

Benchmarking Well Performance for Variable Geology and Engineering in the Utica/Point Pleasant Play*

Murray Roth¹ and Michael Roth²

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Abstract

Approaching its first thousand horizontal wells, the Utica/Point Pleasant play in Ohio, West Virginia, and Pennsylvania is a newcomer to the "unconventional club". While the Ohio oil and gas industry has a long history, the Utica and deeper Point Pleasant formations have only recently emerged as economically viable transitional gas-to-liquids targets. While these Ordovician-aged rocks do not have an exact analogue in any other North American unconventional play, many of the learnings from transitional phase plays like the Eagle Ford have provided general blueprints for effective field development. Depth, thickness, and geochemistry maps provide valuable insights into the west-east transition of the basin from liquids-rich to dry gas, near and beyond the Pennsylvania border. Rock cuttings and log data provide insights into the porosity and permeability characteristics of the Utica, Point Pleasant, and Marcellus, the latter largely shallowing to uneconomic depths in the area of this study. Sufficient well coverage is in place to correlate geologic measurements with fluid phase maps of gas-oil ratio and breakdown pressures measured during hydraulic fracturing. In combination, analytic characterization of geologic and fluid maps provide valuable insights into relative sweetspots and emerging opportunities in southern Ohio and in West Virginia. As in other unconventional plays, extensive experimentation is underway to "right-size" drilling and completions for variable rock and fluid characteristics. Starting 50% higher than the Eagle Ford historic average, Utica and Point Pleasant completions are placing an average of 6.5 million pounds of sand, with individual wells ranging beyond 17 million pounds. Fluid volumes are comparable to the Eagle Ford, at an average of 100,000 barrels. Horizontal well lengths generally fall between 4000 and 7000 feet, but do extend up to 9000 feet. Analytic studies of gas and liquids production in the Utica and Point Pleasant play indicate that the

geology and fluid mix are amenable to "high-intensity" hydraulic fracturing. Normalized to horizontal lengths, Eagle-Ford like hydraulic fracturing jobs of 1000–2000 pounds per foot of sand and 20–40 barrels per foot correlate to the best producing wells to date. Recent drilling results are also bearing out geologic prospectivity further south than the initial "core area" of east-central Ohio.

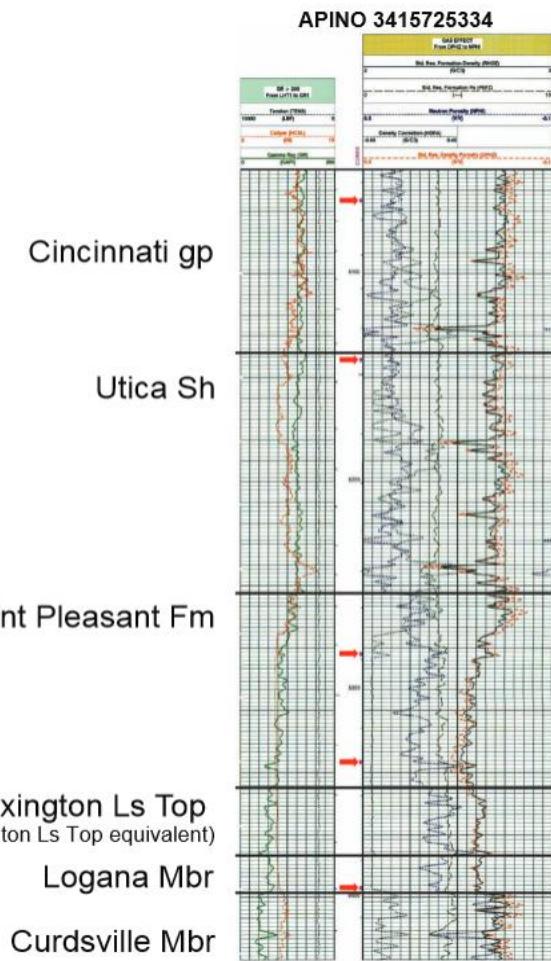
Reference Cited

Riley, R.A., 2010, A Utica-Point Pleasant type log for eastern Ohio: Ohio Department of Natural resources, division of the Geological survey, one sheet (PDF).

BENCHMARKING WELL PERFORMANCE FOR VARIABLE GEOLOGY AND ENGINEERING IN THE UTICA/POINT PLEASANT PLAY

Murray Roth
Michael Roth

Utica/Point Pleasant Type Log



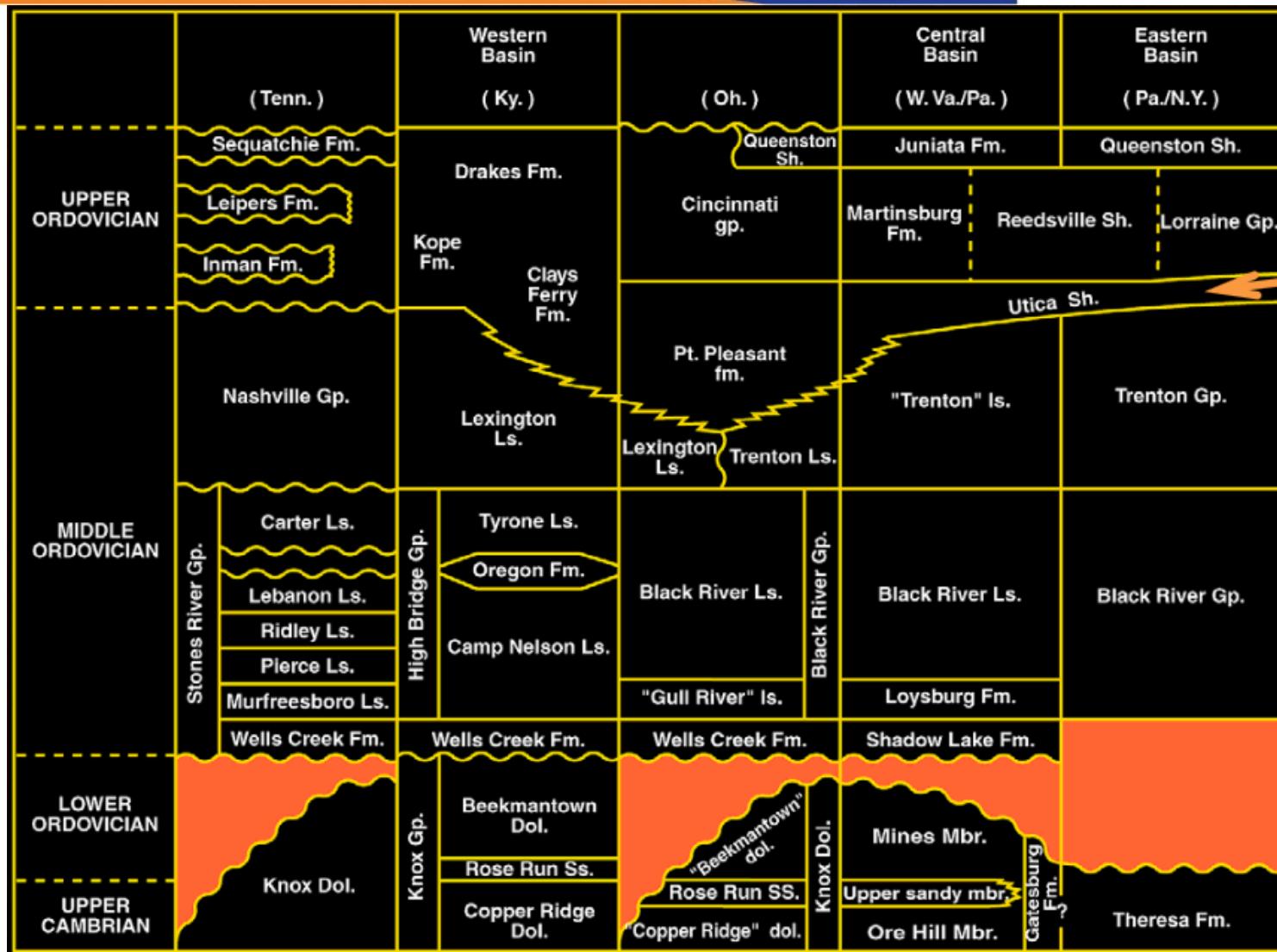
A Utica-Point Pleasant Type Log for Eastern Ohio

Source Rock Analyses

Depth (ft)	Sample Type	TOC	Rock Unit
6064	core	0.48	Cincinnati gp
6141	core	2.72	Utica Sh
6282	core	2.41	Point Pleasant Fm
6336	core	3.73	Point Pleasant Fm
6396	core	1.61	Logana Mbr
7192	core	0.11	Wells Creek Fm
7579	core	0.14	Copper Ridge dol
8274	core	0.23	Conasauga gp

Recommended citation for page 1: Riley, R.A., 2010, A Utica-Point Pleasant type log for eastern Ohio: Ohio Department of Natural Resources, Division of Geological Survey, one sheet (PDF), available at <http://www.dnr.state.oh.us/Portals/10/Energy/Utica/FuscarawasWellRockAnalyses.pdf>.

Utica/Point Pleasant

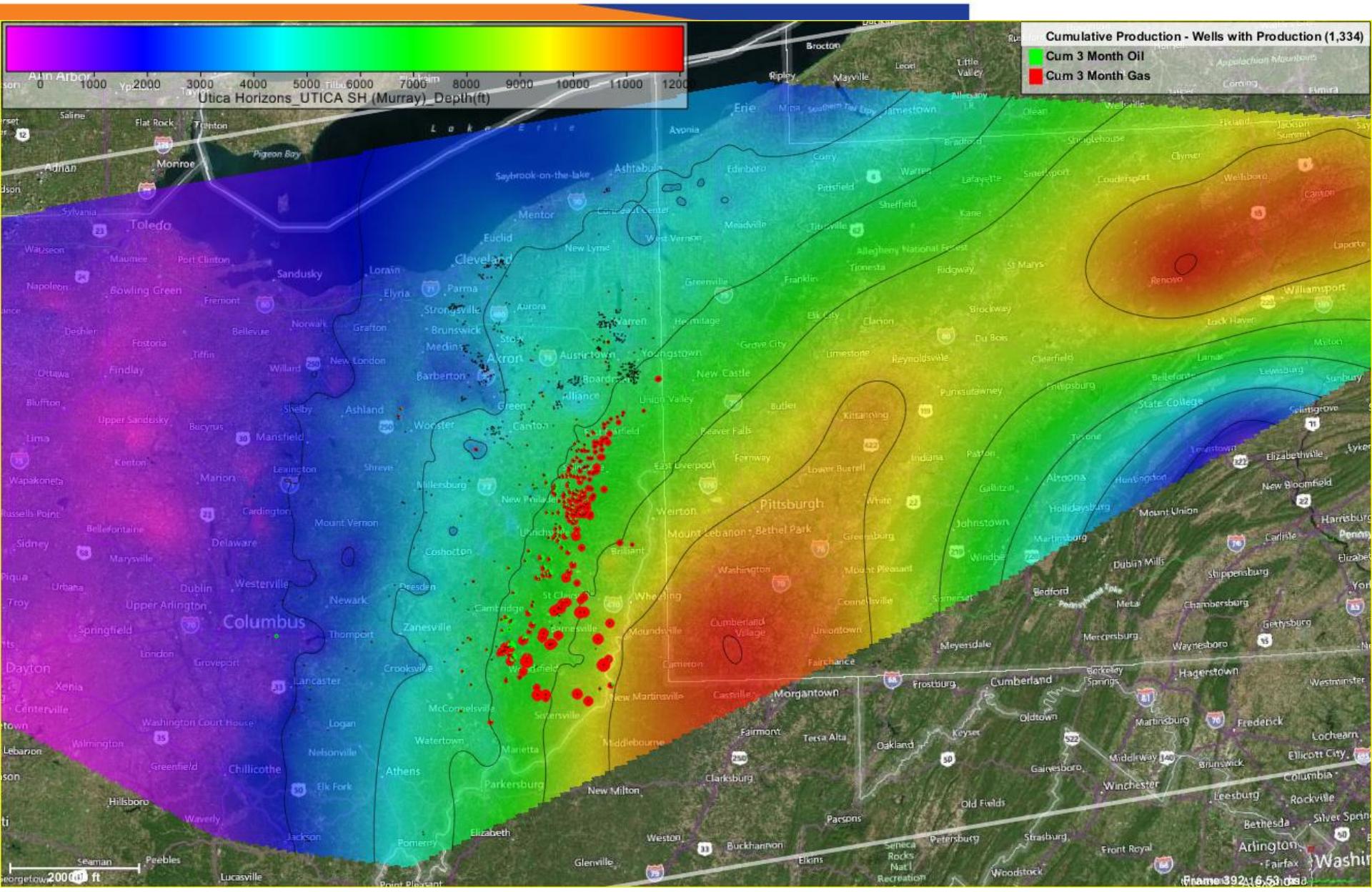


Study Objectives

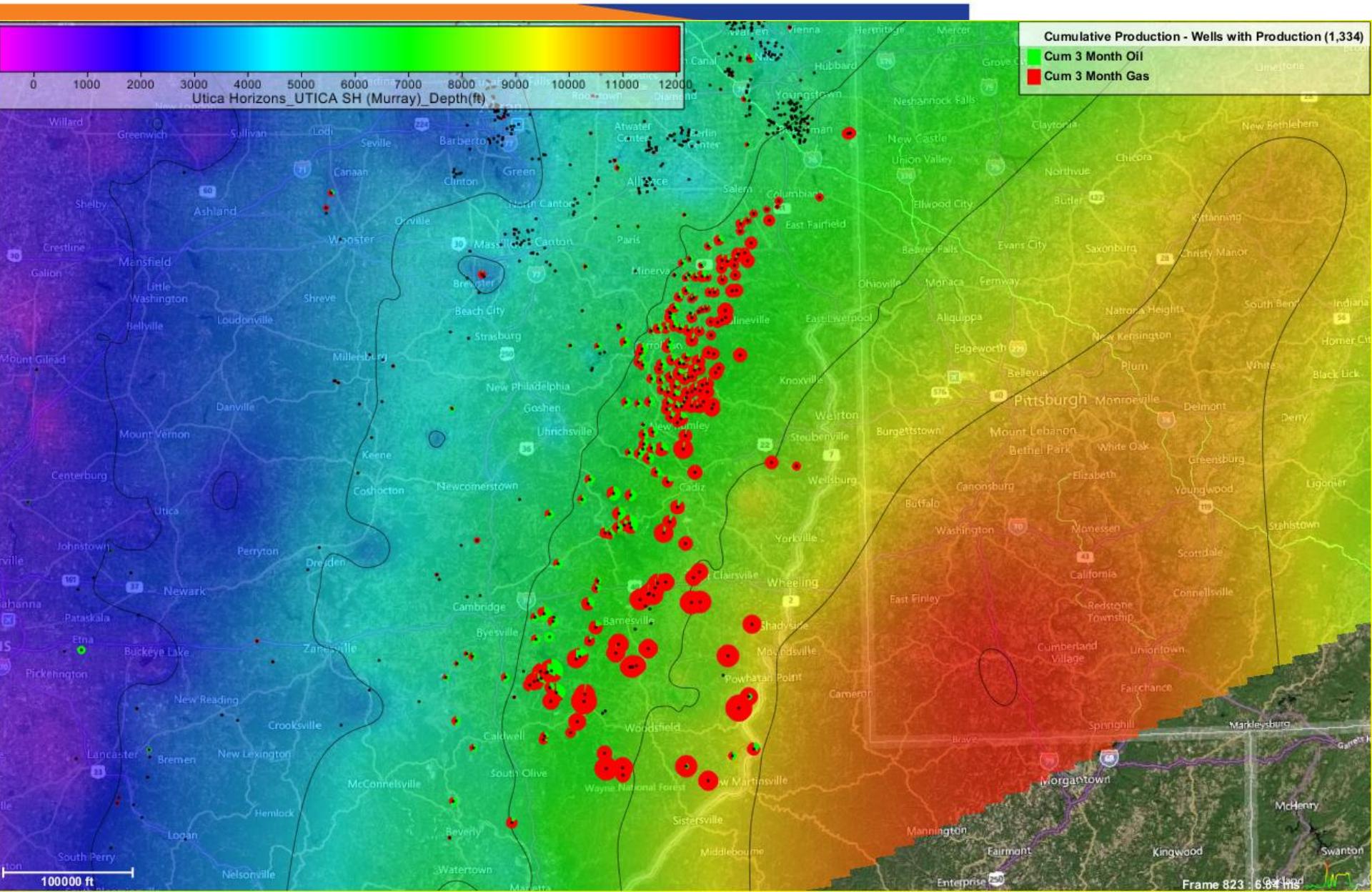


- Identify key geologic drivers of production and the degree to which they impact performance
 - Depth
 - Thickness
 - GOR
 - Thermal Maturity
 - TMAX
- Benchmark engineering impact on performance for variable geology

