



LITHO SCANNER
Petrophysical Interpretation

6899.00ft - 8330.00ft
Scale 1:240 (5" per 100')

COMPANY: North East Natural Energy LLC			
WELL: Boggress 17H			
FIELD: Wildcat			
COUNTY: Monongalia			
STATE: West Virginia			
COUNTRY:			
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FIELD: Wildcat		COUNTY: Monongalia	
COUNTY: Monongalia		STATE: West Virginia	
STATE: West Virginia		COUNTRY:	
COUNTRY:			
API No: 47-061-01812-00-00		Other Services:	
Location		Field: Lat and Long: 39.40.12.6 N	
Sec: Clay Township: Core Range-Blacksville		Lat: 39° 41' 15" N	
Long: 80° 6' 27.1" W		Elevations: K.B. 1296 ft	
Permanent Datum: GL		Elev: 1268 ft	
Log Measured From: KB		28 ft above Perm. Datum	
Drilling Measured from: KB			
Magnetic Dec: -9.072007		Magnetic Inc: 66.55547	
Magnetic Intensity: 0.5190679		G.L. 1268 ft	
Date	15-Apr-2019		
Run No.	1B		
Depth Driller	8400 ft		
Depth Logger (Schl)	8400 ft		
Bitm Log Interval	8400 ft		
Top Log Interval	6900 ft		
Casing-Driller	9.625 in @ 2538 ft		
Casing-Logger	2543 ft		
Bit Size	8.5 in		
Type Fluid in Hole	WATER		
Dens. Visc.	9.5 lbm/gal -999.25 s		
pH Fluid loss	-999.25 -999.25 in3		
Source of Sample	Active Tank		
Rm @ Meas. Temp.	0.04 ohm.m @ 103 degF		
Rmf @ Meas. Temp.	0.0255 ohm.m @ 103 degF		
Rmc @ Meas. Temp.	0.04 ohm.m @ 102 degF		
Source: Rmf Rmc	Pressed		
Rm @ BHT	0.02664805 @ 158 degF		
Circulation Stopped	22:00:00		
Logger on Bottom	22:44:00		
Max Rec. Temp.	158 deg F		
Equipment Location	3703 Bradford, PA		
Recorded by:	Elizabeth Morrone		
Witnessed by:	BJ Varney		

FOLD HERE	The well name, location and borehole reference data were furnished by the customer
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Ser. Order #	MaxVers.: 9.0.106845.3100	Process Date: 5/1/2019	Center: Pittsburgh	Baseline: Techlog 2018.2	Log Analyst: N. Uschner
Remarks:					

LithoScanner (NEXT) data used in interpretation from Run 2.
Marcellus Formation Interpretation
Arenite/Pyrite/Dolomite model.
Simandoux Model; Rw = 0.0438 @ 143 degF; m = 1.7, n = 2; 1.4/0.6/0.24
Generalized Devonian Isotherms; Pressure Gradient = 0.68 psi/ft Max Temp = 143 degF
Pay: Gas filled Phi > 2 perc; Phi > 4 & < 22 perc; Kint > 100 nD; Sw < 45 perc; TOC > 2 wt perc; Reservoir: Gas filled Phi >2 perc
Well tops supplied by client.

Thank you for choosing Schlumberger!
Crew: Morrone, Komacki, Shirley
Tool ran per tool sketch

Brine is 9.5 ppg with chloride count of 165,000 ppm
CMR logged in T1 B Long Mode

Petrophysical Analysis (PEX, NEXT) Presentation Description

(Some listed may not be present)

Track 1: Zone
Zonation provided by the client

Track 2: Depth
Depth numbers - Depth scale is 1:240 (5 inches of log per 100 feet of borehole)
NEXT CS curve - Cable speed for NEXT logging run
Tension curve - Cable tension for Platform Express logging run
DSOZ curve - Computed density standoff
DSOZ area shading - indicates DSOZ > 0
RSOZ curve - Computed resistivity standoff
RSOZ area shading - indicates RSOZ > 0

