	40° 16' 27.300 N	80° 33' 42.700 W	- actual wellpath misses target center by 10.5usft at 11638.0usft MD (5826.4 TVD, 5915.4 N, -1305.9 E) - Point
Russell Hervey 5H PBHI - actual wellpath misses target center by 9.1usft at 11638.0usft MD (5826.4 TVD, 5915.4 N, -1305.9 E) - Point	0.00	0.00	5,834.4	5,915.5	-1,310.2	647,998.18	1,703,697.03	40° 16' 27.300 N	80° 33' 42.700 W	
Russell Hervey 5H PBHI - actual wellpath misses target center by 29.9usft at 11638.0usft MD (5826.4 TVD, 5915.4 N, -1305.9 E) - Point	0.00	0.00	5,796.8	5,915.5	-1,310.2	647,998.18	1,703,697.03	40° 16' 27.300 N	80° 33' 42.700 W	

Design Annotations					
Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates		Comment	
		+N/-S (usft)	+E/-W (usft)		
5,223.0	5,222.8	17.5	-17.2	Last Gyro Survey @ 5223' MD	
11,588.0	5,828.1	5,868.1	-1,290.0	Last Cathedral Survey @ 11588' MD	
11,638.0	5,826.4	5,915.4	-1,305.9	Projection to Bit @ 11638' MD	

Checked By: _____ Approved By: _____ Date: _____

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