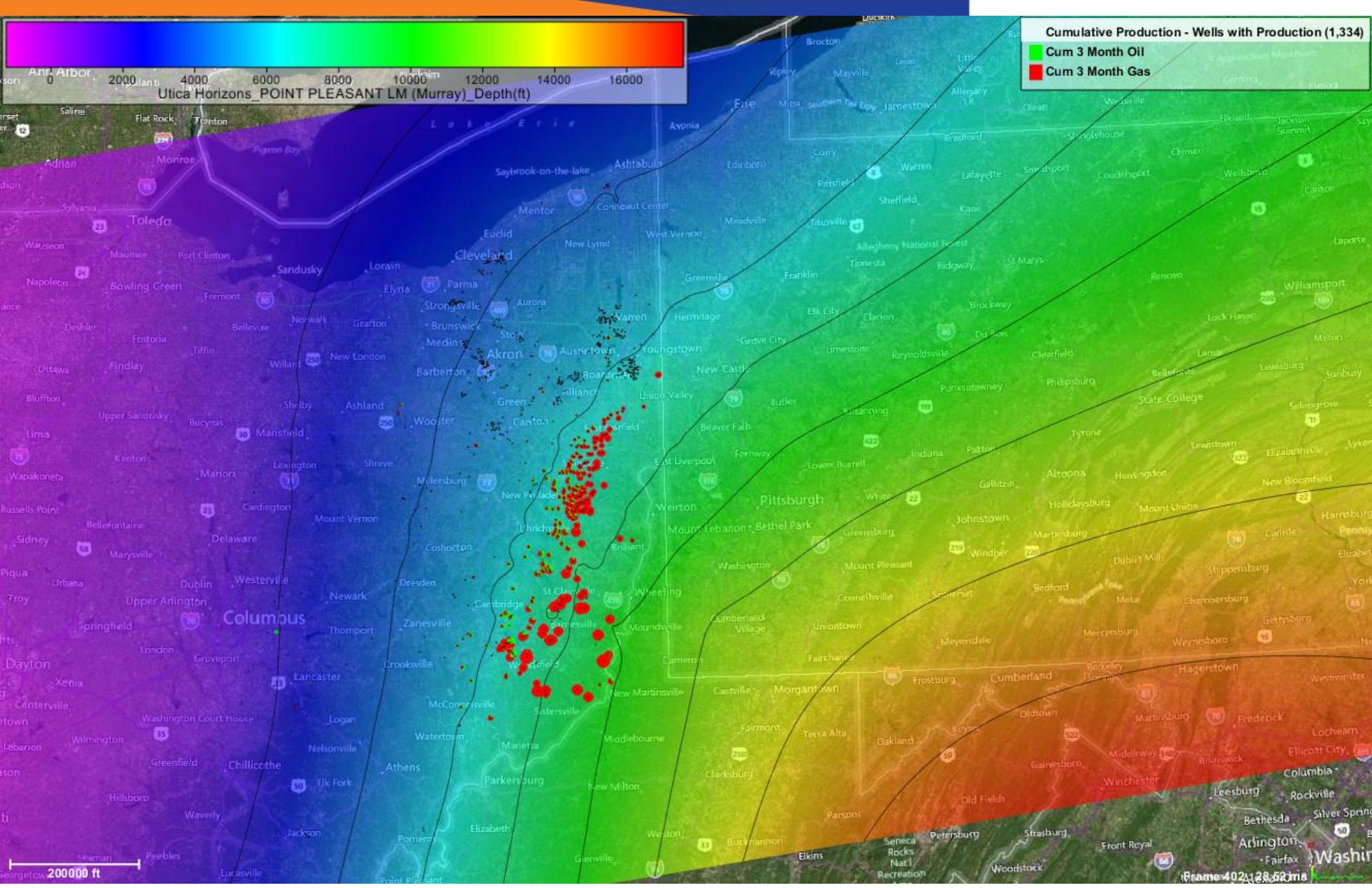
Utica Depth



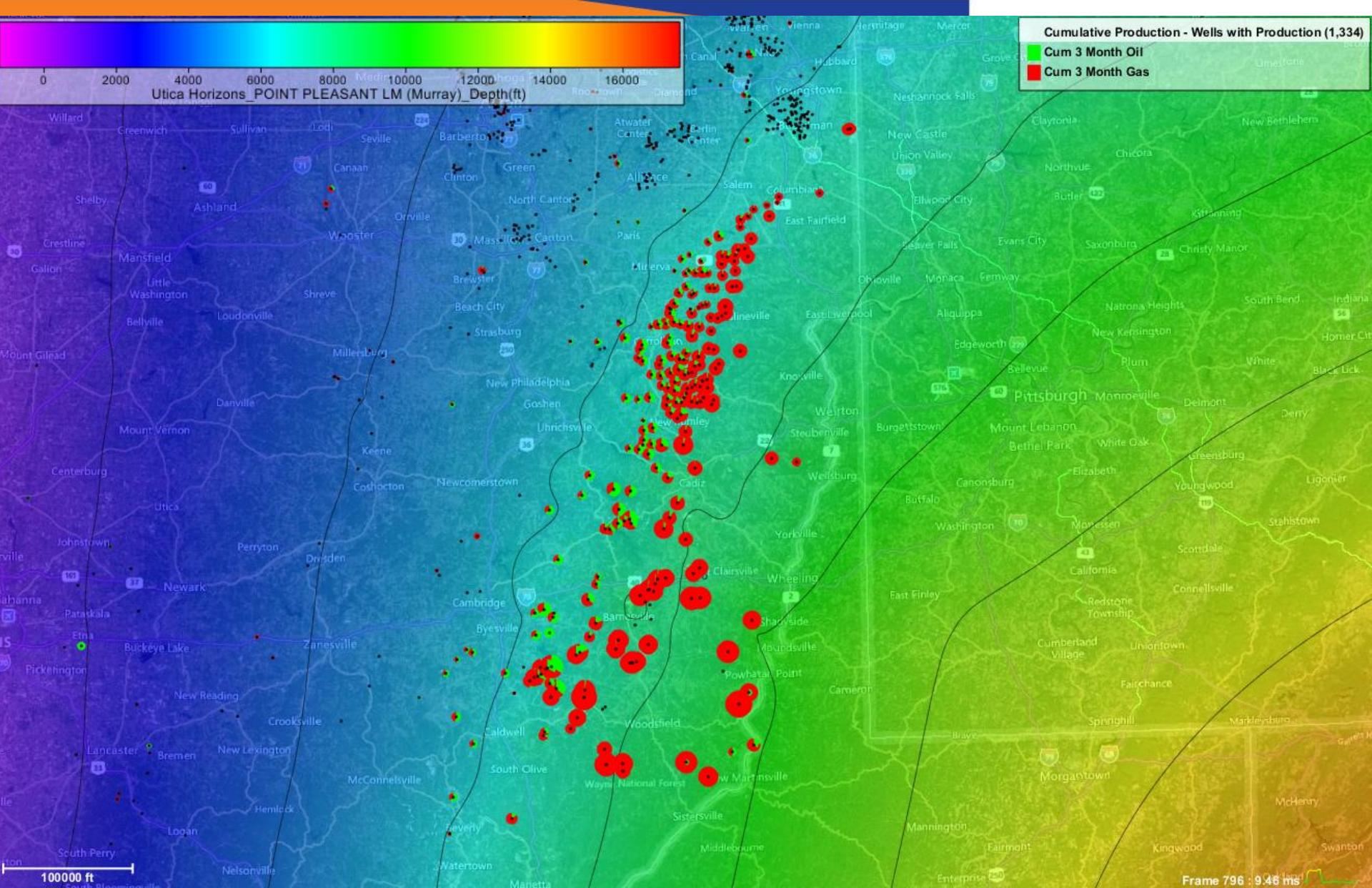
Utica Depth



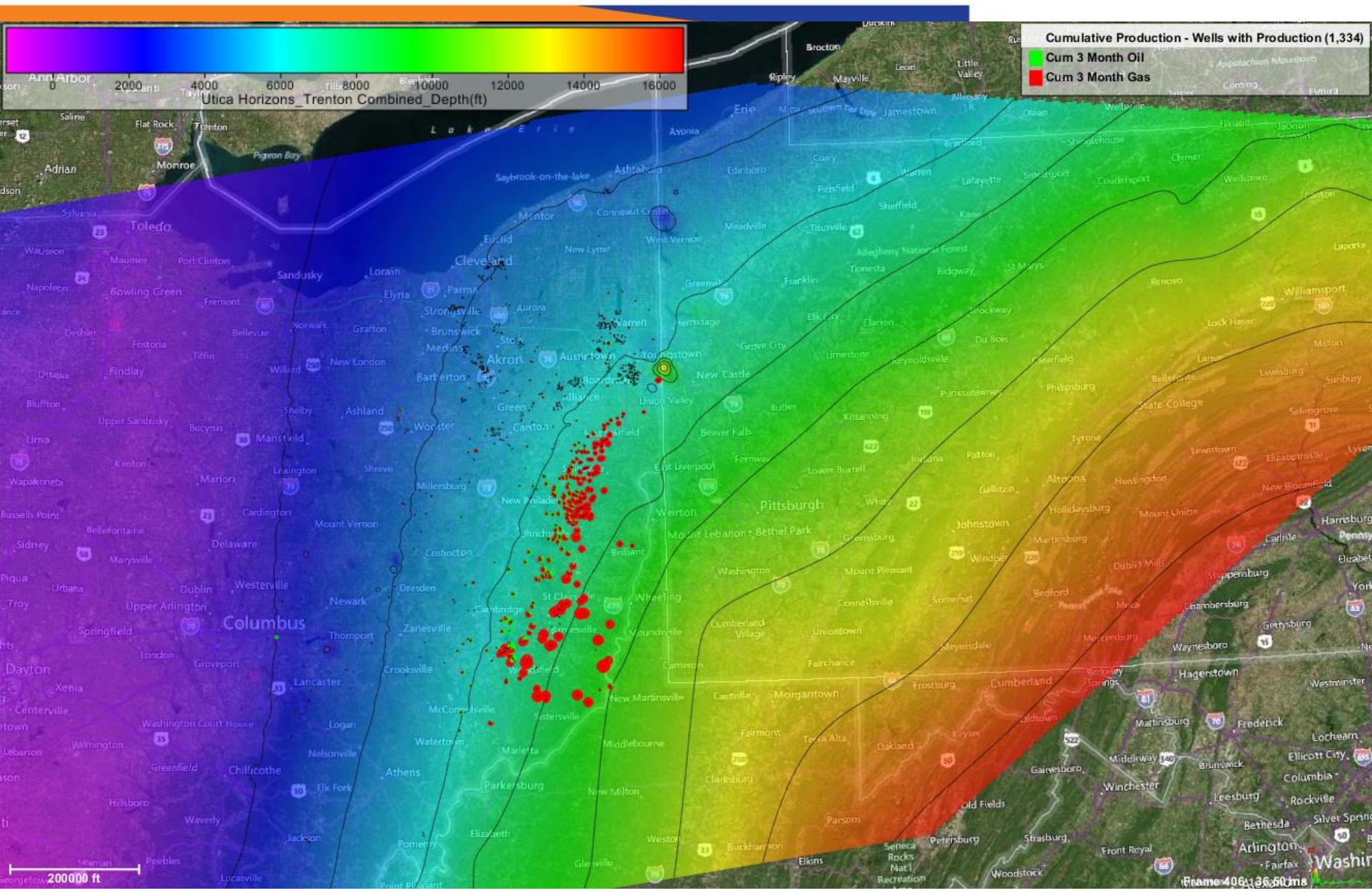
Point Pleasant Depth



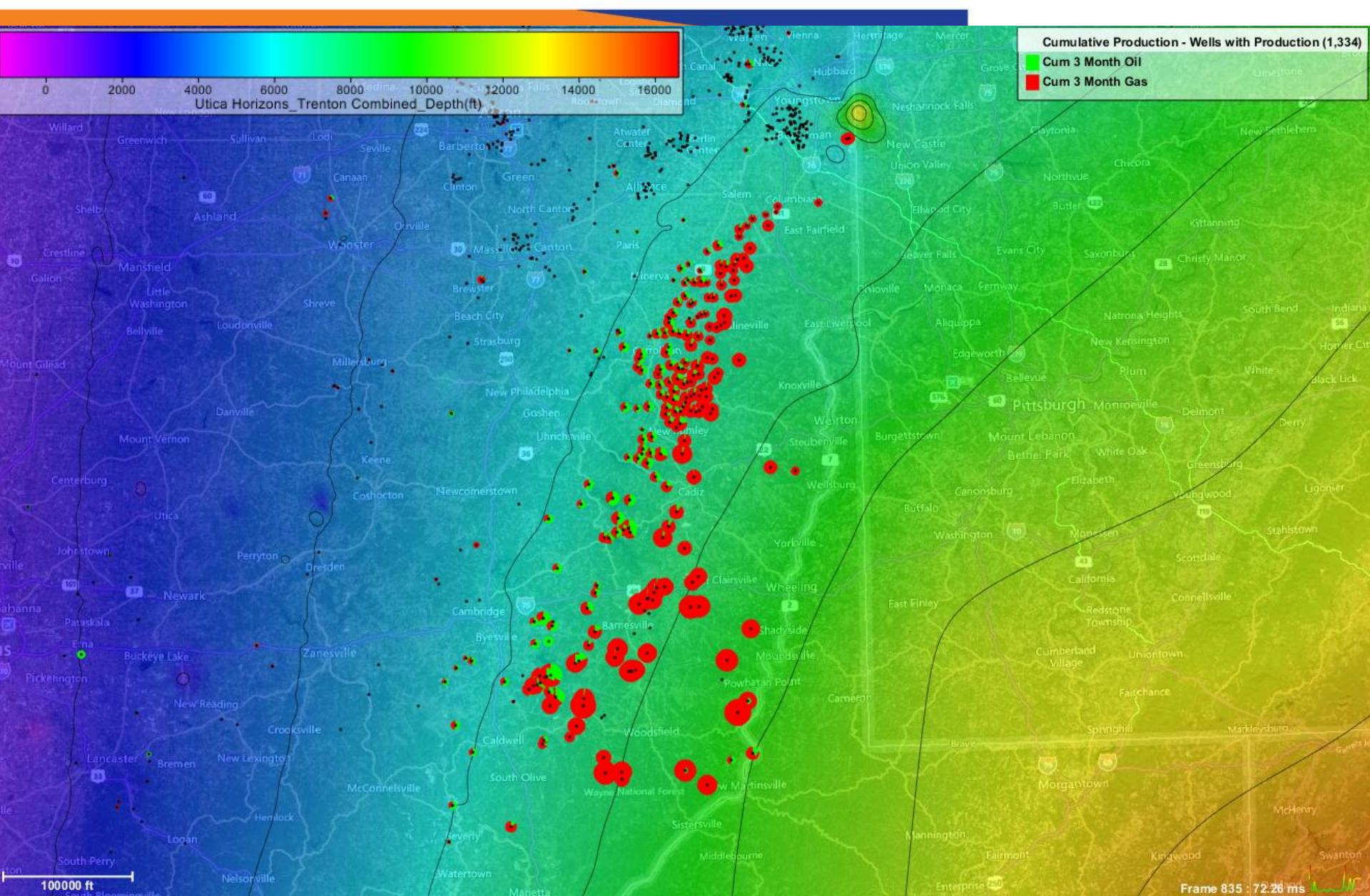
Point Pleasant Depth



Trenton Depth

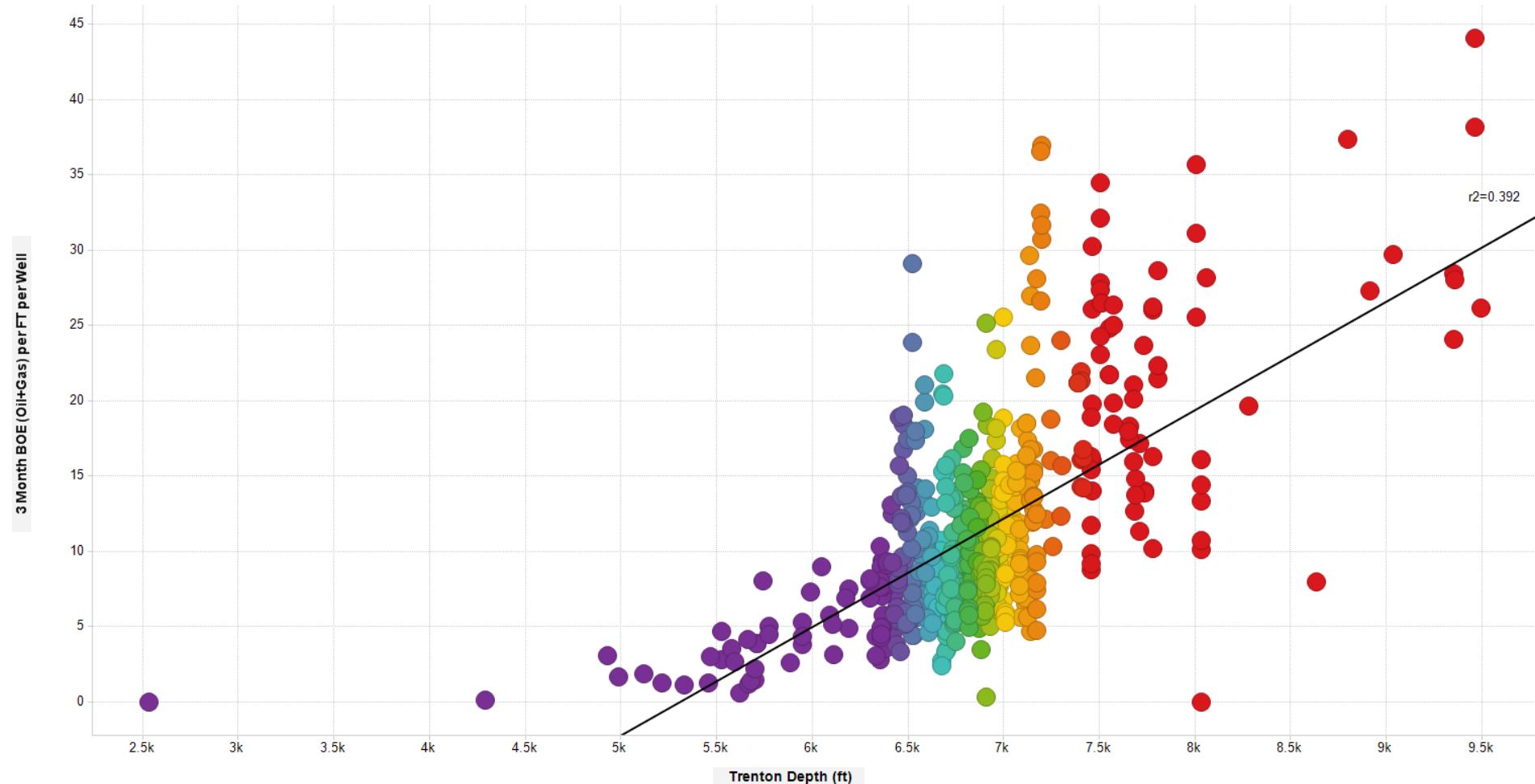


Trenton Depth



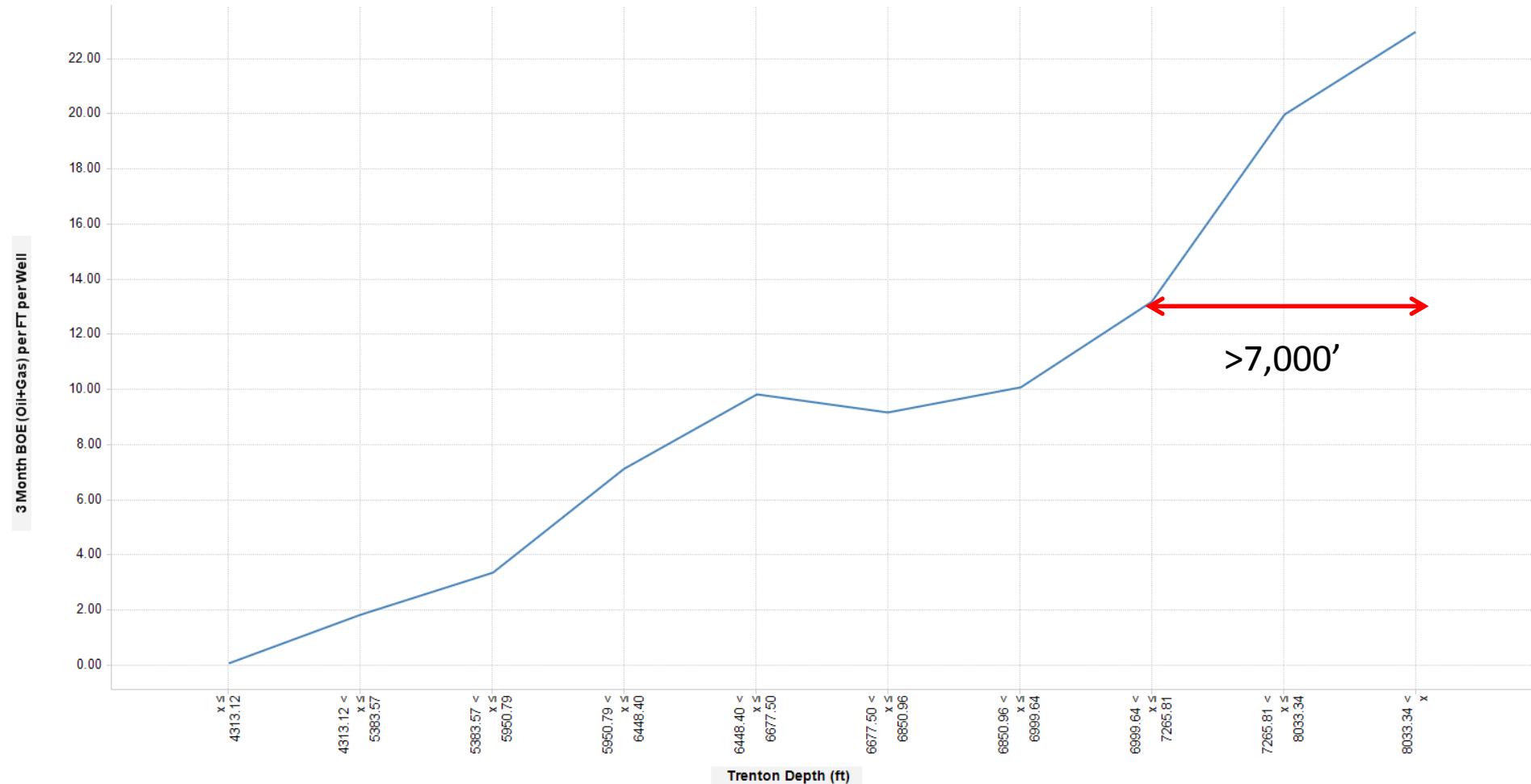
3 Month BOE/ft vs. Trenton Depth

3 Month BOE (Oil+Gas) per FT per Well vs. Trenton Depth (ft)