Track 3: Gamma-Ray
GR or SGR curves - Standard gamma-ray that is environmentally corrected
CGR curves - Gamma -ray corrected for Uranium
Caliper curve - Hole diameter measured with density caliper

Caliper curve - Hole diameter measurement
Bit Size curve - Bit size
SP curve - Spontaneous Potential
Rugosity curve - Second derivative of caliper indicating rate of change of caliper
Mudcake area shading - indicates Caliper < Bit Size
Washout area shading - indicates Caliper > Bit Size
Rugosity area shading - indicates Rugosity > 0
GR area shadings - indicates Gamma Ray wrapping with progressively more green as GR increases
CGR-SGR shading - Indicates the amount of Uranium

Track 4: Resistivity

AT10-AT90 curves - Two foot resolution induction curves - the numeric value represents the depth of investigation
RLA1-RLA5 curves - Laterolog curves - 5 is deepest, 1 is shallowest depth of investigation

Track 5: Spectral (Natural) Gamma Ray

Uranium curve - Uranium concentration
Thorium curve - Thorium concentration
Potassium curve - Potassium concentration

Track 6: Porosity (data edited if needed in washed out or rugose hole)

DPHZ-field curve - Unedited density porosity from field data
DPHI-Edit curve - Edited density porosity
DPH8 field curve - Unedited high resolution density porosity from field data
NPHI/TNPH-field curve - Unedited NPHI/TNPH neutron porosity from field data
NPHU-Edit curve - Environmentally corrected and edited neutron porosity
DRHO/HDRA curve - Density correction
PEFZ curve - Formation photoelectric factor
Crossover area shading - indicates NPHU-Edit < DPHI-Edit

Track 7: Bulk/Grain Density

RHOZ Edit curve - Edited bulk density
RHO8 field curve - Unedited high resolution bulk density from field data
Quanti.ELAN Rhom curve - Matrix density calculated with Quanti.ELAN
NEXT Rhom curve - Matrix density calculated from NEXT (NEXT-calculated matrix density is insensitive to organic matter; and only calculates matrix mineralogy, therefore it will overestimate matrix density in these zones)
"QELAN Rhom" values – Quanti.ELAN grain density values
RHOM Diff area shading - indicates NEXT Rhom < Quanti.ELAN Rhom

Track 8: Matrix Adjusted Curves

MAD curve - Matrix adjusted bulk density
MAN curve - Matrix adjusted neutron

Track 9: NEXT Mineralogy (weight percent)

Clay curve and shading- Total clay (chlorite, illite, montmorillonite) content
QFM curve and shading - Quartz, feldspar, and mica (added to clay curve for summed display)
Calcite curve and shading - Calcite from SpectroLith (added to QFM curve for summed display)
Dolomite curve and shading - Dolomite from SpectroLith (added to Calcite curve for summed display)
Pyrite curve and shading - Sulfur minerals (pyrite) from SpectroLith (added to Dolomite curve for summed display)
Other mineralogy solved for as specified

