

Northeast Natural Energy LLC

Monongalia County, WV (NAD 83)

Kassay

2H

ST01/ 63194

Design: Surveys (Highlands 8)

Standard Survey Report

22 August, 2018

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OCT 01 2018

WV Department of
Environmental Protection

Survey Report

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Office of Oil and Gas

Company: Northeast Natural Energy LLC	Local Co-ordinate Reference: Well 2H
Project: Monongalia County, WV (NAD 83)	TVD Reference: RKB @ 1552.00usft (Highlands 8)
Site: Kassay	MD Reference: RKB @ 1552.00usft (Highlands 8)
Well: 2H	North Reference: Grid
Wellbore: ST01 / 63194	Survey Calculation Method: Minimum Curvature
Design: Surveys (Highlands 8)	Database: USA Compass

OCT 01 2018

WV Department of
Environmental Protection

Project	Monongalia County, WV (NAD 83)		
Map System:	US State Plane 1983	System Datum:	Mean Sea Level
Geo Datum:	North American Datum 1983		
Map Zone:	West Virginia Northern Zone		Using geodetic scale factor

Site	Kassay		
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Site Position:		Northing:	422,652.90 usft	Latitude:	39° 39' 29.98194 N
From:	Map	Easting:	1,772,972.20 usft	Longitude:	80° 11' 40.22304 W
Position Uncertainty:	0.00 usft	Slot Radius:	13-3/16 "	Grid Convergence:	-0.44 °

Well	2H					
Well Position	+N/-S	0.00 usft	Northing:	422,652.90 usft	Latitude:	39° 39' 29.98194 N
	+E/-W	0.00 usft	Easting:	1,772,972.20 usft	Longitude:	80° 11' 40.22304 W
Position Uncertainty		0.00 usft	Wellhead Elevation:	usft	Ground Level:	1,534.00 usft

Wellbore	ST01 / 63194				
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Magnetics	Model Name	Sample Date	Declination (°)	Dip Angle (°)	Field Strength (nT)
	MVHD	9/16/2018	-9.14	66.75	52,210.21276569

Design	Surveys (Highlands 8)				
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Audit Notes:					
Version:	1.0	Phase:	ACTUAL	Tie On Depth:	1,177.00

Vertical Section:	Depth From (TVD) (usft)	+N/-S (usft)	+E/-W (usft)	Direction (°)
	0.00	0.00	0.00	148.23

Survey Program	Date 8/22/2018				
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From (usft)	To (usft)	Survey (Wellbore)	Tool Name	Description
155.00	1,177.00	Phoenix MWD Survey (OH / 63194)	MWD+HDGM	OWSG Rev.2 MWD + HDGM
1,177.00	2,668.00	Phoenix MWD Survey (ST01 / 63194)	MWD+HDGM	OWSG Rev.2 MWD + HDGM

Survey										
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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 (°/100usft)	Turn Rate (°/100usft)
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
155.00	0.70	81.70	155.00	0.14	0.94	0.38	0.45	0.45	0.00
182.00	0.80	78.60	181.99	0.20	1.28	0.51	0.40	0.37	-11.48
212.00	0.90	77.90	211.99	0.29	1.72	0.66	0.34	0.33	-2.33
241.00	0.90	75.60	240.99	0.39	2.16	0.81	0.12	0.00	-7.93
269.00	0.80	77.50	268.98	0.49	2.57	0.94	0.37	-0.36	6.79
300.00	0.70	75.60	299.98	0.58	2.96	1.06	0.33	-0.32	-6.13
332.00	0.70	90.20	331.98	0.63	3.35	1.23	0.56	0.00	45.63
363.00	0.60	88.00	362.98	0.64	3.70	1.41	0.33	-0.32	-7.10
394.00	0.60	91.30	393.98	0.64	4.02	1.58	0.11	0.00	10.65

Survey Report

WV Department of Environmental Protection

Company:	Northeast Natural Energy LLC	Local Co-ordinate Reference:	Well 2H
Project:	Monongalia County, WV (NAD 83)	TVD Reference:	RKB @ 1552.00usft (Highlands 8)
Site:	Kassay	MD Reference:	RKB @ 1552.00usft (Highlands 8)
Well:	2H	North Reference:	Grid
Wellbore:	ST01 / 63194	Survey Calculation Method:	Minimum Curvature
Design:	Surveys (Highlands 8)	Database:	USA Compass