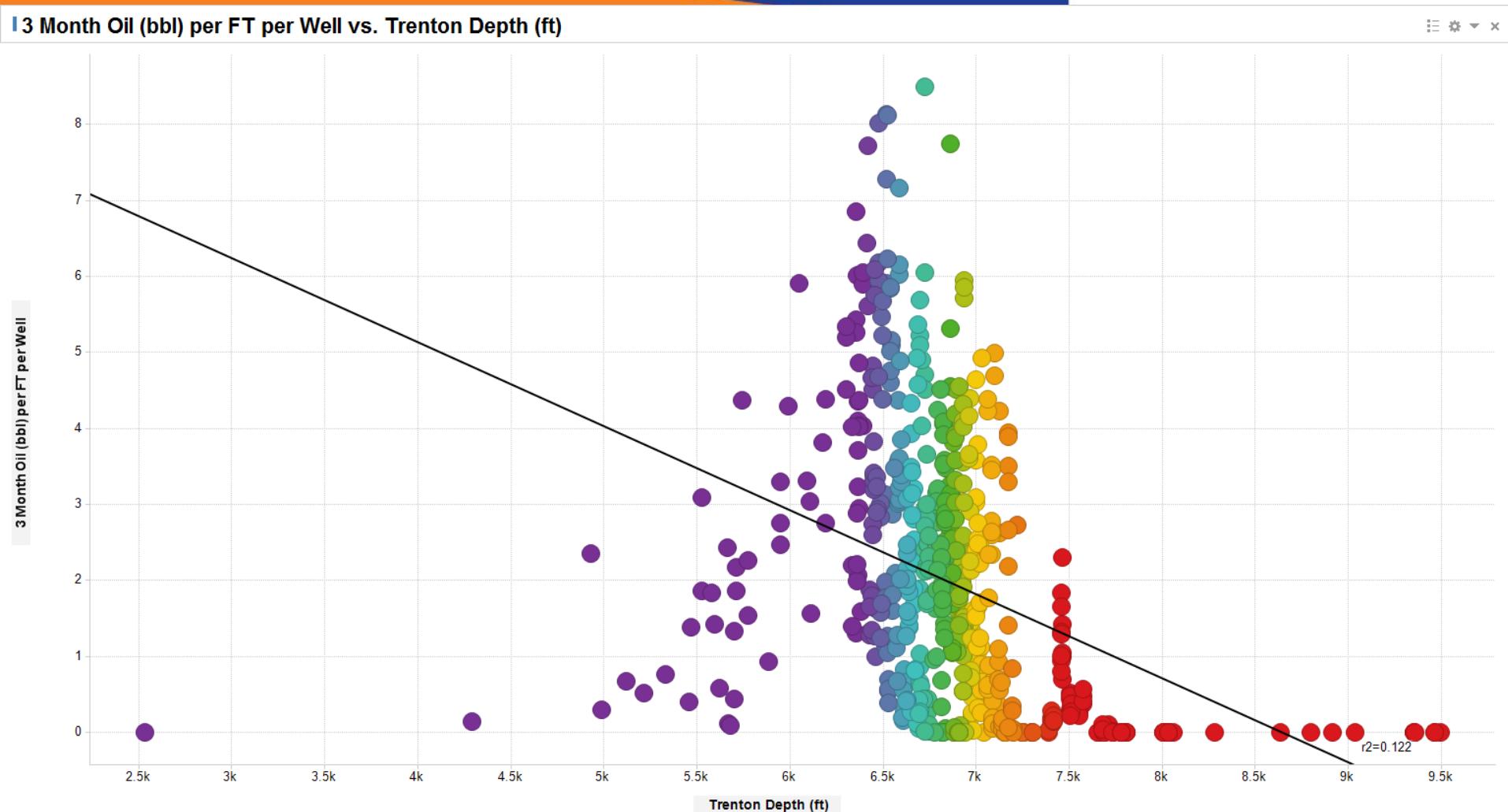


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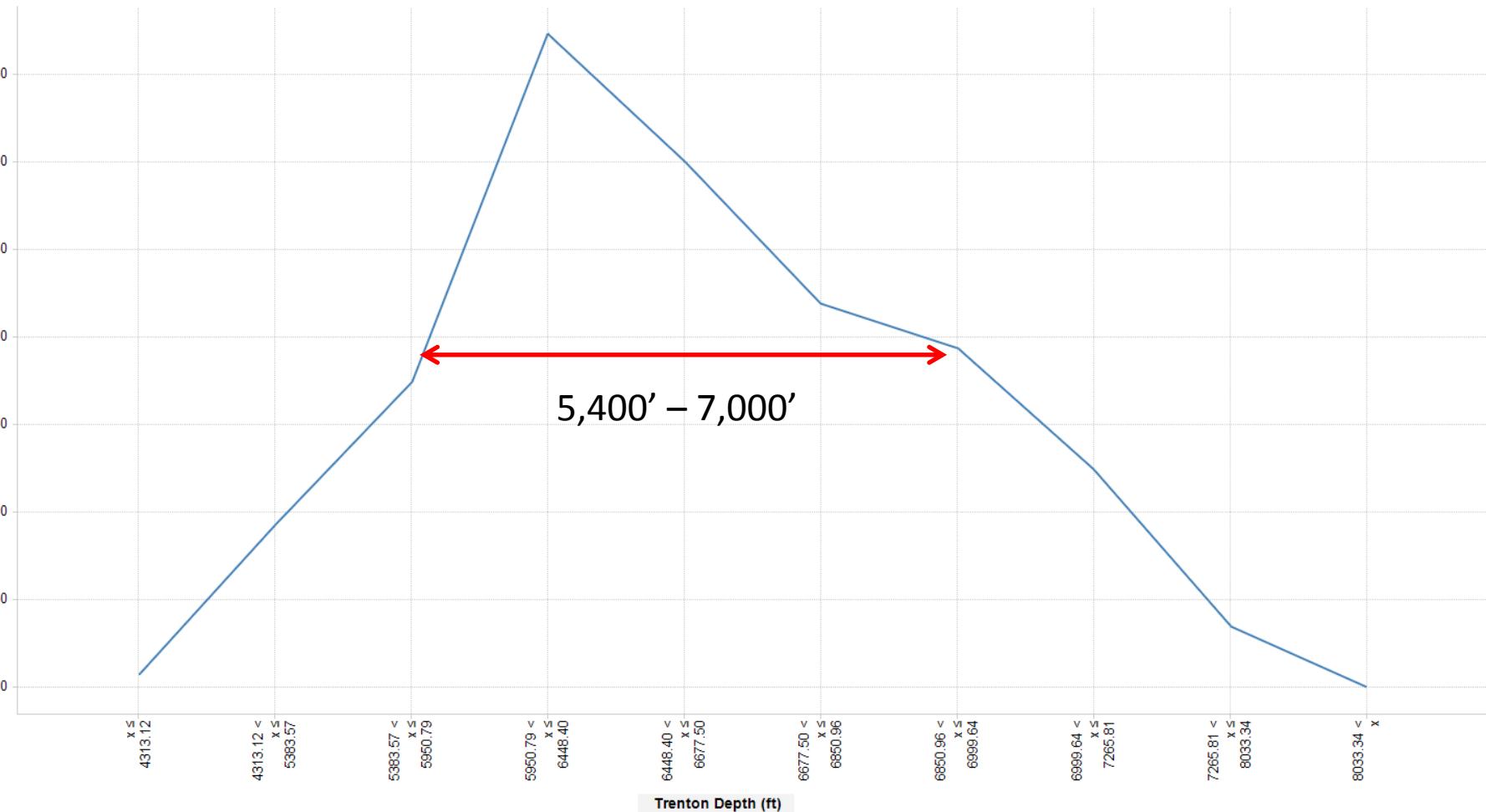


3 Month Oil/ft vs. Trenton Depth

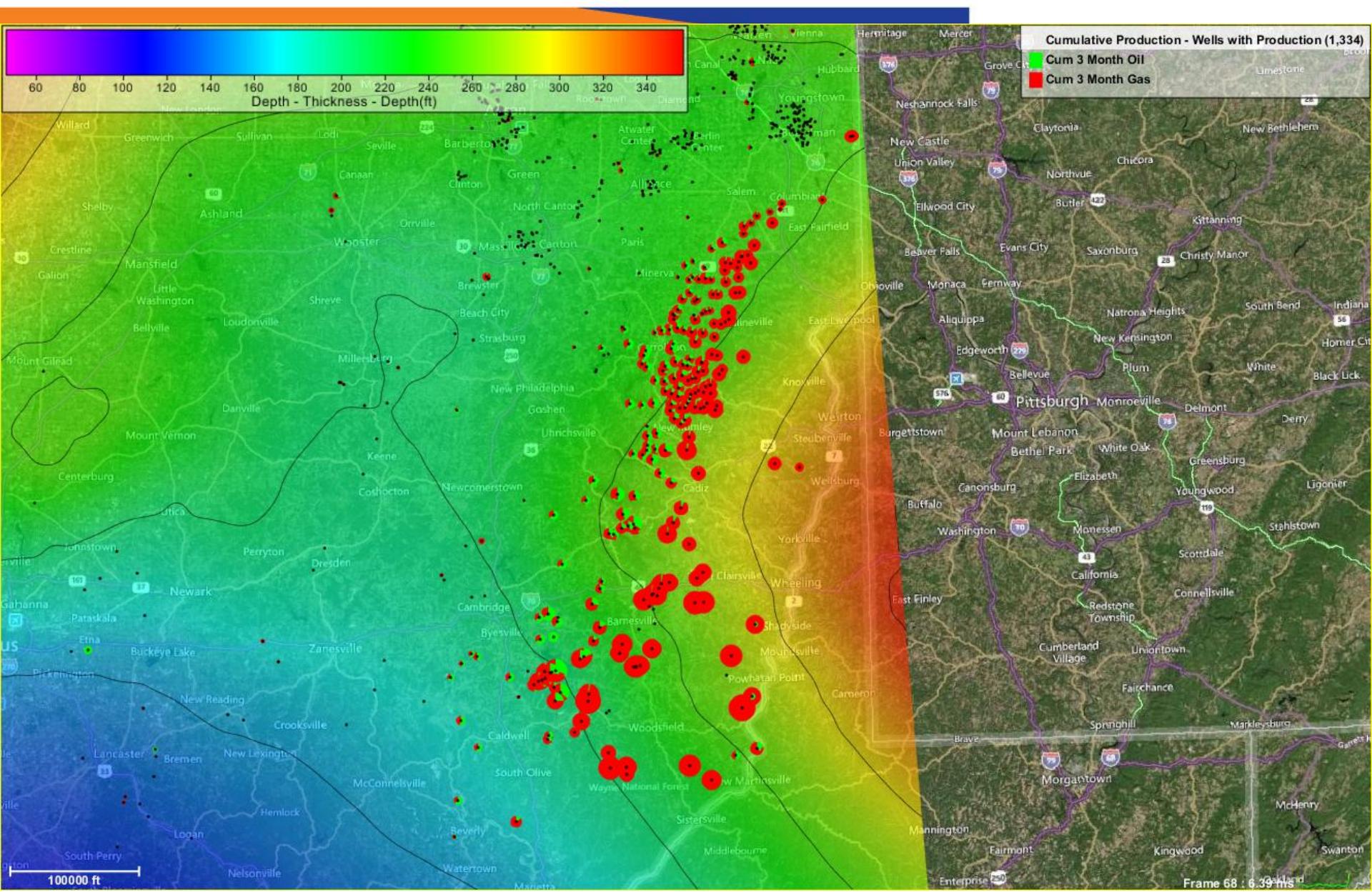


3 Month Oil/ft vs. Trenton Depth

3 Month Oil (bbl) per FT per Well vs. Trenton Depth (ft)

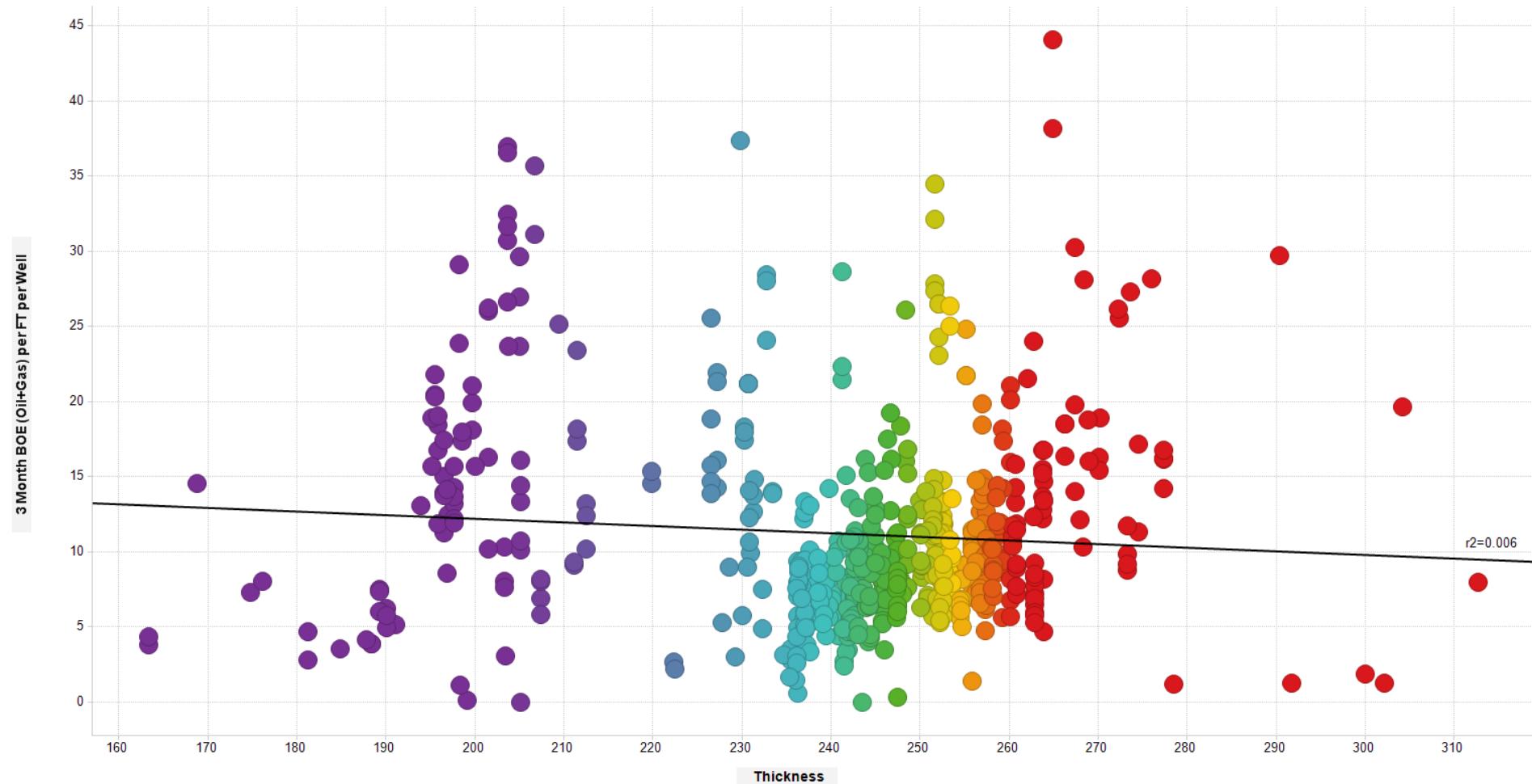


Utica/Point Pleasant Thickness



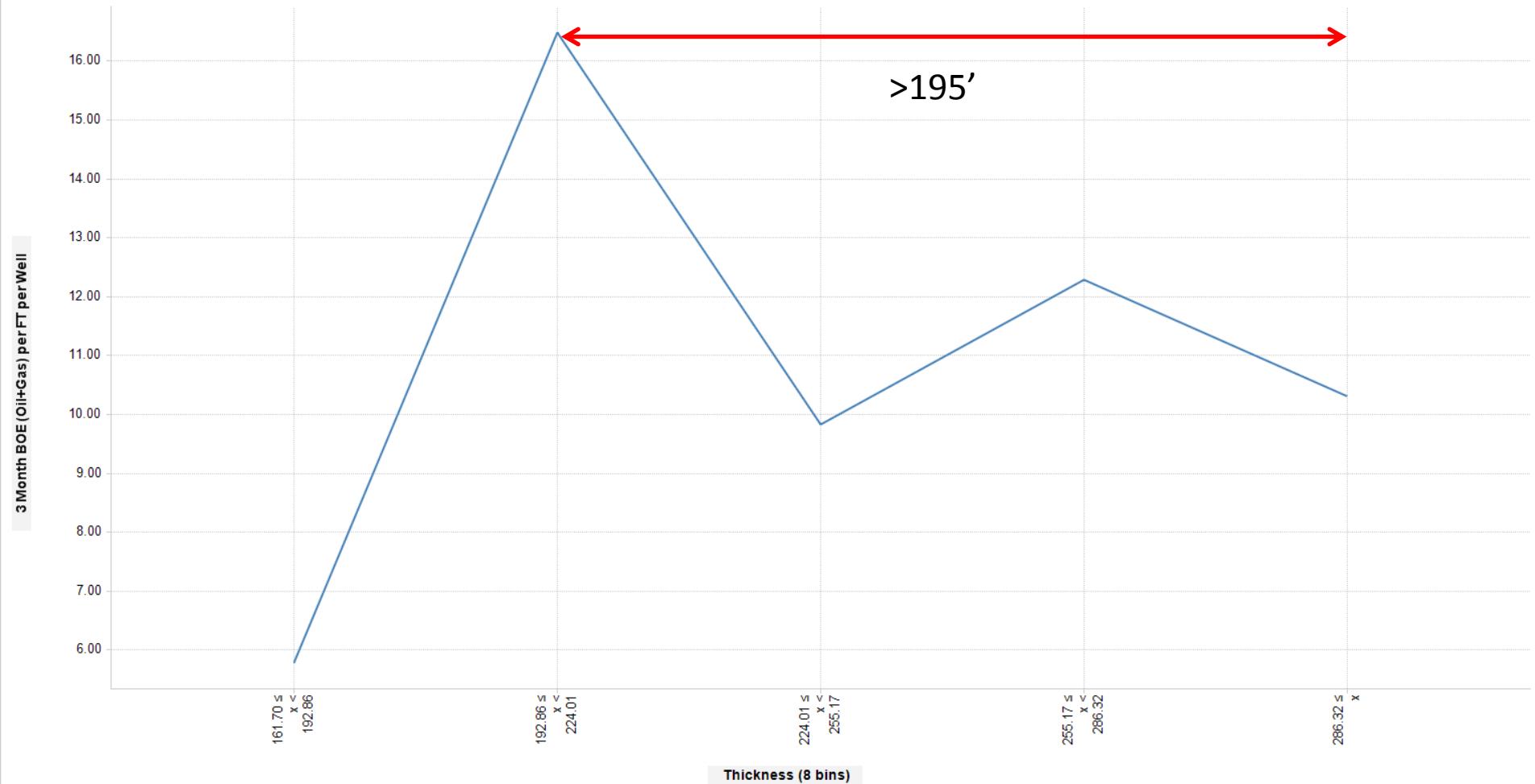
3 Month BOE/ft vs. Utica/Point Pleasant Thickness