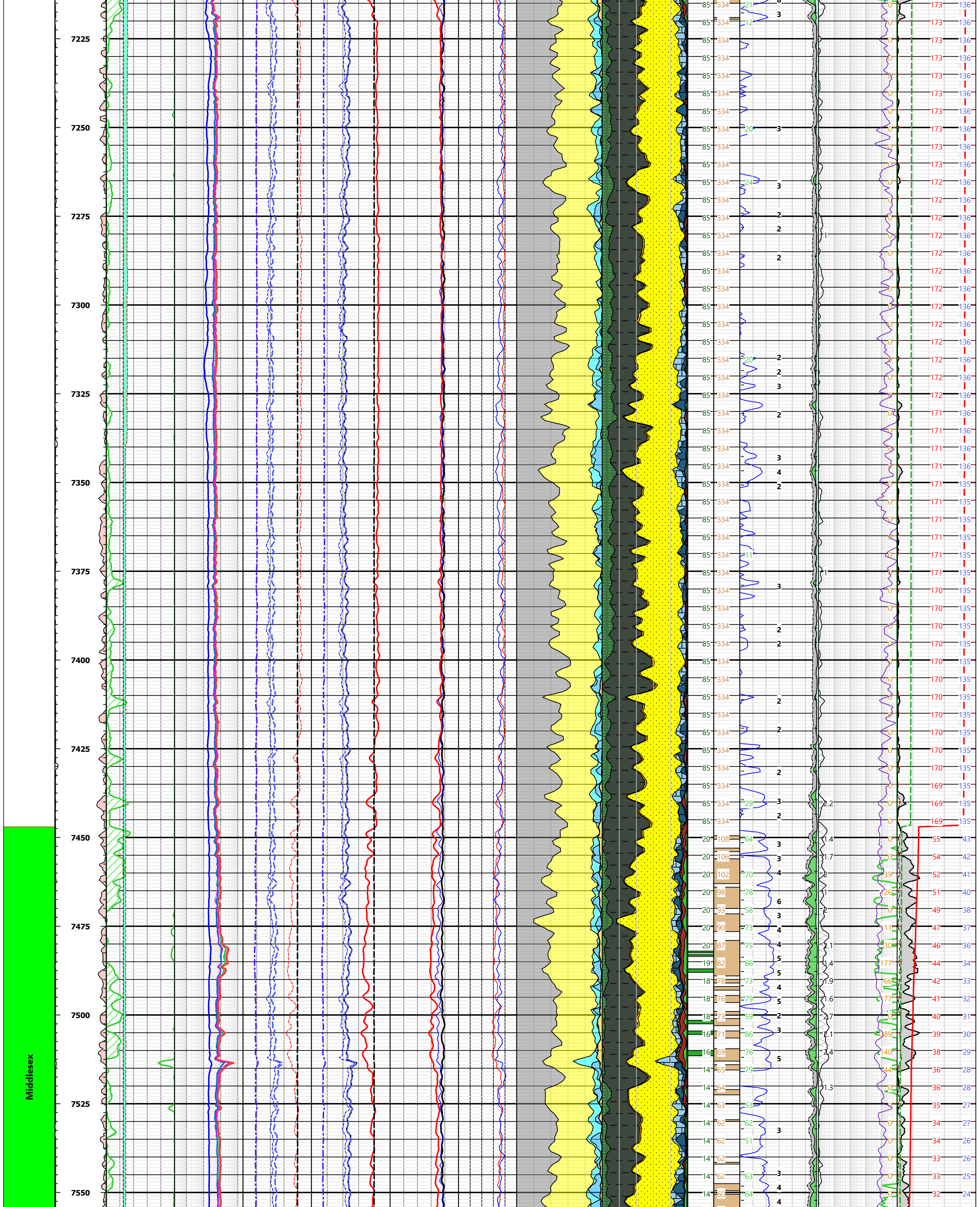
Track 10: Quanti.ELAN Volumes (volume percent, volumes are cumulative for summed display)