Survey

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)
425.00	0.40	89.60	424.97	0.64	4.29	1.72	0.65	-0.65	-5.48
457.00	0.30	96.20	456.97	0.63	4.49	1.83	0.34	-0.31	20.63
488.00	0.30	94.80	487.97	0.61	4.65	1.93	0.02	0.00	-4.52
519.00	0.20	116.10	518.97	0.58	4.78	2.02	0.44	-0.32	68.71
550.00	0.10	235.30	549.97	0.54	4.81	2.07	0.85	-0.32	384.52
581.00	0.30	255.90	580.97	0.51	4.71	2.05	0.68	0.65	66.45
613.00	0.60	241.50	612.97	0.41	4.48	2.01	0.99	0.94	-45.00
644.00	0.70	266.70	643.97	0.32	4.14	1.91	0.97	0.32	81.29
675.00	1.10	270.00	674.97	0.31	3.66	1.66	1.30	1.29	10.65
707.00	1.20	267.10	706.96	0.29	3.02	1.34	0.36	0.31	-9.06
738.00	1.90	265.90	737.95	0.24	2.18	0.95	2.26	2.26	-3.87
769.00	2.20	265.60	768.93	0.15	1.07	0.43	0.97	0.97	-0.97
800.00	2.60	264.60	799.90	0.04	-0.22	-0.15	1.30	1.29	-3.23
832.00	3.00	263.60	831.86	-0.12	-1.77	-0.83	1.26	1.25	-3.13
863.00	3.70	265.20	862.81	-0.29	-3.58	-1.63	2.28	2.26	5.16
895.00	4.30	265.20	894.73	-0.48	-5.80	-2.65	1.88	1.88	0.00
926.00	4.70	266.80	925.64	-0.65	-8.23	-3.78	1.35	1.29	5.16
958.00	4.80	267.20	957.53	-0.79	-10.87	-5.06	0.33	0.31	1.25
989.00	4.90	265.60	988.41	-0.95	-13.49	-6.29	0.54	0.32	-5.16
1,020.00	4.80	267.00	1,019.30	-1.12	-16.10	-7.53	0.50	-0.32	4.52
1,083.00	4.80	268.20	1,082.08	-1.34	-21.37	-10.11	0.16	0.00	1.90
1,145.00	4.90	260.00	1,143.86	-1.88	-26.57	-12.39	1.13	0.16	-13.23
1,177.00	5.00	261.00	1,175.74	-2.34	-29.30	-13.44	0.41	0.31	3.13
Tie In - ST01									
1,216.00	4.90	261.30	1,214.60	-2.86	-32.62	-14.75	0.26	-0.26	0.77
First Phoenix MWD Survey - ST01									
1,243.00	5.10	258.10	1,241.49	-3.28	-34.93	-15.61	1.27	0.74	-11.85
1,274.00	5.30	257.70	1,272.37	-3.87	-37.68	-16.55	0.66	0.65	-1.29
1,305.00	5.30	256.70	1,303.23	-4.50	-40.47	-17.48	0.30	0.00	-3.23
1,339.00	4.70	269.60	1,337.11	-4.87	-43.39	-18.71	3.74	-1.76	37.94
1,363.00	3.40	257.00	1,361.05	-5.04	-45.07	-19.45	6.53	-5.42	-52.50
1,394.00	2.40	255.10	1,392.01	-5.41	-46.59	-19.93	3.24	-3.23	-6.13
1,425.00	1.50	260.20	1,422.99	-5.65	-47.62	-20.27	2.95	-2.90	16.45
1,457.00	0.70	300.30	1,454.98	-5.62	-48.20	-20.60	3.33	-2.50	125.31
1,488.00	1.30	3.10	1,485.98	-5.17	-48.35	-21.06	3.75	1.94	202.58
1,520.00	2.90	10.90	1,517.95	-4.02	-48.18	-21.95	5.07	5.00	24.38
1,551.00	4.40	13.00	1,548.89	-2.09	-47.76	-23.37	4.86	4.84	6.77
1,582.00	6.50	10.60	1,579.75	0.80	-47.17	-25.51	6.81	6.77	-7.74
1,614.00	8.10	13.80	1,611.49	4.77	-46.30	-28.43	5.16	5.00	10.00
1,645.00	8.50	24.60	1,642.17	8.97	-44.82	-31.23	5.18	1.29	34.84
1,676.00	8.40	36.50	1,672.83	12.87	-42.52	-33.33	5.64	-0.32	38.39
1,707.00	8.50	41.30	1,703.50	16.41	-39.66	-34.84	2.30	0.32	15.48
1,739.00	8.60	45.10	1,735.14	19.88	-36.41	-36.07	1.79	0.31	11.88

Survey Report

Company:	Northeast Natural Energy LLC	Local Co-ordinate Reference:	Well 2H
Project:	Monongalia County, WV (NAD 83)	TVD Reference:	RKB @ 1552.00usft (Highlands 8)
Site:	Kassay	MD Reference:	RKB @ 1552.00usft (Highlands 8)
Well:	2H	North Reference:	Grid
Wellbore:	ST01 / 63194	Survey Calculation Method:	Minimum Curvature
Design:	Surveys (Highlands 8)	Database:	USA Compass