3 Month BOE (Oil+Gas) per FT per Well vs. Thickness



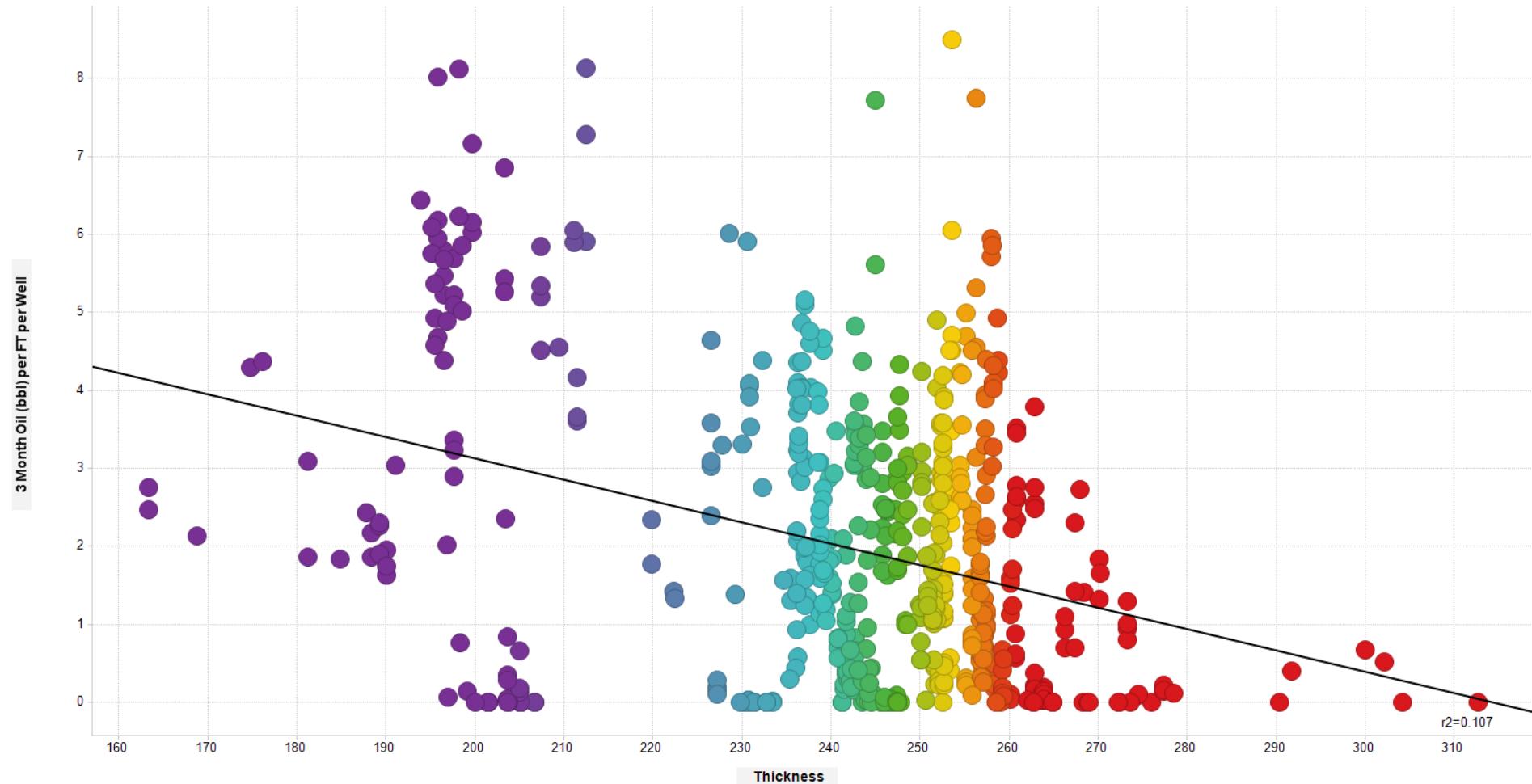
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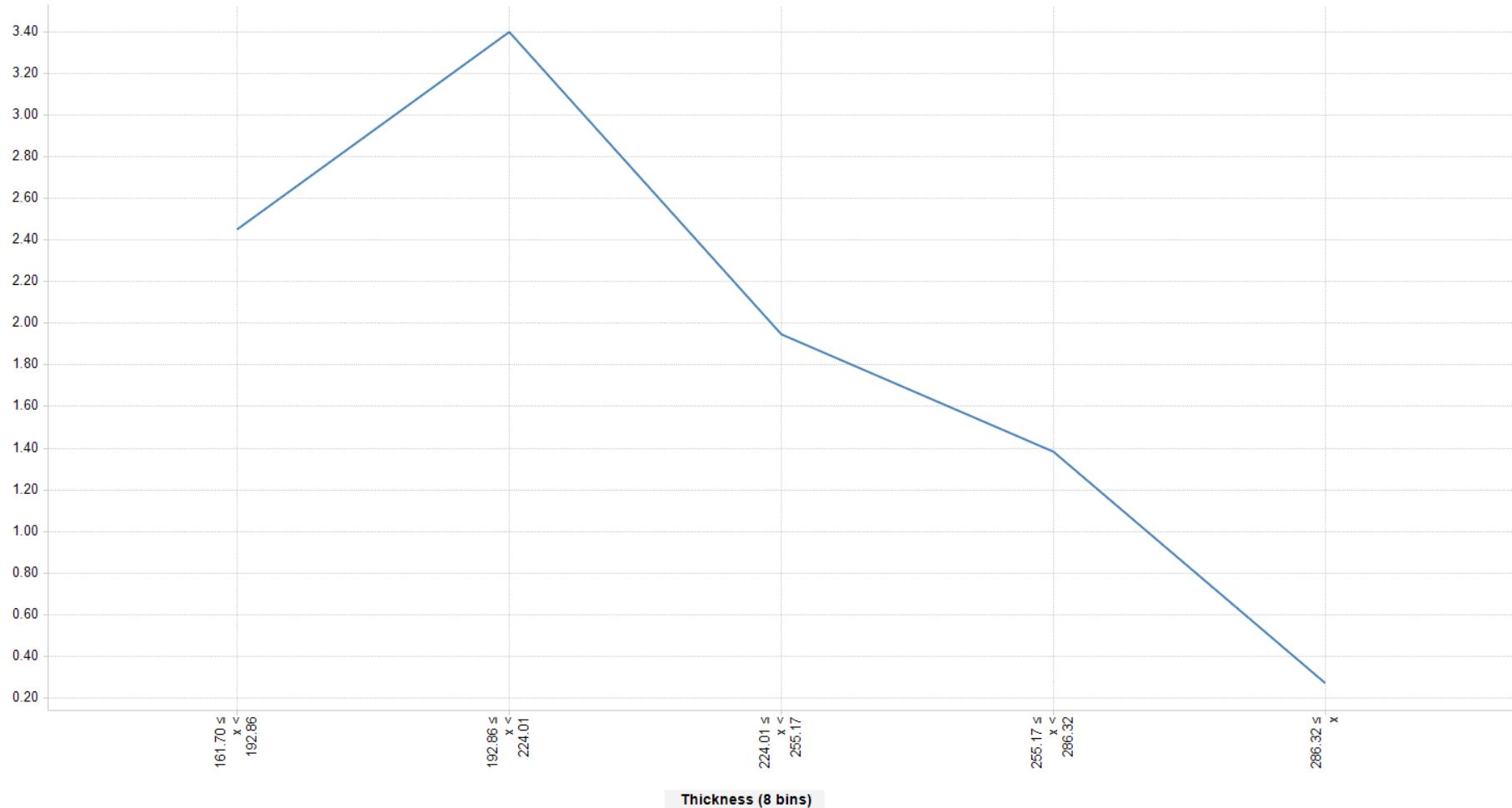
3 Month Oil/ft vs. Utica/Point Pleasant Thickness

3 Month Oil (bbl) per FT per Well vs. Thickness

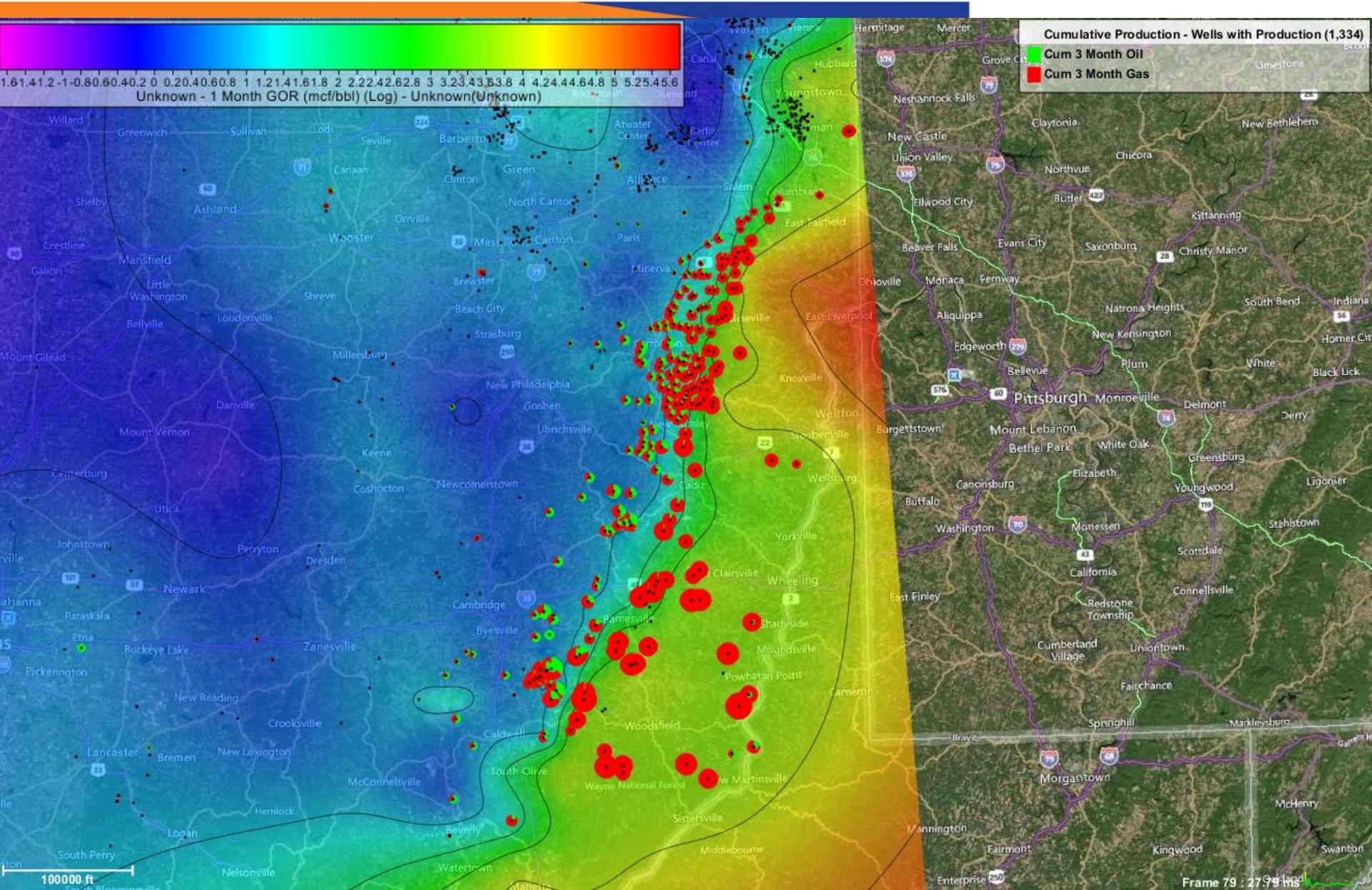


3 Month Oil/ft vs. Utica/Point Pleasant Thickness

3 Month Oil (bbl) per FT per Well vs. Thickness

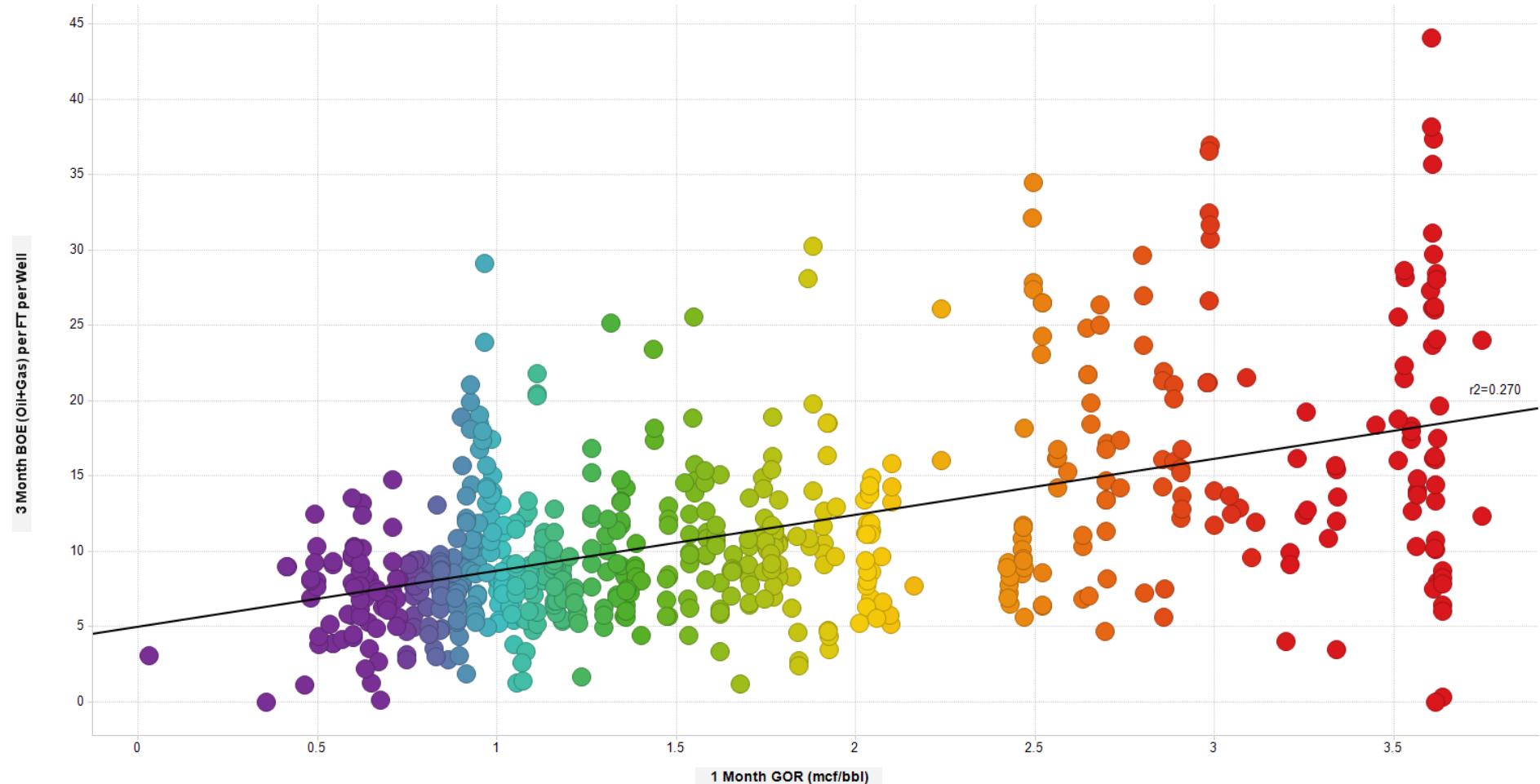


Point Pleasant GOR (Log)



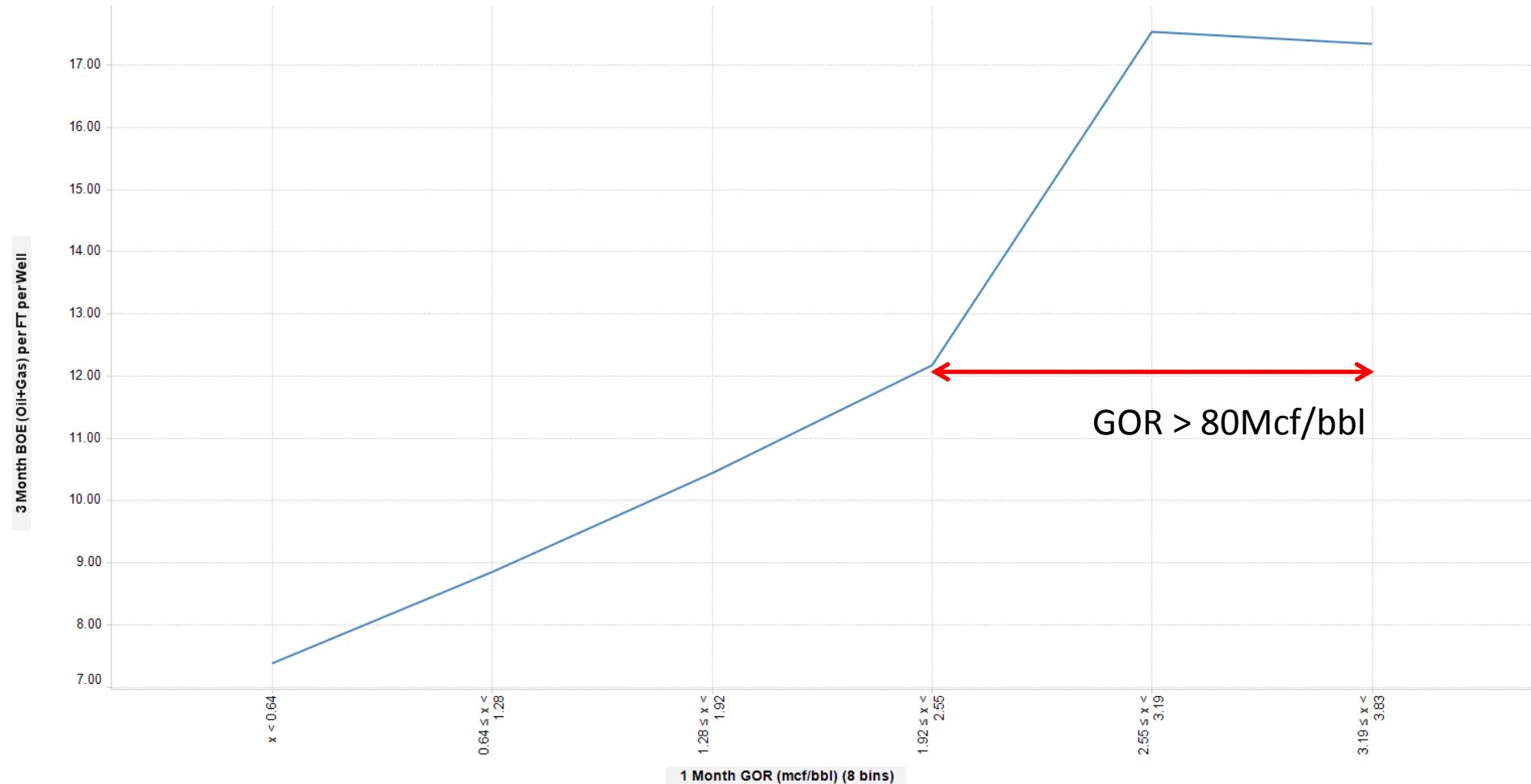
3 Month BOE/ft vs. Pleasant GOR (Log)

3 Month BOE (Oil+Gas) per FT per Well vs. 1 Month GOR (mcf/bbl)



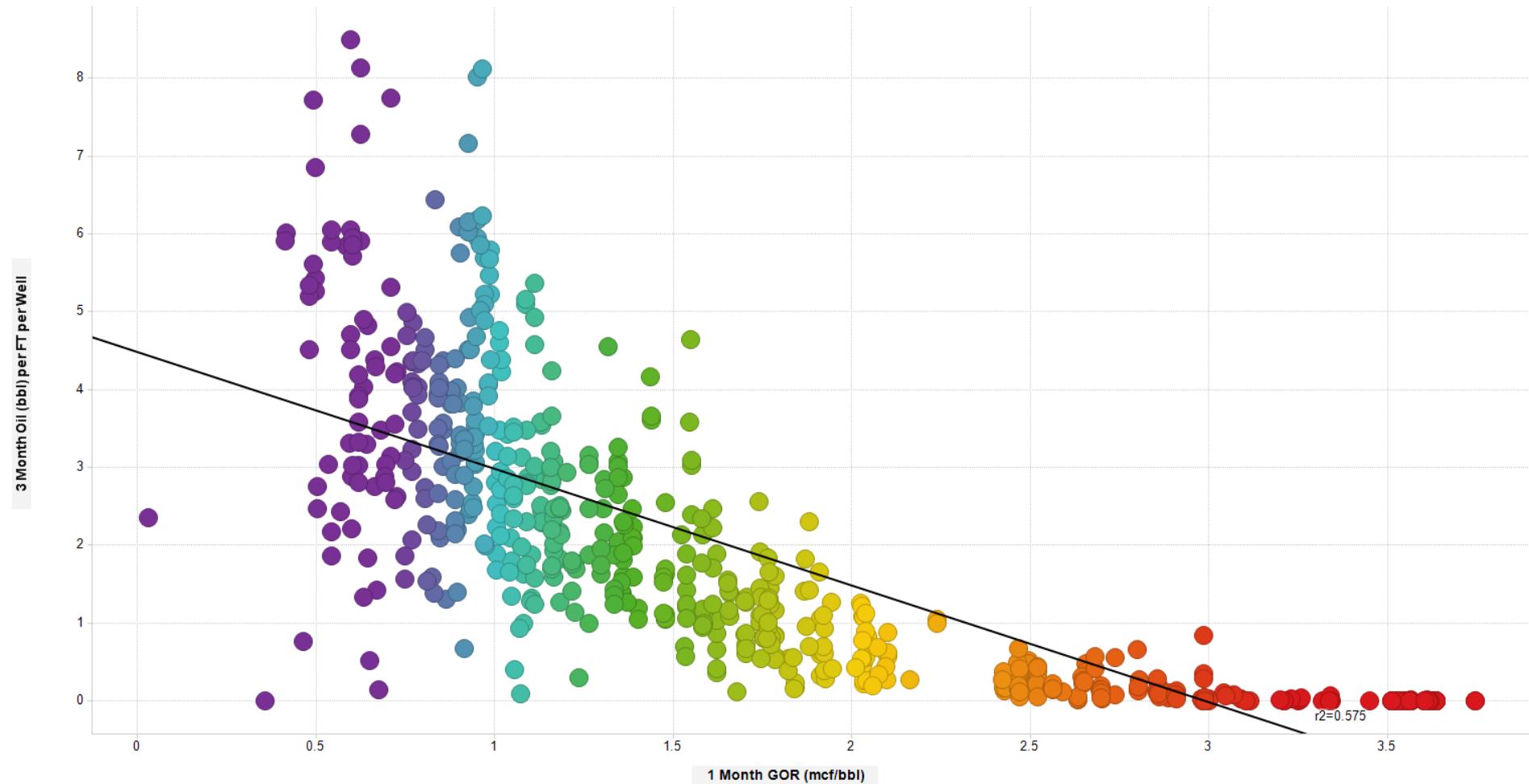
3 Month BOE/ft vs. Pleasant GOR (Log)