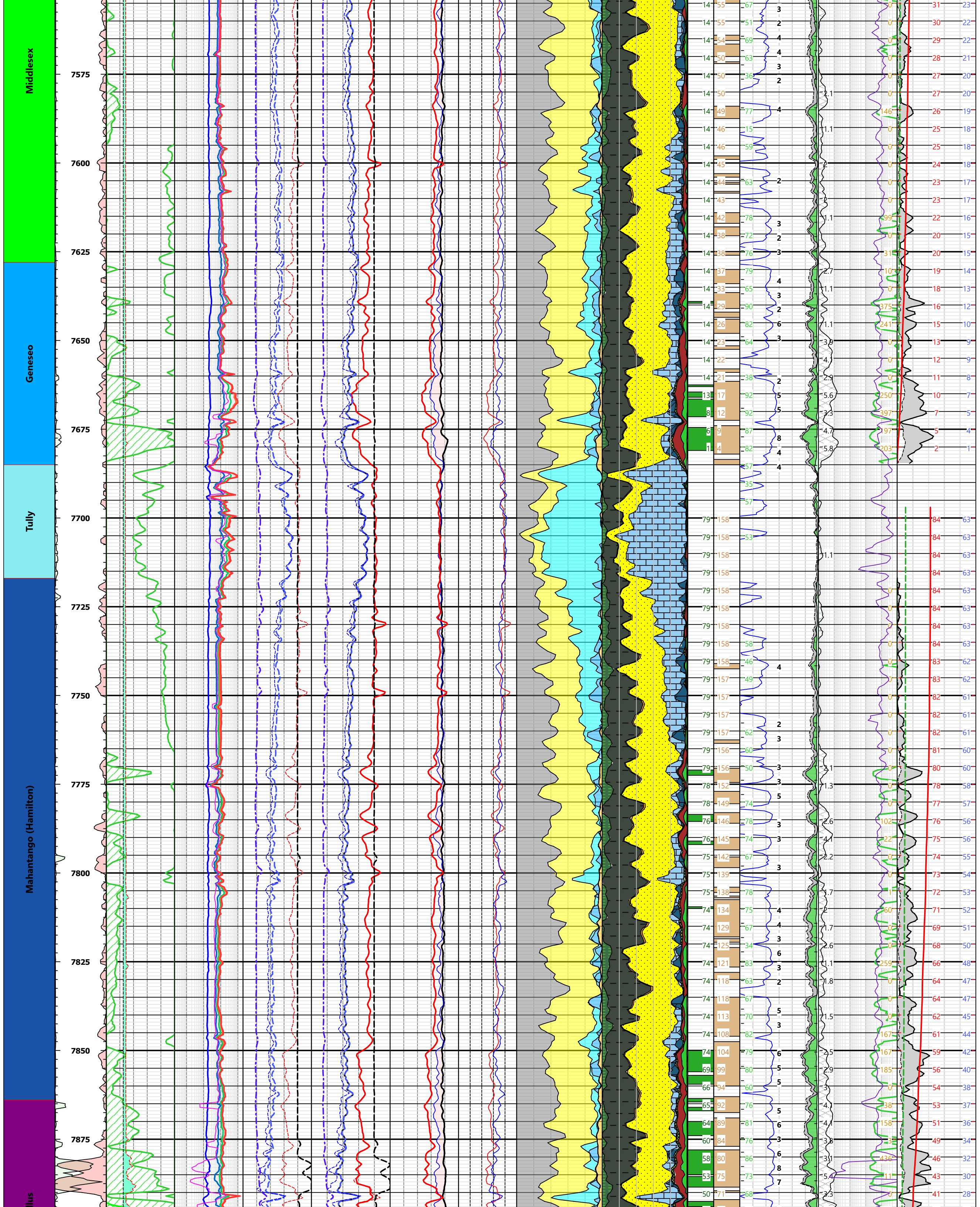
Chlorite
Illite
Montmorillonite
Bound Water
Quartz
Pyrite
Calcite
Dolomite
Kerogen
Hydrocarbon
Water
Moved Hydrocarbon
Moved Water