Survey

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)	
1,770.00	8.90	43.70	1,765.78	23.25	-33.11	-37.20	1.19	0.97	-4.52	
1,801.00	8.70	45.20	1,796.41	26.64	-29.79	-38.33	0.98	-0.65	4.84	
1,832.00	7.20	46.30	1,827.12	29.63	-26.72	-39.26	4.86	-4.84	3.55	
1,864.00	6.10	48.00	1,858.90	32.15	-24.01	-39.98	3.49	-3.44	5.31	
1,895.00	5.00	50.40	1,889.75	34.12	-21.74	-40.45	3.63	-3.55	7.74	
1,926.00	4.40	52.80	1,920.65	35.70	-19.75	-40.75	2.04	-1.94	7.74	
1,958.00	3.40	55.90	1,952.58	36.97	-17.99	-40.90	3.19	-3.13	9.69	
1,989.00	2.10	57.70	1,983.54	37.79	-16.75	-40.95	4.20	-4.19	5.81	
2,020.00	1.50	57.50	2,014.52	38.31	-15.93	-40.96	1.94	-1.94	-0.65	
2,051.00	1.00	63.30	2,045.52	38.65	-15.34	-40.94	1.66	-1.61	18.71	
2,083.00	0.00	268.20	2,077.51	38.78	-15.09	-40.91	3.13	-3.13	0.00	
2,114.00	0.40	236.10	2,108.51	38.72	-15.18	-40.91	1.29	1.29	0.00	
2,145.00	0.60	228.90	2,139.51	38.55	-15.40	-40.88	0.67	0.65	-23.23	
2,177.00	0.80	241.70	2,171.51	38.33	-15.72	-40.87	0.79	0.63	40.00	
2,208.00	0.90	240.80	2,202.51	38.11	-16.12	-40.89	0.33	0.32	-2.90	
2,239.00	0.90	240.70	2,233.50	37.87	-16.55	-40.91	0.01	0.00	-0.32	
2,270.00	0.90	237.00	2,264.50	37.62	-16.96	-40.92	0.19	0.00	-11.94	
2,302.00	1.10	242.70	2,296.49	37.34	-17.45	-40.93	0.70	0.63	17.81	
2,333.00	1.10	240.80	2,327.49	37.06	-17.97	-40.97	0.12	0.00	-6.13	
2,364.00	1.00	243.10	2,358.48	36.79	-18.47	-41.01	0.35	-0.32	7.42	
2,396.00	1.10	239.90	2,390.48	36.51	-18.99	-41.04	0.36	0.31	-10.00	
2,427.00	1.30	255.90	2,421.47	36.28	-19.59	-41.16	1.25	0.65	51.61	
2,458.00	1.00	242.70	2,452.47	36.07	-20.17	-41.28	1.29	-0.97	-42.58	
2,489.00	1.00	231.60	2,483.46	35.78	-20.62	-41.27	0.62	0.00	-35.81	
2,521.00	0.50	175.60	2,515.46	35.46	-20.83	-41.12	2.60	-1.56	-175.00	
2,552.00	0.90	139.30	2,546.46	35.15	-20.66	-40.76	1.87	1.29	-117.10	
2,584.00	1.30	133.20	2,578.45	34.71	-20.23	-40.16	1.30	1.25	-19.06	
Final Phoenix MWD Survey - ST01										
2,668.00	1.30	133.20	2,662.43	33.40	-18.84	-38.32	0.00	0.00	0.00	
Projection to TD - ST01										

Design Annotations

Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates		Comment
		+N/-S (usft)	+E/-W (usft)	
1,177.00	1,175.74	-2.34	-29.30	Tie In - ST01
1,216.00	1,214.60	-2.86	-32.62	First Phoenix MWD Survey - ST01
2,584.00	2,578.45	34.71	-20.23	Final Phoenix MWD Survey - ST01
2,668.00	2,662.43	33.40	-18.84	Projection to TD - ST01

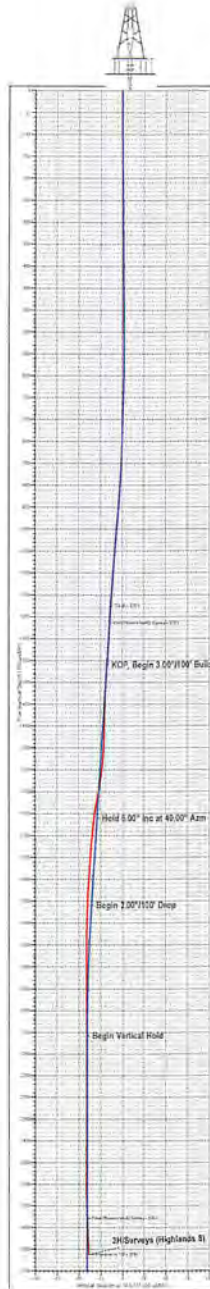


Project: Monongalia County, WV (NAD 83)
 Site: Kassay
 Well: 2H
 Wellbore: ST01 / 63194
 Plan: Plan 3 08-16-18
 Rig: Highlands 8