3 Month BOE (Oil+Gas) per FT per Well vs. 1 Month GOR (mcf/bbl)

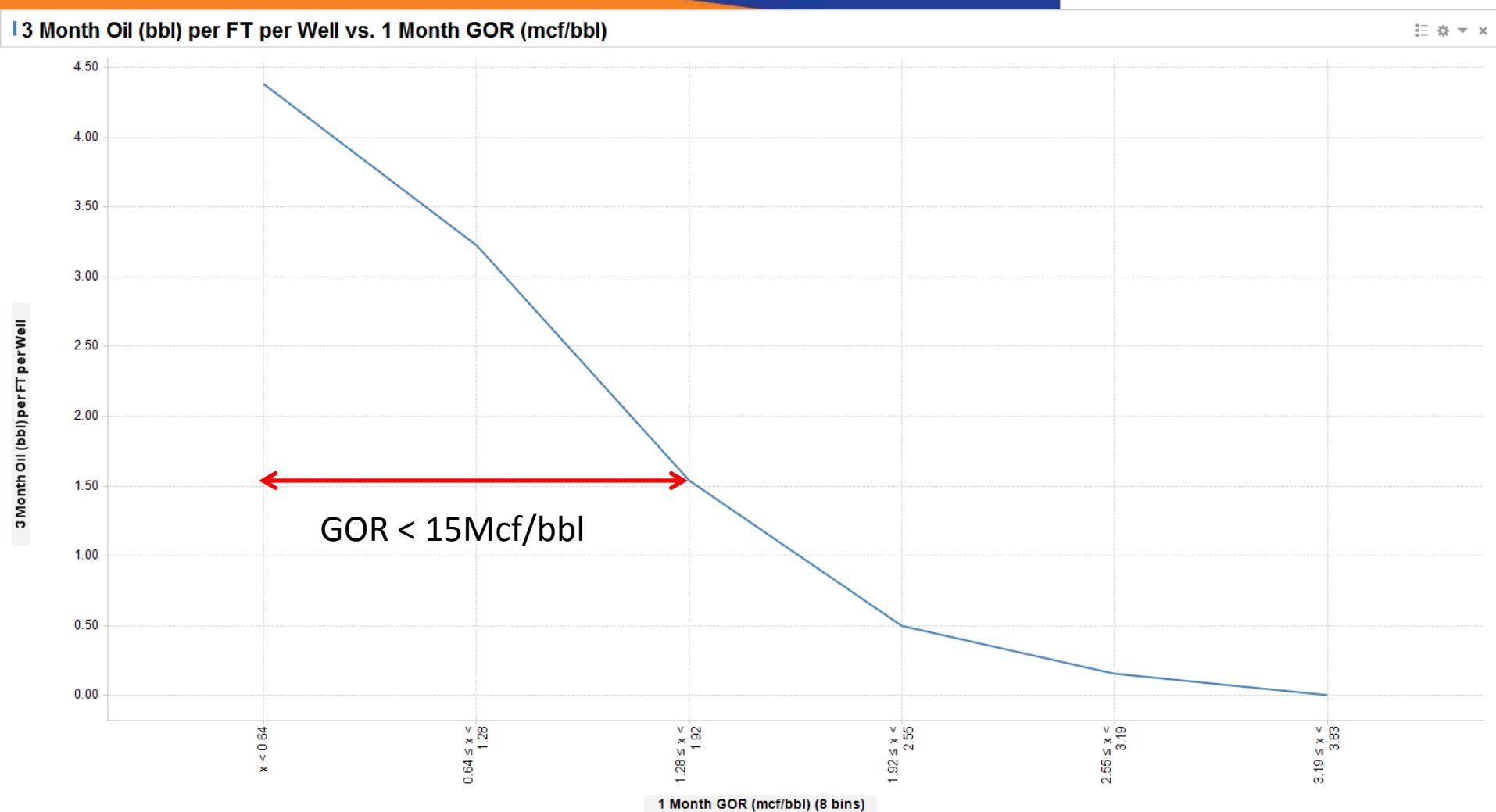


3 Month Oil/ft vs. Pleasant GOR (Log)

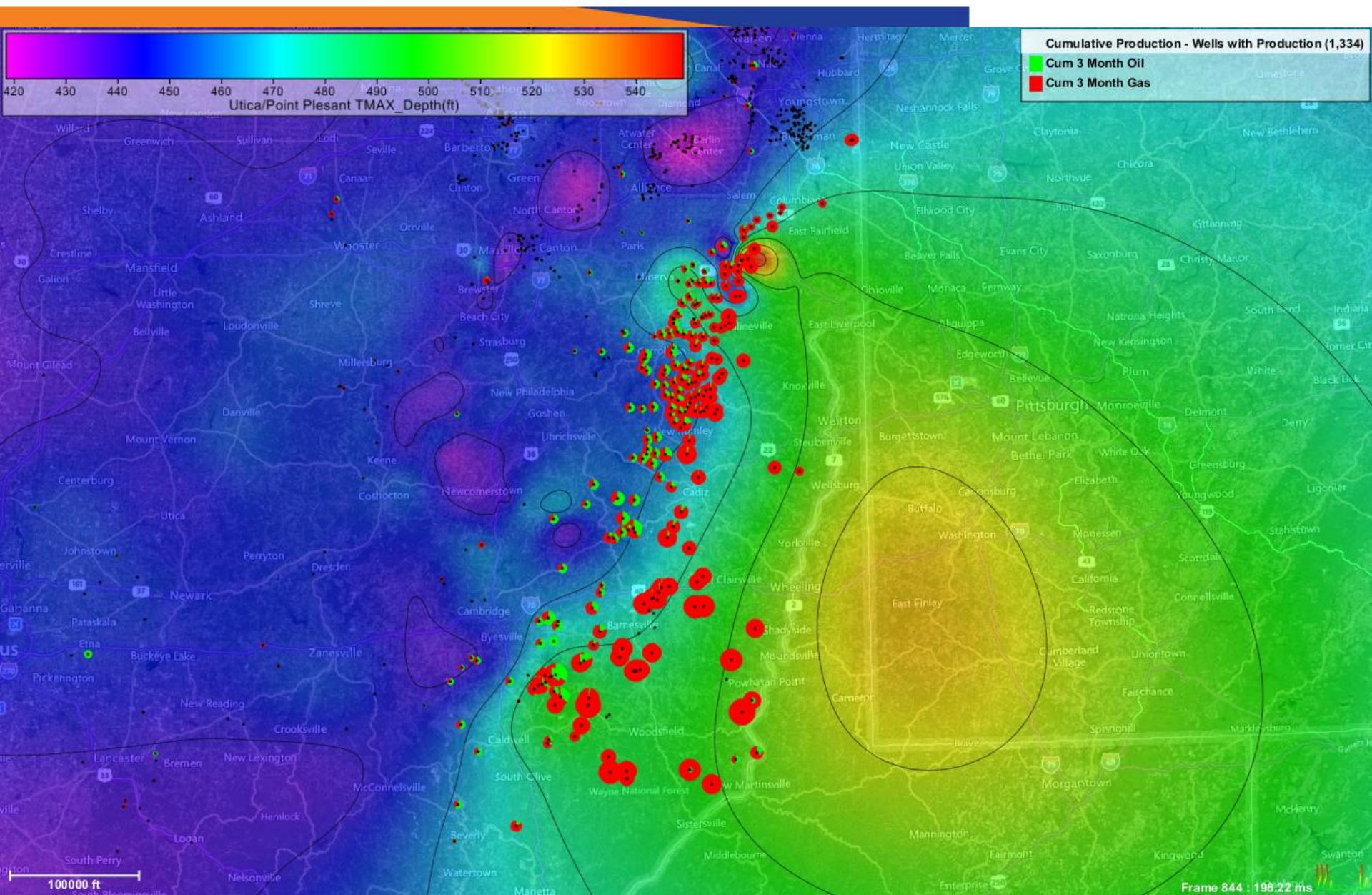
3 Month Oil (bbl) per FT per Well vs. 1 Month GOR (mcf/bbl)