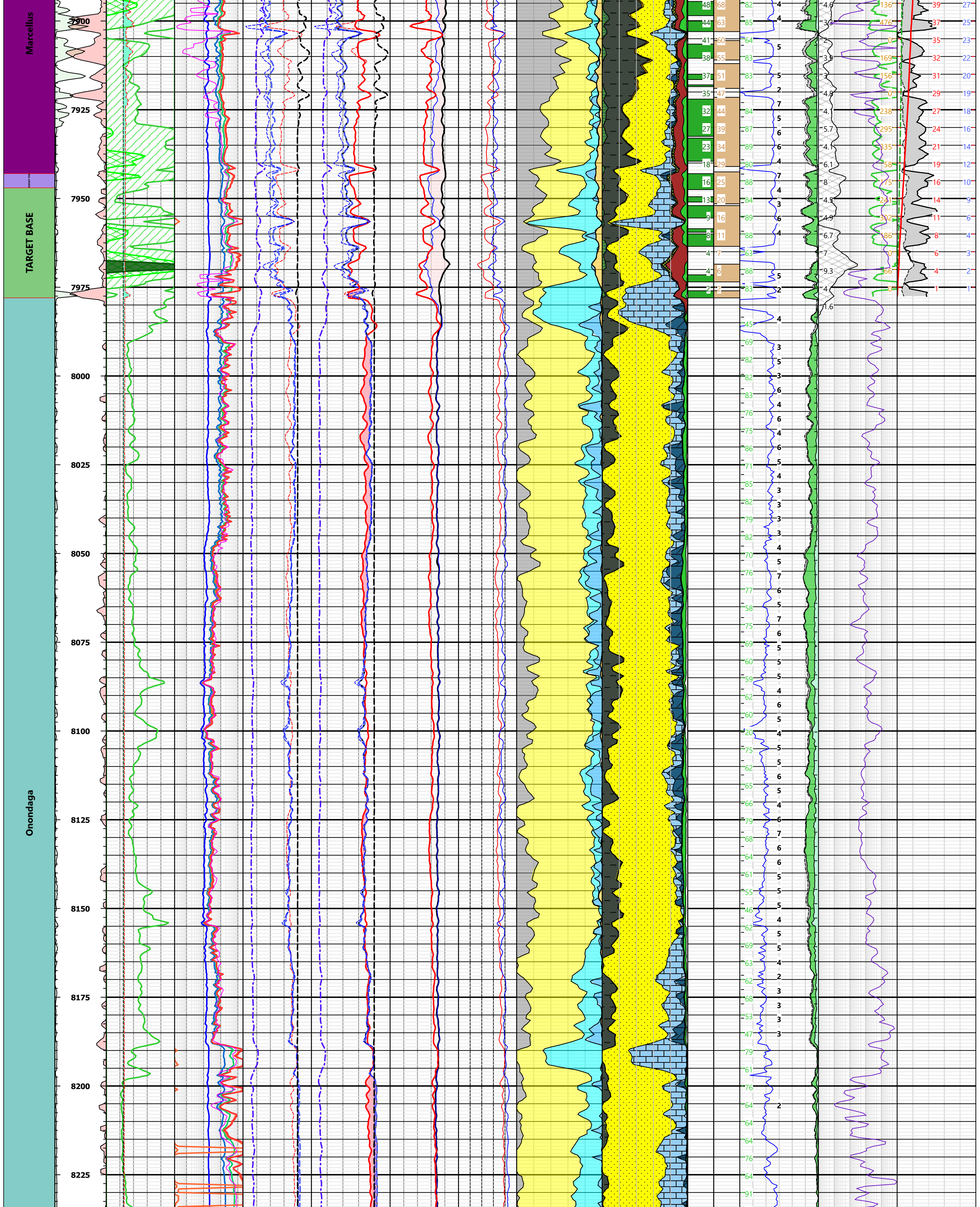
Track 11: Pay/Reservoir

Res curve - Reservoir cutoffs - see listing above trailer for reservoir cutoffs
Pay curve - Pay cutoffs - see listing above trailer for pay cutoffs
"Res" values - Cumulative reservoir in feet
"Pay" values - Cumulative pay in feet
Pay area shading - indicates pay cutoffs met

[illegible]







	ft	Density g/cm³	Porosity %	Saturation %	Volume %	Perm nD		Gas wt%	Gas SCF/ton	Gas BCF/sec	Gas SCF/ton	Gas BCF/sec
Gross		147	2.66	2.89	47.38	29.65	1.35	1.23	16.82	5.65	76.16	25.59
Reservoir		65	2.63	4.58	23.47	28.54	36.21	1.49	20.47	3.01	137.56	20.34
Pay		14	2.56	5.67	18.44	27.47	222.31	2.75	37.68	1.17	184.4	5.74