Map System: US State Plane 1983
 Datum: North American Datum 1983
 Ellipsoid: GRS 1980
 Zone Name: West Virginia Northern Zone
 Local Origin: Well 2H, Grid North
 Latitude: 39° 39' 29.98193 N
 Longitude: 80° 11' 40.22304 W
 Grid East: 1772972.20
 Grid North: 422652.90
 Scale Factor: 1.000
 Geomagnetic Model: MVD
 Sample Date: 16-Sep-18
 Magnetic Declination: -9.14°
 Dip Angle from Horizontal: 66.75°
 Magnetic Field Strength: 52210.21276570nT
 To convert a Magnetic Direction to a Grid Direction, Subtract 8.70°
 To convert a Magnetic Direction to a True Direction, Subtract 9.14°
 To convert a True Direction to a Grid Direction, Add 0.44°

- LEGEND**
- 10H, OH / 63194, Plan 2 07-31-18 VO
 - 4H, OH / 63194, Plan 2 07-31-18 VO
 - 3H, OH, Surveys VO
 - 2H, OH / 63194, Plan 2 07-31-18 VO
 - 1H, OH, Surveys VO
 - 12H, OH, Surveys VO
 - 2H, ST01 / 63194, Surveys (Highlands B) VO
 - 2H, OH / 63194, Surveys (Highlands B) VO
 - 2H, OH, Surveys VO
 - 3H, OH, Surveys VO
 - 4H, OH, Surveys VO
 - Plan 3 08-16-18



Azimuths to Grid North
 True North: 0.44°
 Magnetic North: -8.70°
 Magnetic Field Strength: 52210.25nT
 Dip Angle: 66.75°
 Date: 9/16/2018
 Model: MVD

WELL DETAILS: 2H											
1534.00											
+N/S	+E/W	Northing	Easting	Latitude	Longitude	Slot					
0.00	0.00	422652.90	1772972.20	39° 39' 29.98193 N	80° 11' 40.22304 W						
SECTION DETAILS											
Sec	MD	Inc	Azi	TVD	+N/S	+E/W	Dleg	TFace	Vsect	Target	Annotation
1	1177.00	5.00	261.00	1175.74	-2.34	-29.30	0.00	0.00	-13.44		Tie In
2	1311.00	5.18	258.75	1309.21	-4.43	-41.00	0.20	-49.08	-17.92		KOP: Begin 3.00"/100' Build & Turn
3	1662.62	6.00	40.00	1660.14	8.58	-44.76	3.00	159.08	-29.16		Hold 6.00" Inc at 40.00° Azm
4	1862.62	6.00	40.00	1859.05	22.60	-31.32	0.00	0.00	-35.70		Begin 2.00"/100' Drop
5	2162.62	0.00	0.00	2158.50	34.62	-21.24	2.00	180.00	-40.61		Begin Vertical Hold
6	7004.12	0.00	0.00	7000.00	34.62	-21.24	0.00	0.00	-40.61		KOP2: Begin 8.00"/100' Build
7	7474.35	37.62	255.83	7437.18	-1.82	-165.61	8.00	255.83	-85.84		Hold 37.62" Inc at 255.83° Azm
8	7781.18	37.62	255.83	7560.20	-47.66	-347.20	0.00	0.00	-142.28		Begin 9.00"/100' Build
9	8899.37	90.00	148.23	8288.00	-814.65	-397.32	0.00	-104.11	483.39	LP - Kassay 2H	LP: Hold 90.00" Inc at 148.23° Azm
10	12899.75	90.00	148.23	8288.00	-4207.14	1703.65	0.00	0.00	4473.77		Begin 2.00"/100' Turn
11	13223.53	90.00	141.55	8288.00	-4480.04	1895.51	2.00	-90.00	4806.80		Hold 141.55" Azm
12	19623.21	90.00	141.55	8288.00	-9492.26	5874.65	0.00	0.00	1163.09	BHL - Kassay 2H	TD at 19623.21

DESIGN TARGET DETAILS							
Name	TVD	+N/S	+E/W	Northing	Easting	Latitude	Longitude
BHL - Kassay 2H	8288.00	-9492.26	5874.65	413161.23	1778649.50	39° 37' 56.61513 N	80° 10' 24.23122 W
LP - Kassay 2H	8288.00	-4206.35	1702.90	418446.60	1774675.00	39° 38' 48.54192 N	80° 11' 18.03803 W
LP - Kassay 2H	8288.00	-814.65	-397.32	421838.30	1772574.90	39° 39' 21.90088 N	80° 11' 45.22245 W

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