3 Month Oil/ft vs. Pleasant GOR (Log)

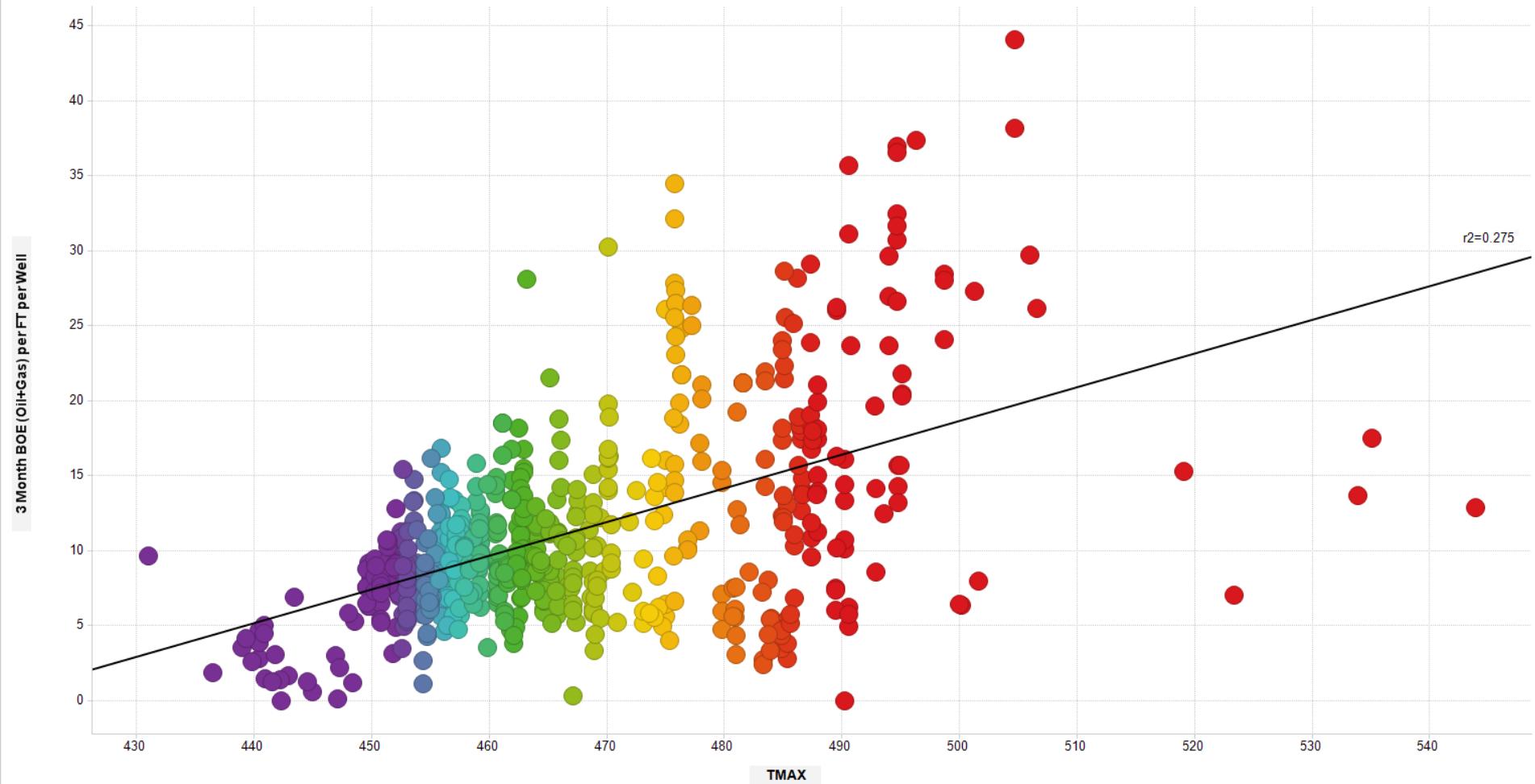


Utica/Point Pleasant TMAX



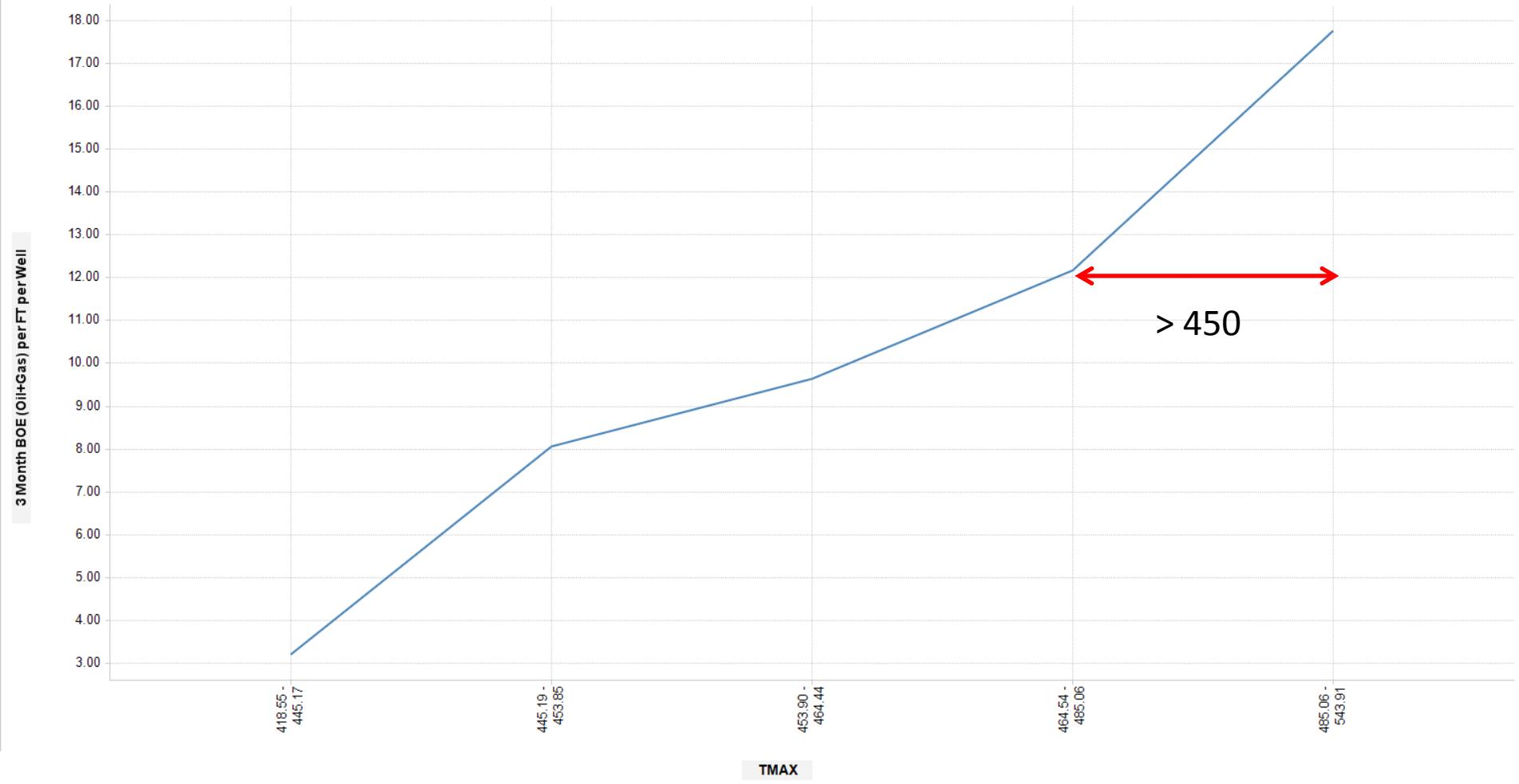
3 Month BOE/ft vs. TMAX

3 Month BOE (Oil+Gas) per FT per Well vs. TMAX



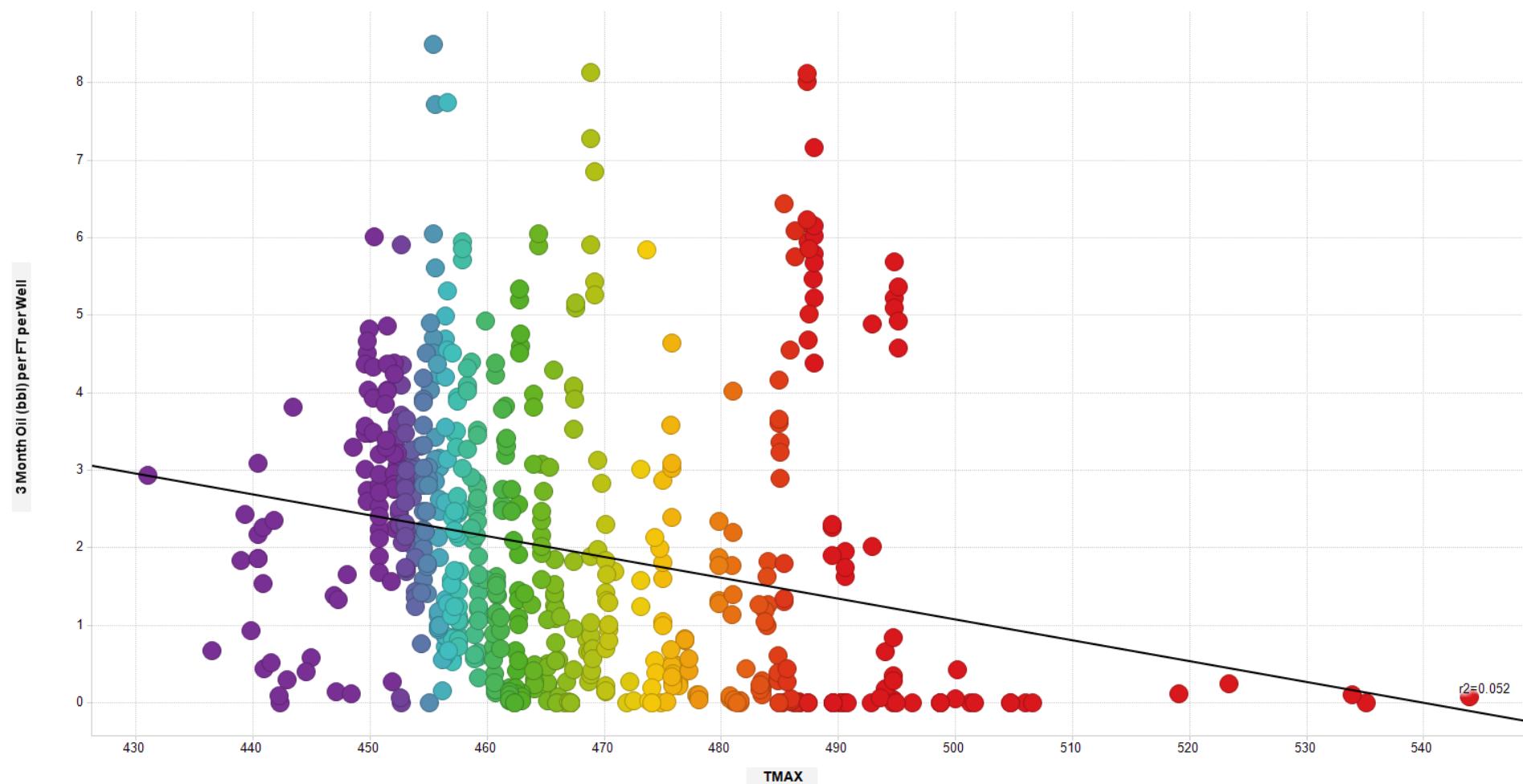
3 Month BOE/ft vs. TMAX

3 Month BOE (Oil+Gas) per FT per Well vs. TMAX



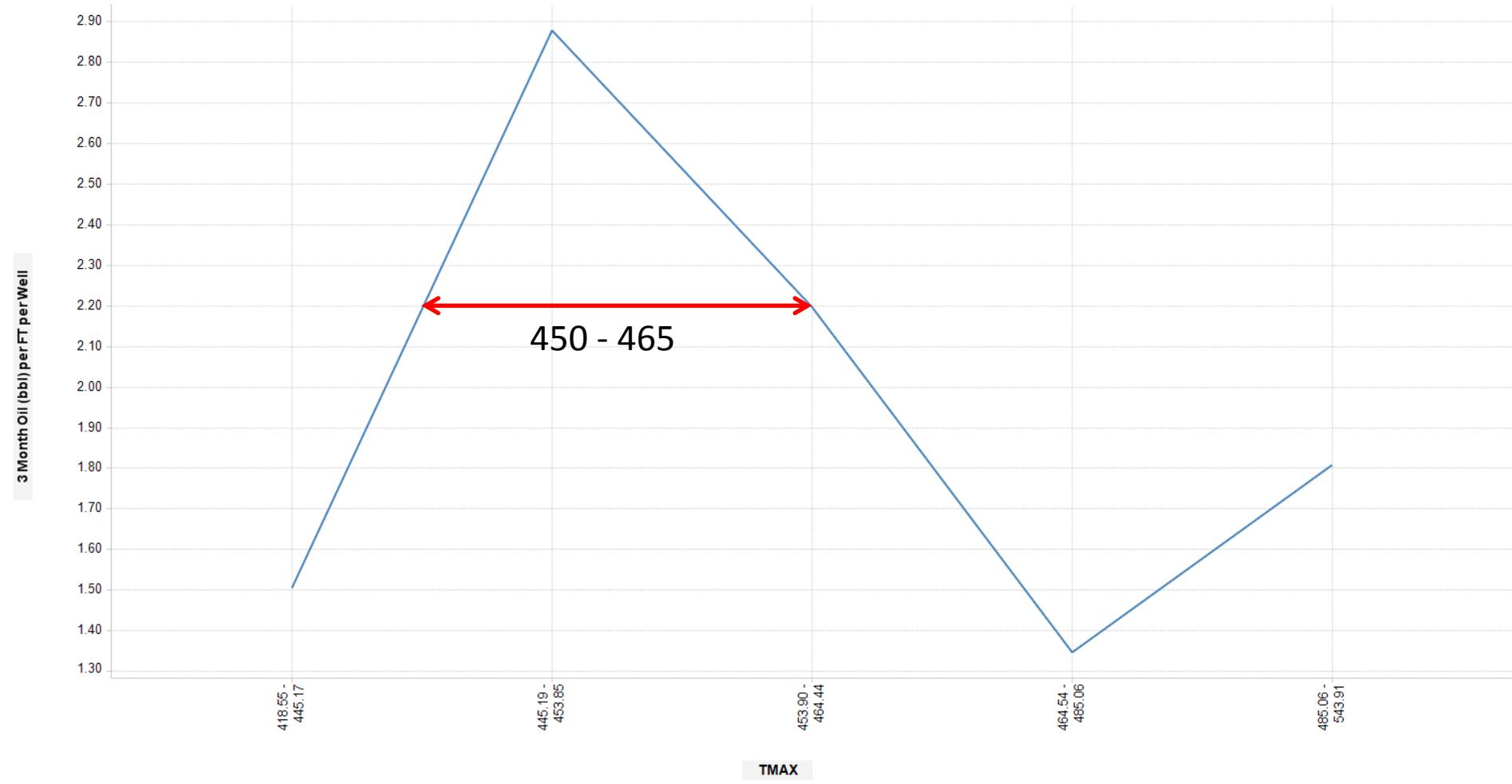
3 Month Oil/ft vs. TMAX

3 Month Oil (bbl) per FT per Well vs. TMAX

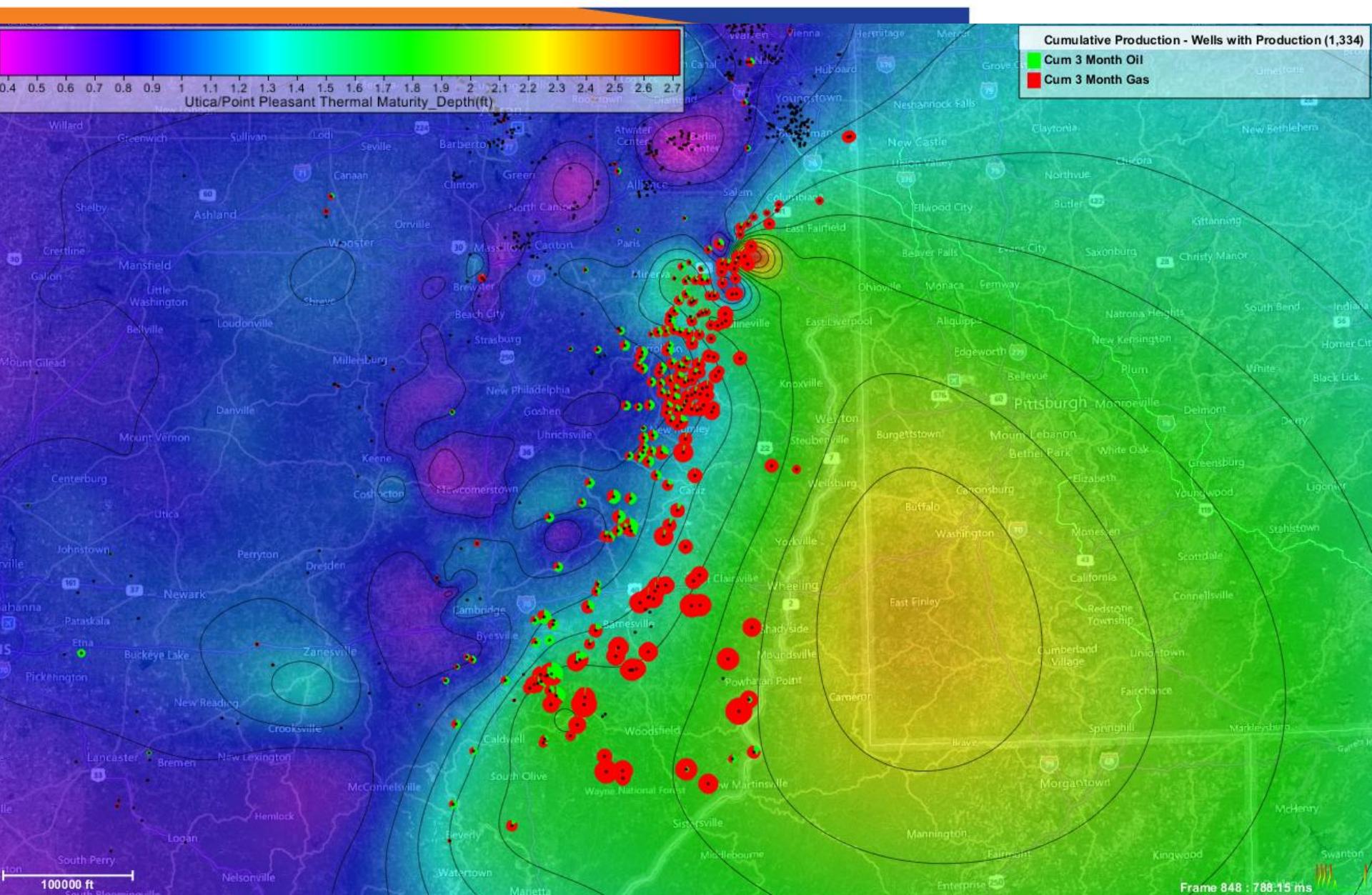


3 Month Oil/ft vs. TMAX

3 Month Oil (bbl) per FT per Well vs. TMAX

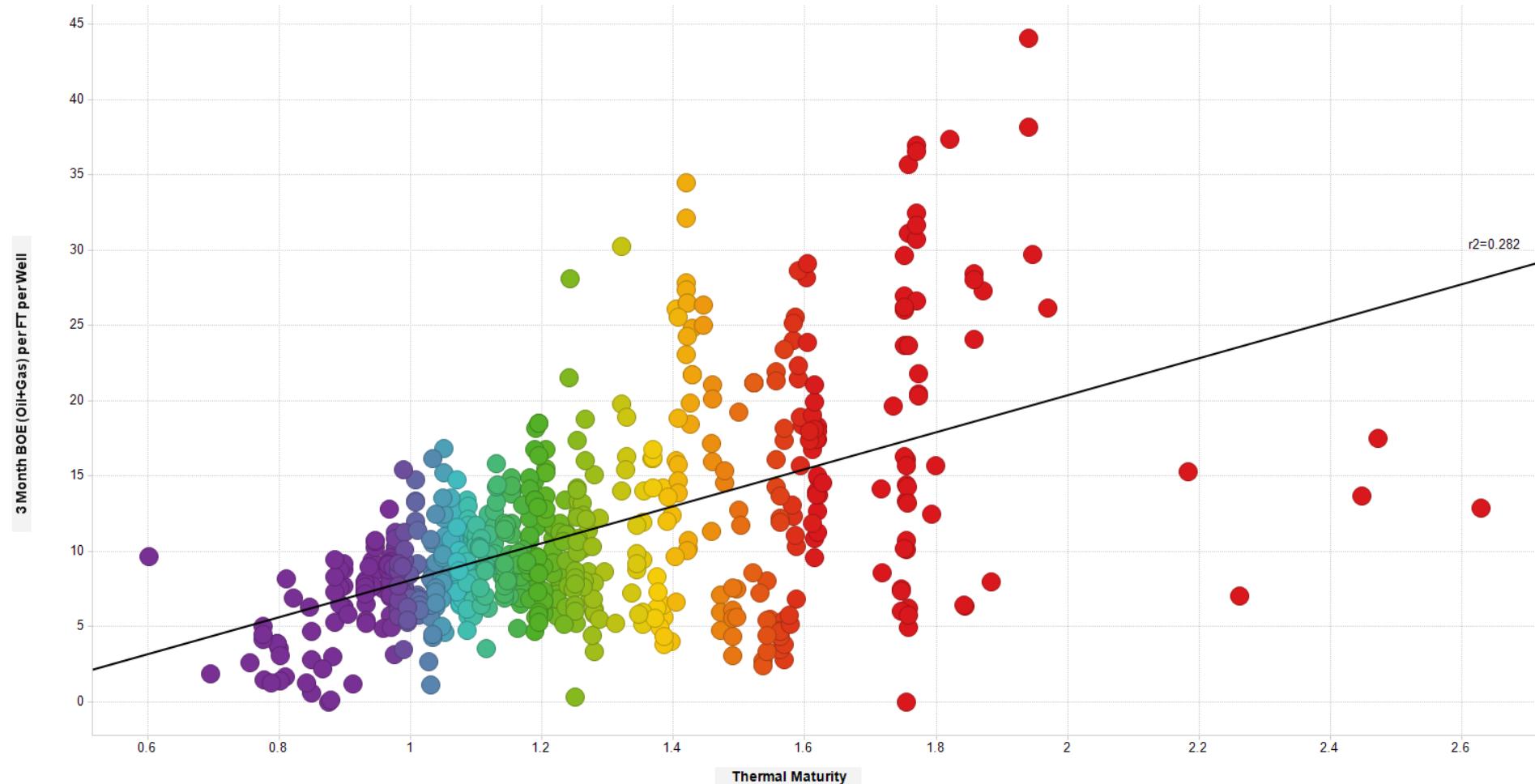


Utica/Point Pleasant Thermal Maturity



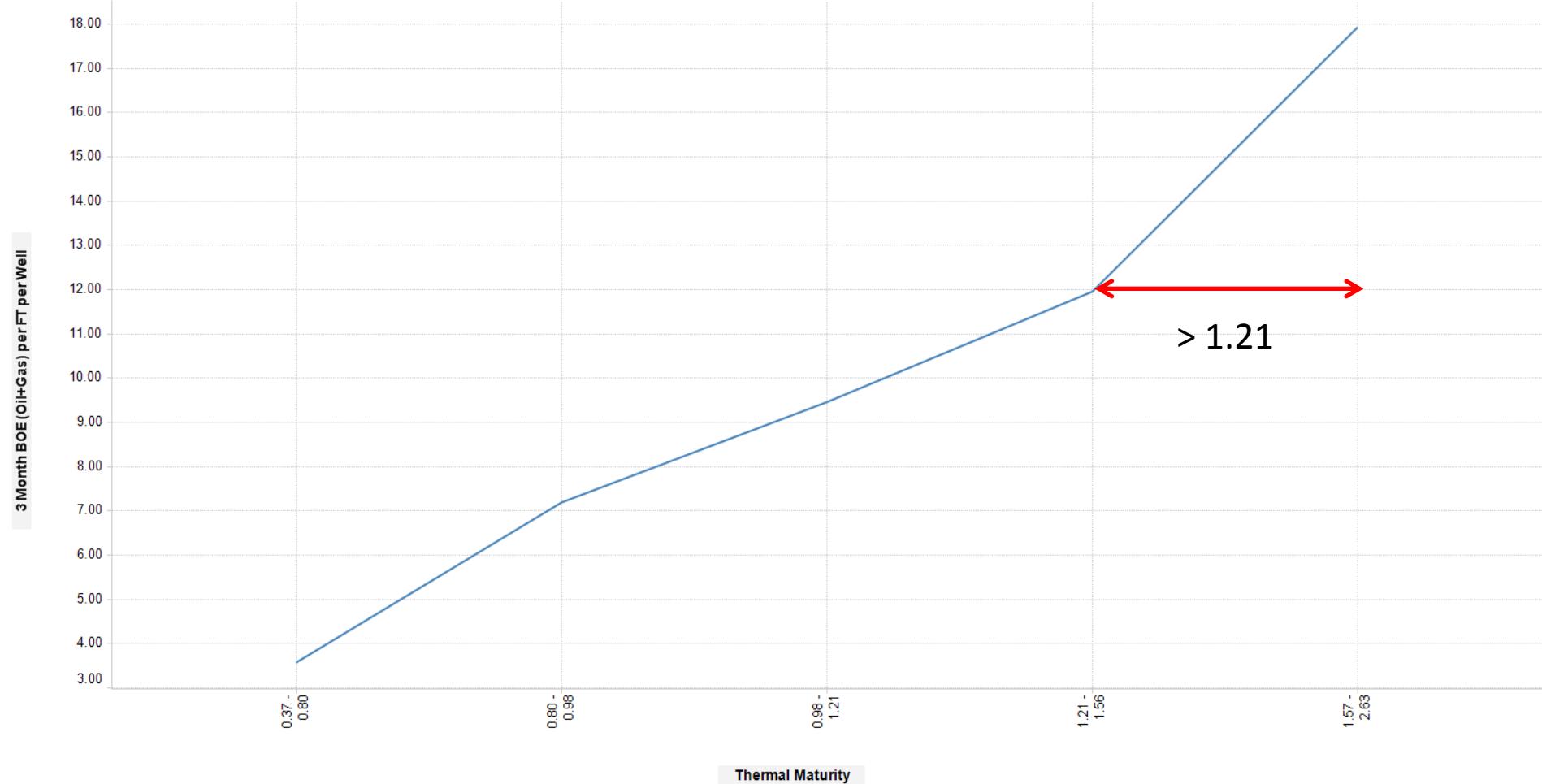
3 Month BOE/ft vs. Thermal Maturity

3 Month BOE (Oil+Gas) per FT per Well vs. Thermal Maturity



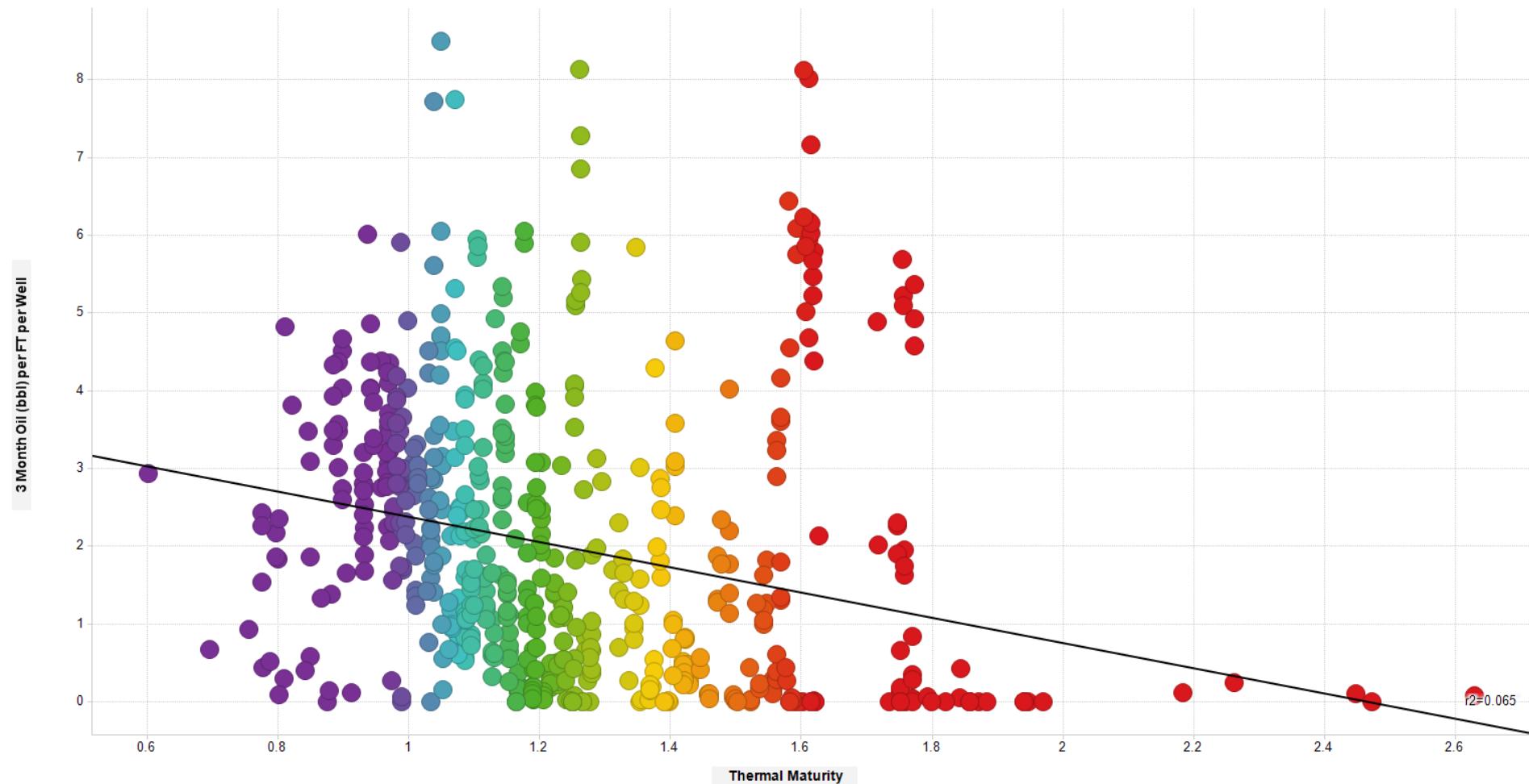
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3 Month BOE (Oil+Gas) per FT per Well vs. Thermal Maturity



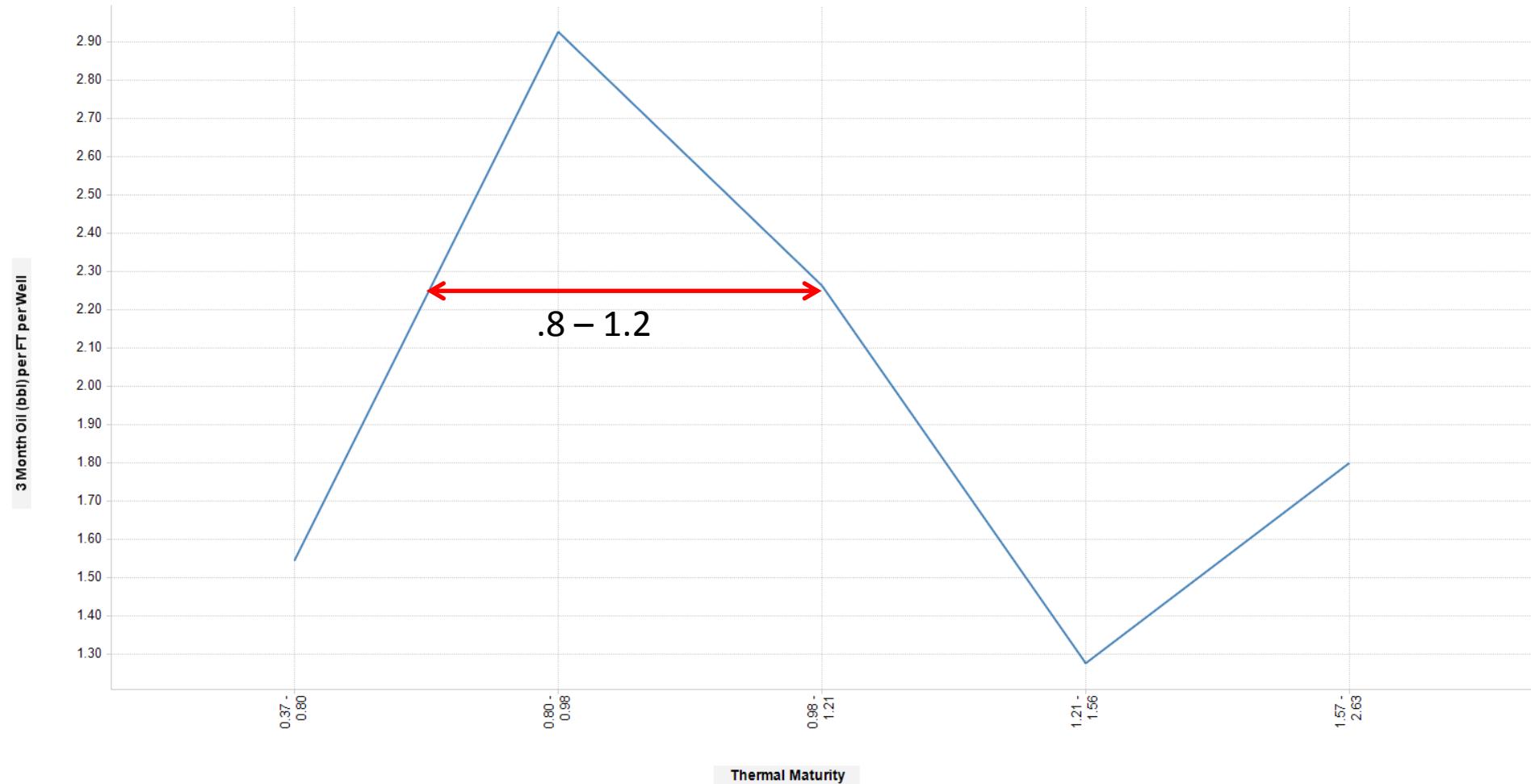
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3 Month Oil (bbl) per FT per Well vs. Thermal Maturity