Shale Formation : Marcellus
Interval Top_Shale_Zone : 7864.00 ft
Interval Bottom_Shale_Zone : 7943.00 ft

Pore Pressure Gradient : 0.68 psi/ft
Reservoir Cutoff : Gas Filled Porosity > 2.00%
Pay Cutoff : Gas Filled Porosity > 2.00% ; Sw < 45.00% ; 4.00% < Porosity < 22.00% ; Perm > 100.00 nd ; TOC > 2.00%

	Thickness	Average Bulk Density	Average Effective Porosity	Average Water Saturation	Average Clay Volume	Average Log Perm	Average TOC	Average Adsorbed Gas	Cumulated Adsorbed Gas	Average Free Gas	Cumulated Free Gas
	ft	g/cm³	%	%	%	nD	wt%	SCF/ton	BCF/sec	SCF/ton	BCF/sec
Gross		79	2.56	4.56	25.19	32.26	32.88	3.91	53.6	9.39	149.65
Reservoir		66	2.55	5.19	17.76	32.97	102.98	4.03	55.3	8.06	173.14
Pay		47	2.53	5.83	15.51	31.31	253.76	4.1	56.28	5.82	198.85

Shale Formation : TARGET TOP
Interval Top_Shale_Zone : 7943.00 ft
Interval Bottom_Shale_Zone : 7947.00 ft

Pore Pressure Gradient : 0.68 psi/ft
Reservoir Cutoff : Gas Filled Porosity > 2.00%
Pay Cutoff : Gas Filled Porosity > 2.00% ; Sw < 45.00% ; 4.00% < Porosity < 22.00% ; Perm > 100.00 nd ; TOC > 2.00%

	Thickness	Average Bulk Density	Average Effective Porosity	Average Water Saturation	Average Clay Volume	Average Log Perm	Average TOC	Average Adsorbed Gas	Cumulated Adsorbed Gas	Average Free Gas	Cumulated Free Gas
	ft	g/cm³	%	%	%	nD	wt%	SCF/ton	BCF/sec	SCF/ton	BCF/sec
Gross		4	2.46	5.66	9.82	17.93	284.92	7.32	100.45	0.86	212.29
Reservoir		4	2.46	5.66	9.82	17.93	284.92	7.32	100.45	0.86	212.29
Pay		4	2.46	5.66	9.82	17.93	284.92	7.32	100.45	0.86	212.29

Shale Formation : TARGET BASE
Interval Top_Shale_Zone : 7947.00 ft
Interval Bottom_Shale_Zone : 7978.00 ft

Pore Pressure Gradient : 0.68 psi/ft
Reservoir Cutoff : Gas Filled Porosity > 2.00%
Pay Cutoff : Gas Filled Porosity > 2.00% ; Sw < 45.00% ; 4.00% < Porosity < 22.00% ; Perm > 100.00 nd ; TOC > 2.00%

	Thickness	Average Bulk Density	Average Effective Porosity	Average Water Saturation	Average Clay Volume	Average Log Perm	Average TOC	Average Adsorbed Gas	Cumulated Adsorbed Gas	Average Free Gas	Cumulated Free Gas
	ft	g/cm³	%	%	%	nD	wt%	SCF/ton	BCF/sec	SCF/ton	BCF/sec
Gross		31	2.51	4.06	25.99	15.72	20.53	5.92	81.24	5.47	141.78
Reservoir		23	2.5	5.13	13.69	16.62	130.87	5.63	77.18	3.82	182.09
Pay		14	2.48	6.01	13.49	16.66	278.99	5.45	74.77	2.26	214.52

COMPANY: North East Natural Energy LLC

WELL: Boggess 17H
FIELD: Wildcat
COUNTY: Monongalia
STATE: West Virginia
COUNTRY:

API No.: 47-061-01812-00-00

Date Processed: 5/1/2019