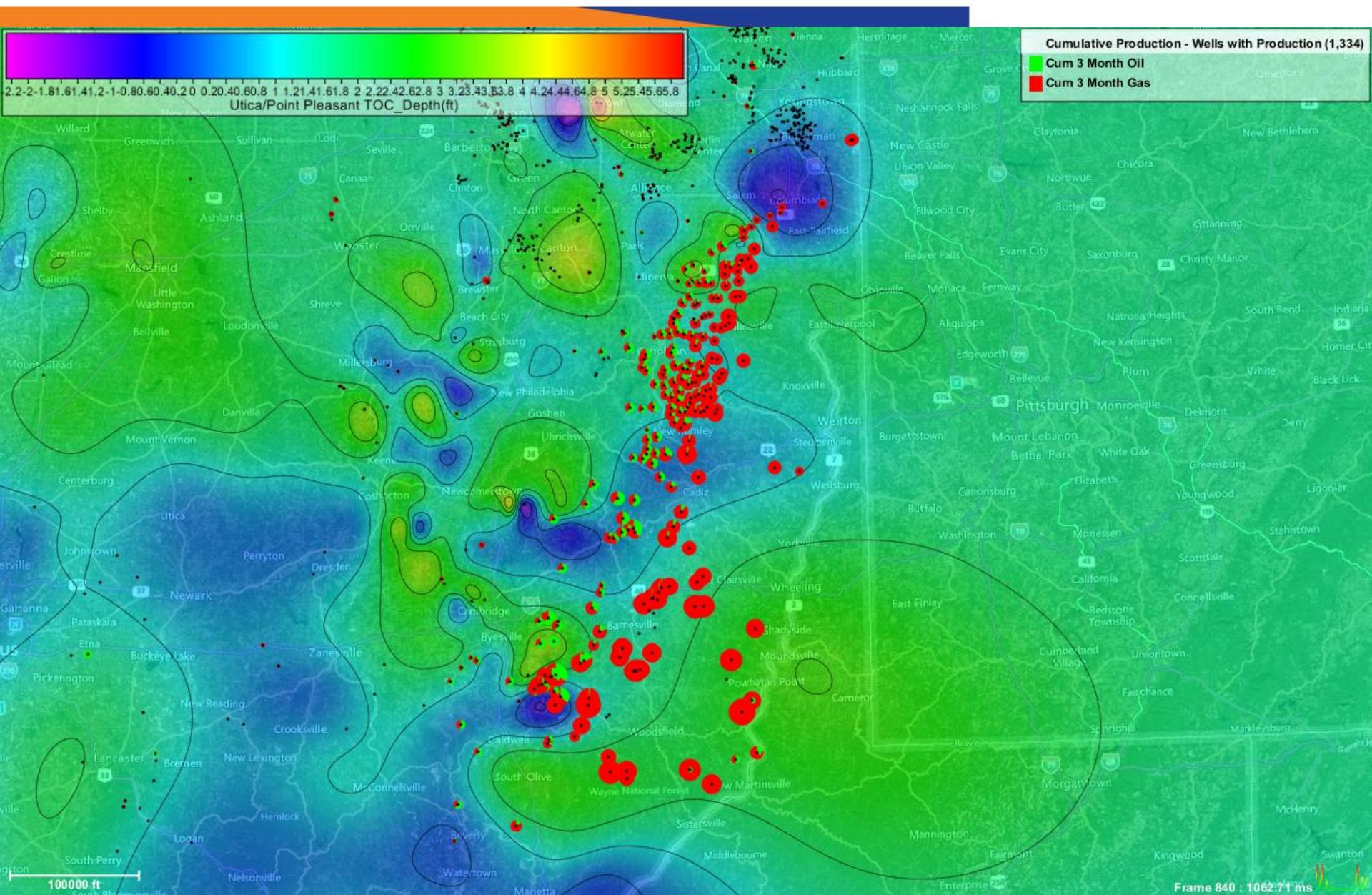


3 Month Oil/ft vs. Thermal Maturity

3 Month Oil (bbl) per FT per Well vs. Thermal Maturity

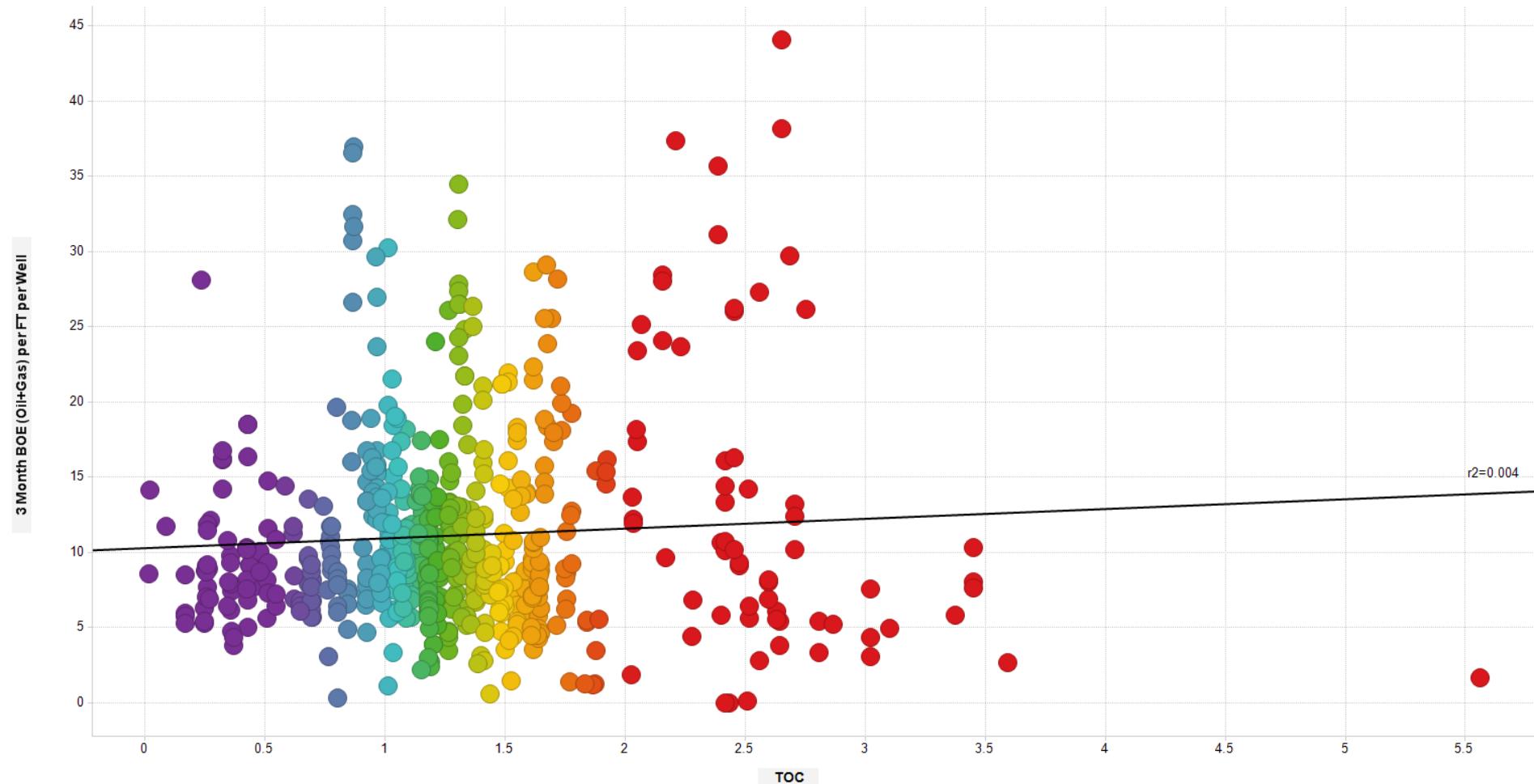


Utica/Point Pleasant Total Organic Carbon



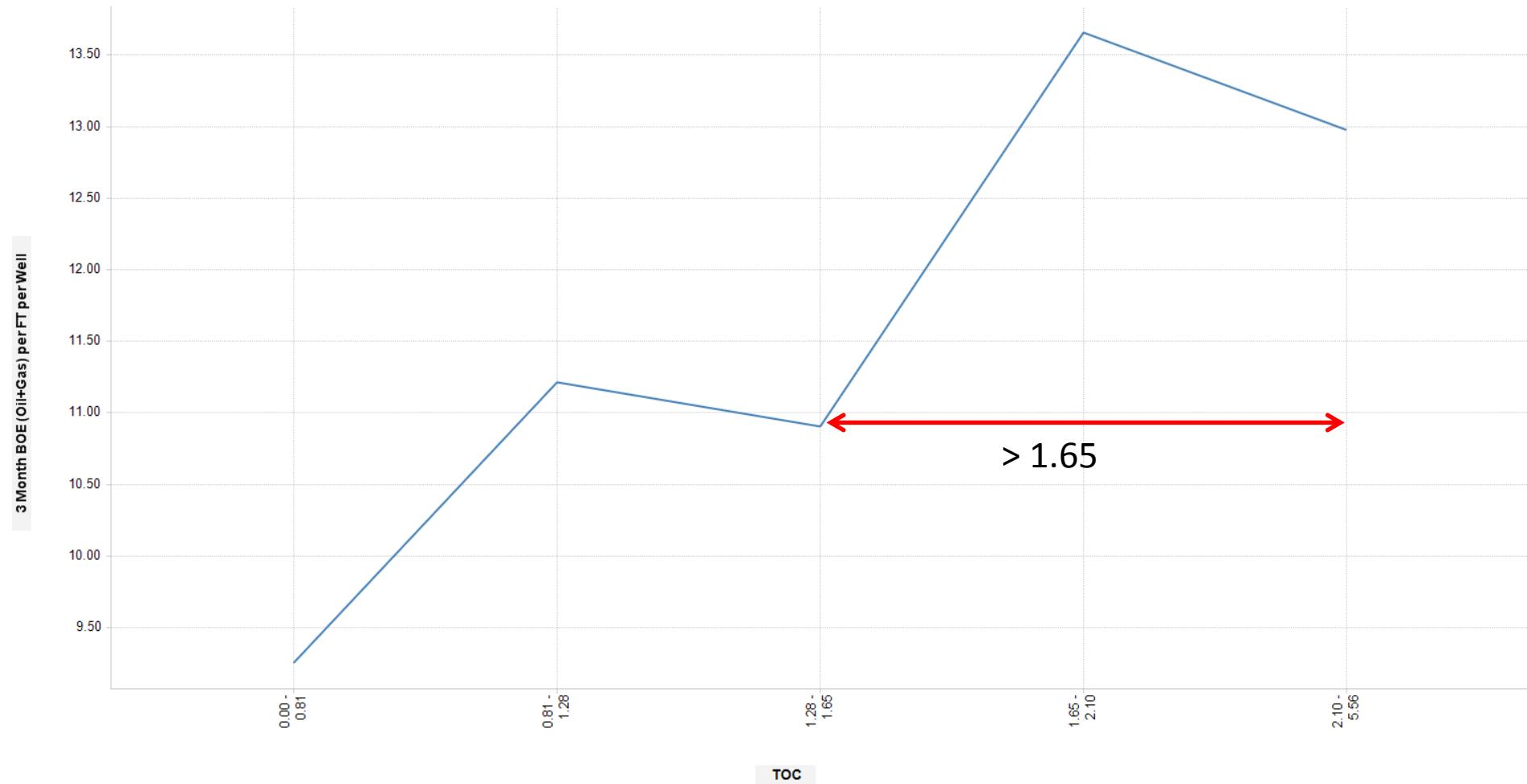
3 Month BOE/ft vs. TOC

3 Month BOE (Oil+Gas) per FT per Well vs. TOC



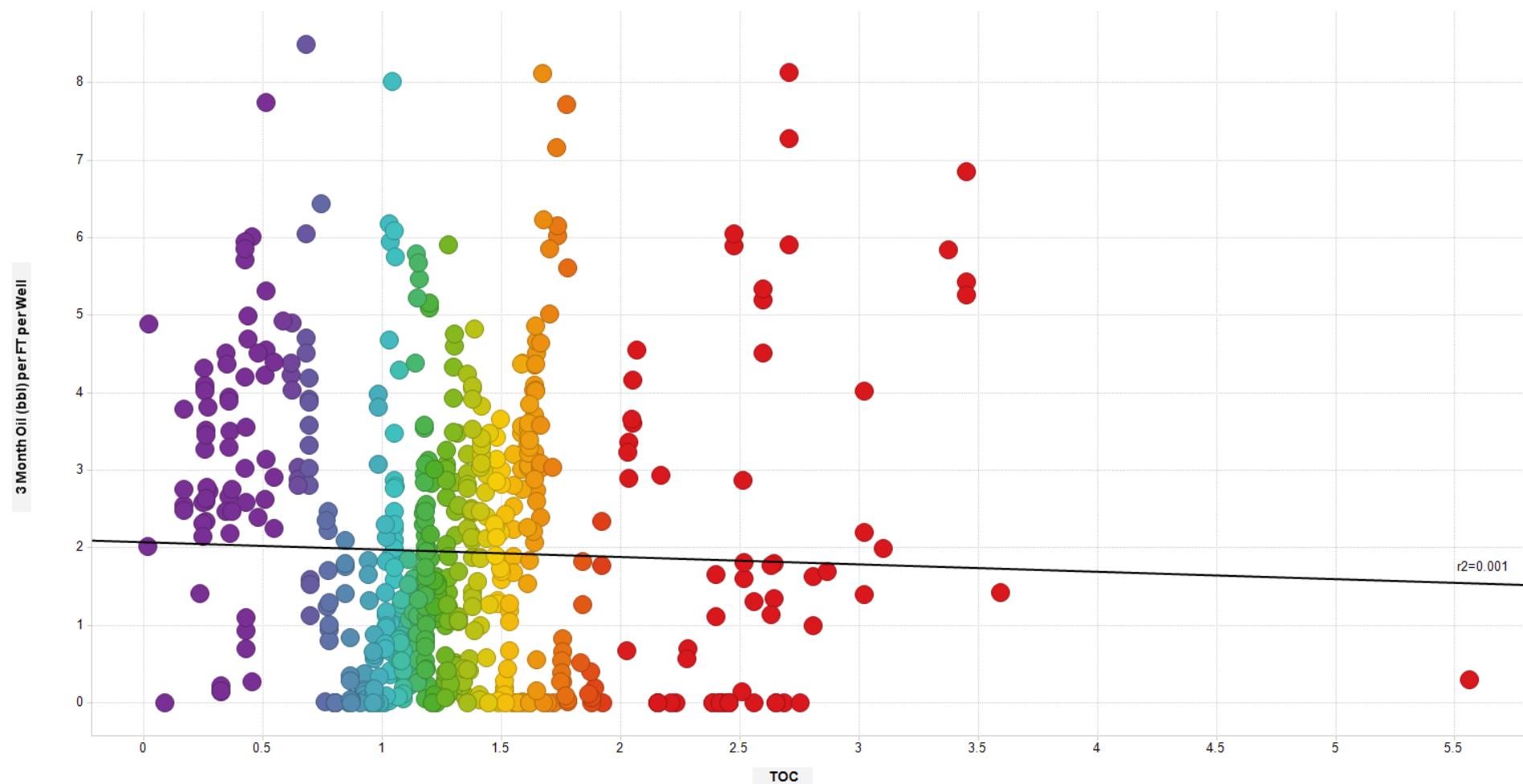
3 Month BOE/ft vs. TOC

3 Month BOE (Oil+Gas) per FT per Well vs. TOC



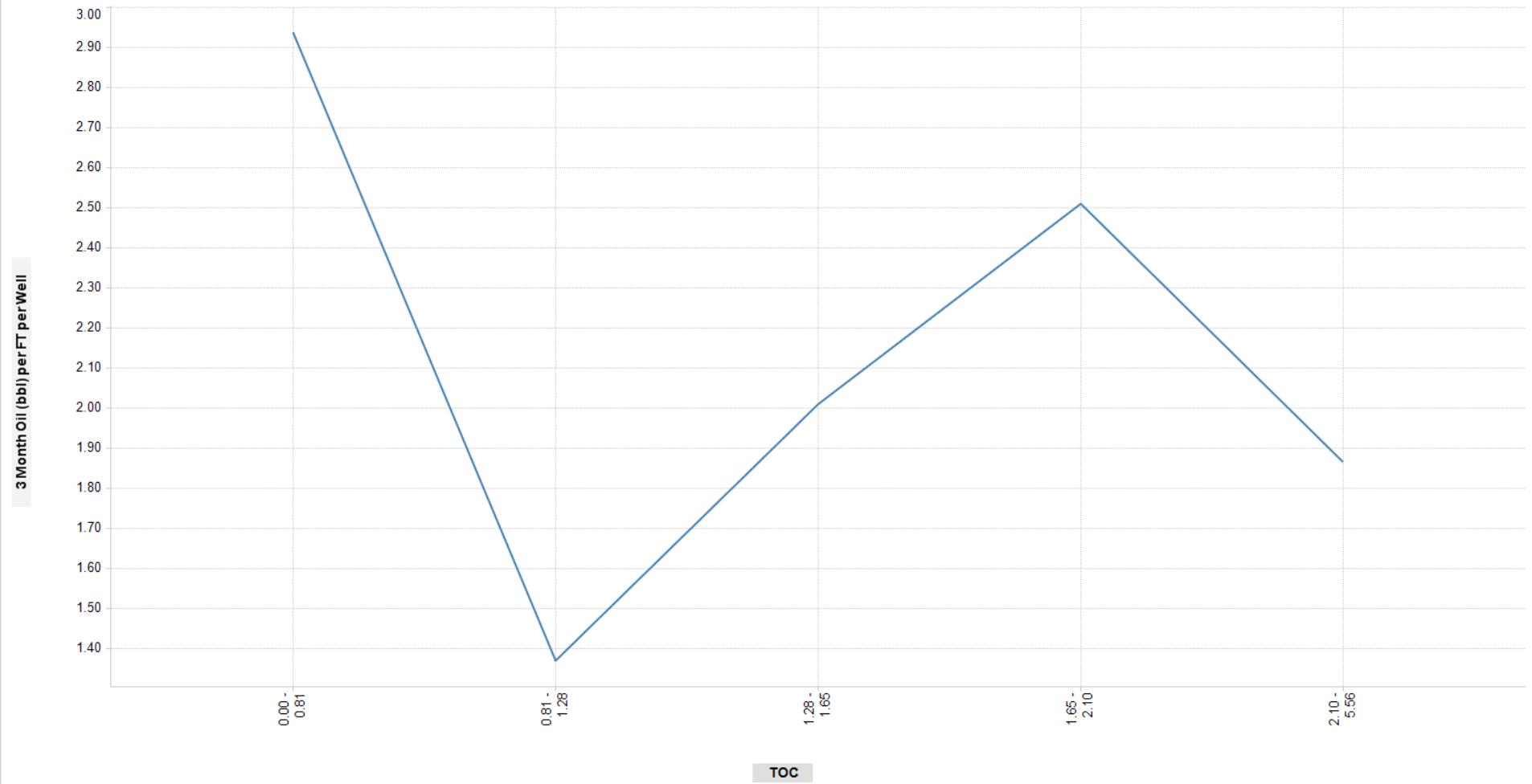
3 Month Oil/ft vs. TOC

3 Month Oil (bbl) per FT per Well vs. TOC



3 Month Oil/ft vs. TOC

3 Month Oil (bbl) per FT per Well vs. TOC



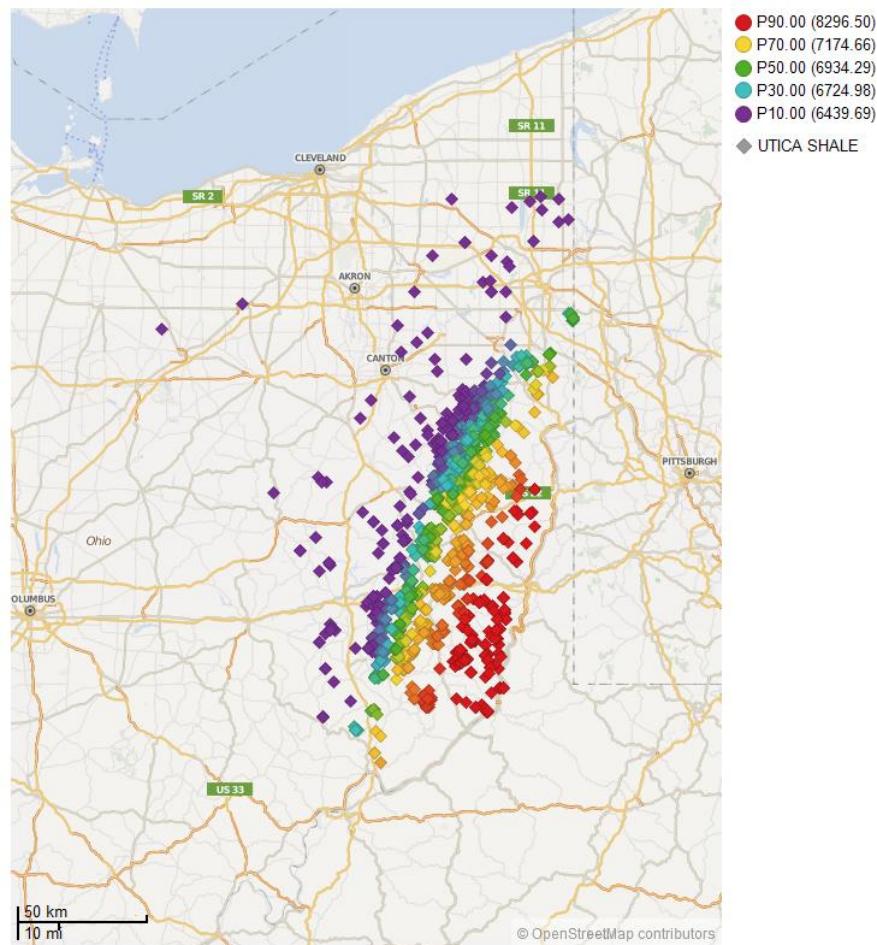
WHERE ARE THE SWEETSPOTS?



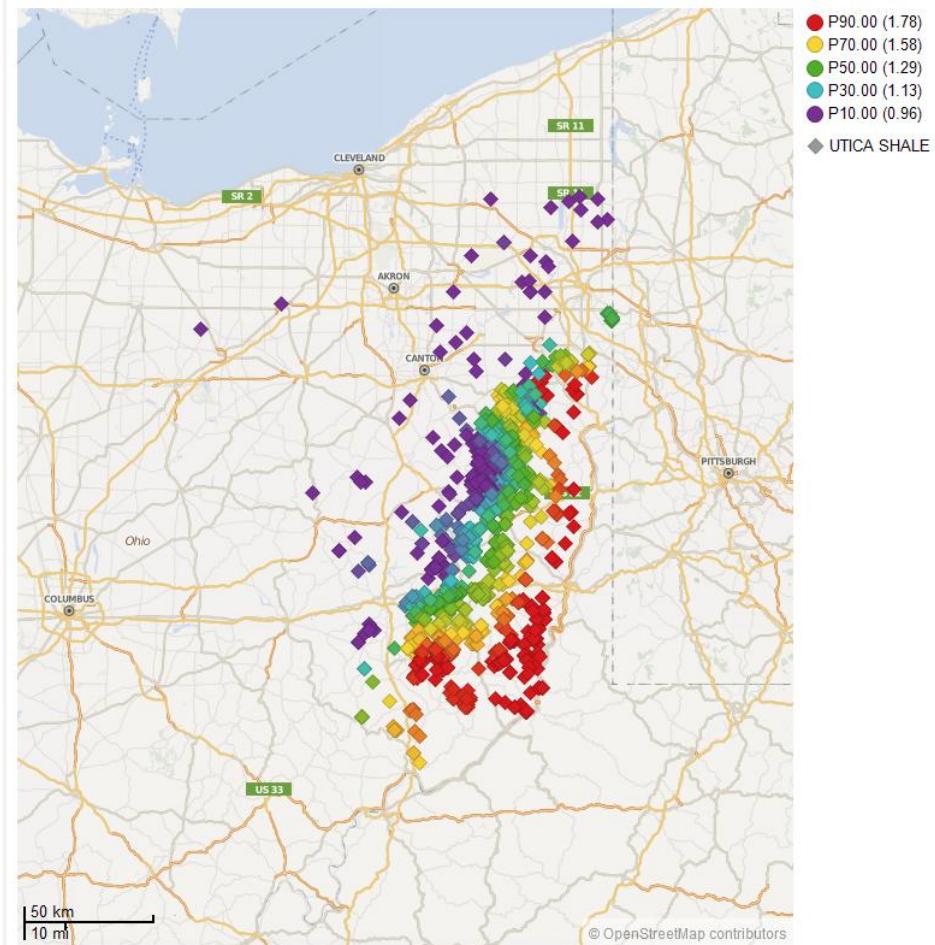
GROUND TRUTH

Trenton Depth vs. Thermal Maturity

| Trenton Depth (ft) Map

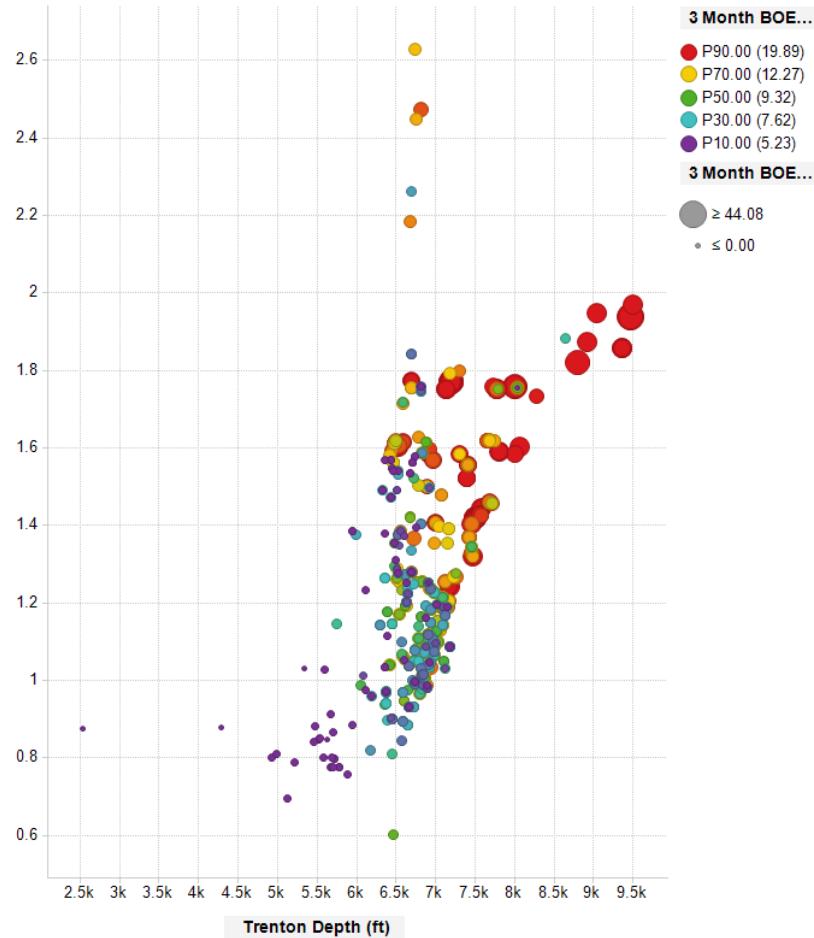


| Thermal Maturity Map

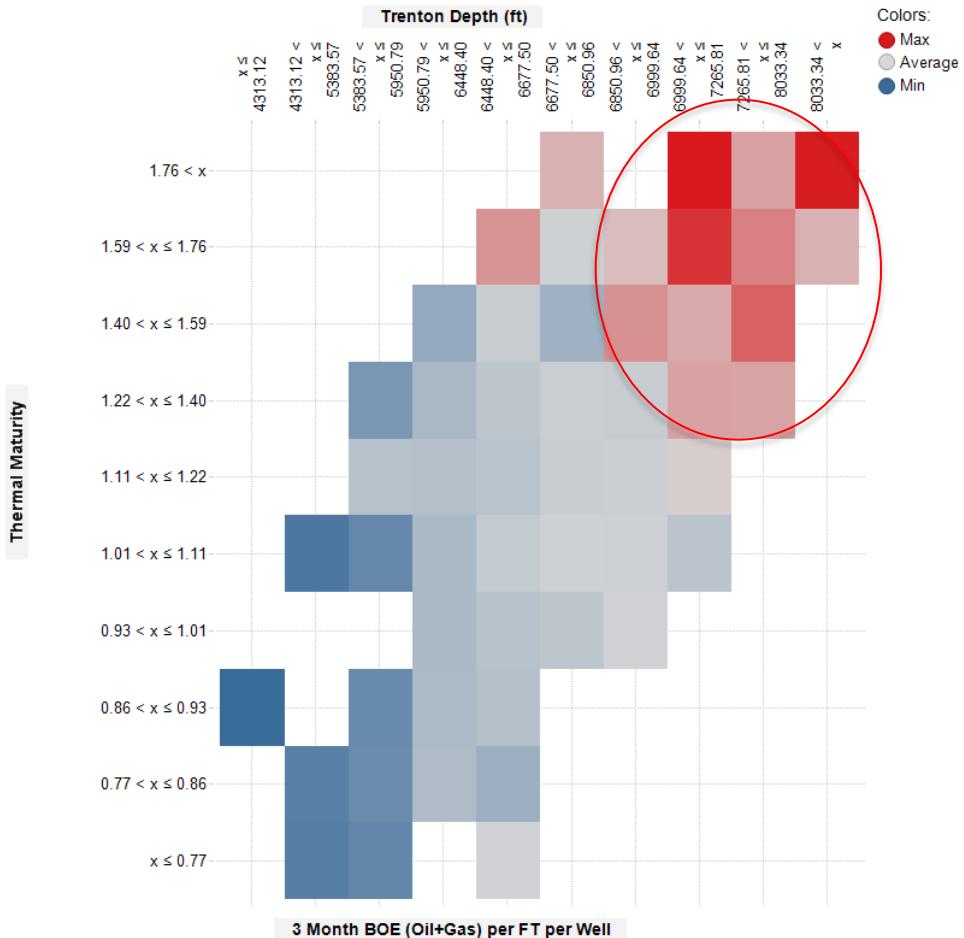


Trenton Depth vs. Thermal Maturity by BOE/ft

Thermal Maturity vs. Trenton Depth (ft)

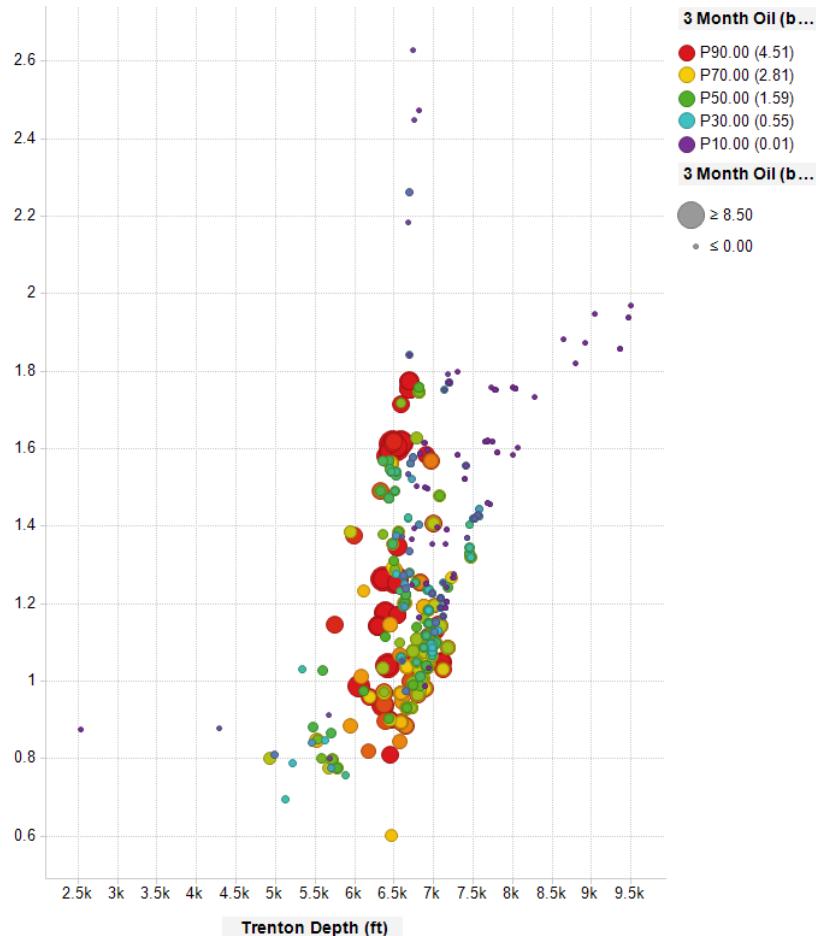


Thermal Maturity vs. Trenton Depth (ft) Heat Map

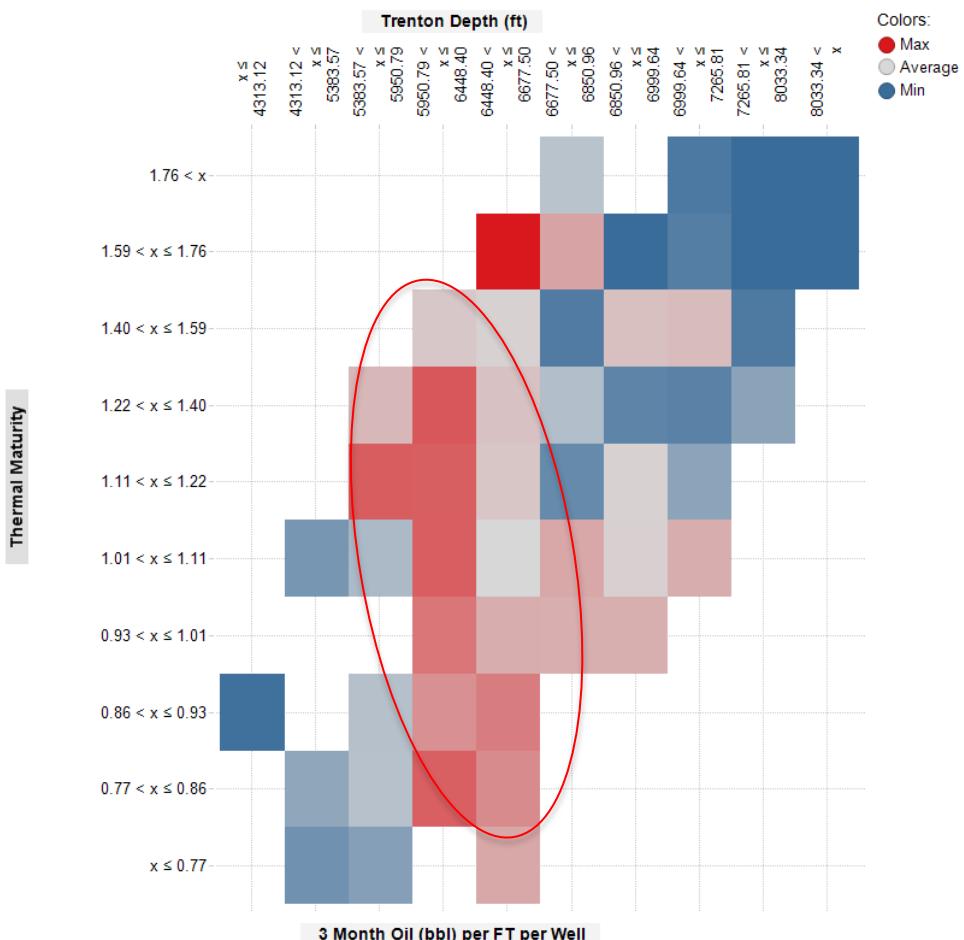


Trenton Depth vs. Thermal Maturity by Oil/ft

Thermal Maturity vs. Trenton Depth (ft)

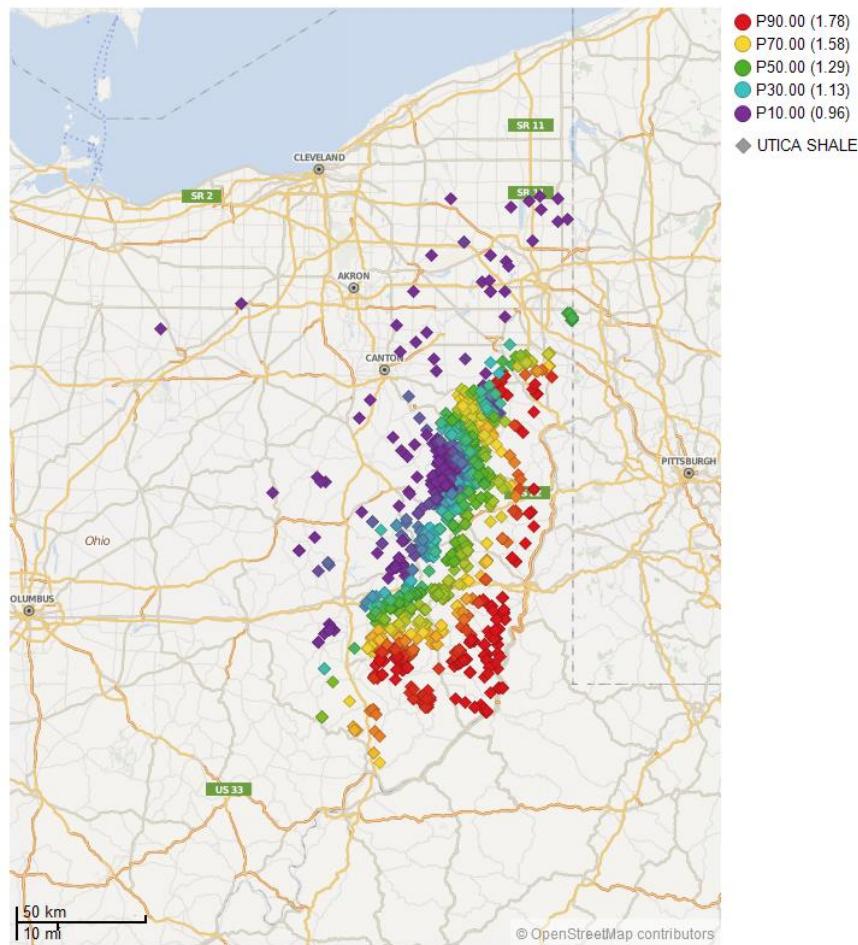


Thermal Maturity vs. Trenton Depth (ft) Heat Map

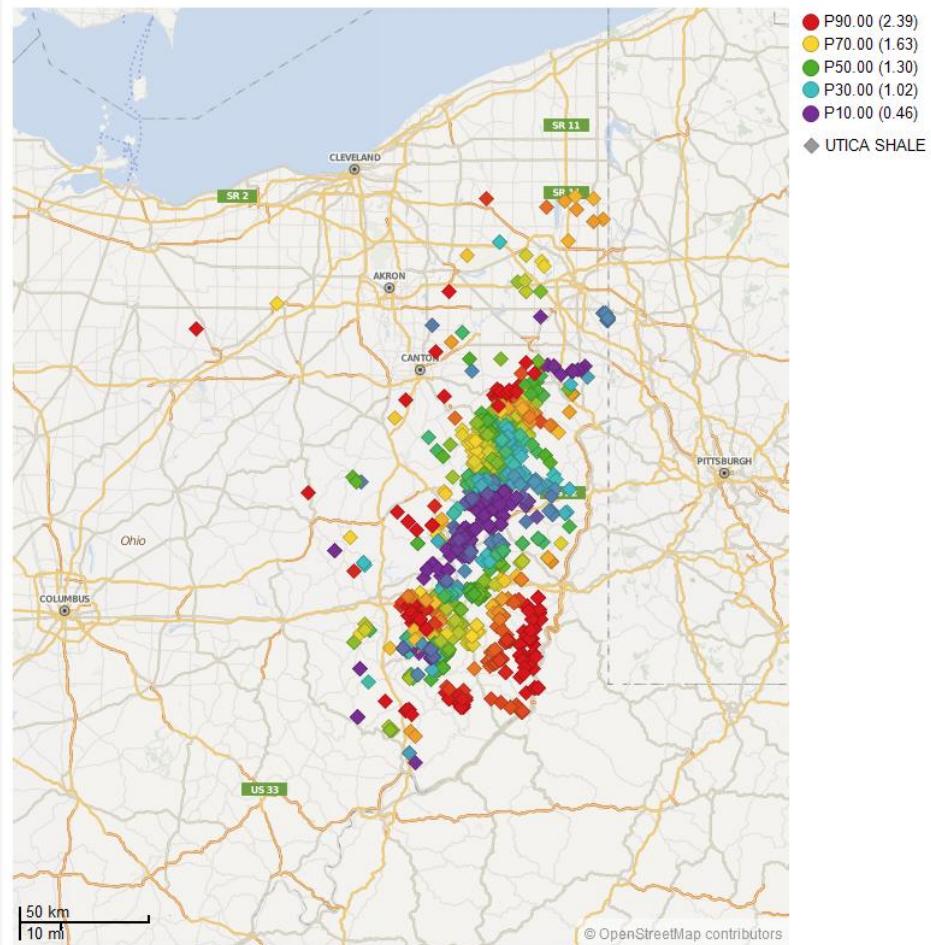


Thermal Maturity vs. TOC by 3 Month BOE/ft

Thermal Maturity Map

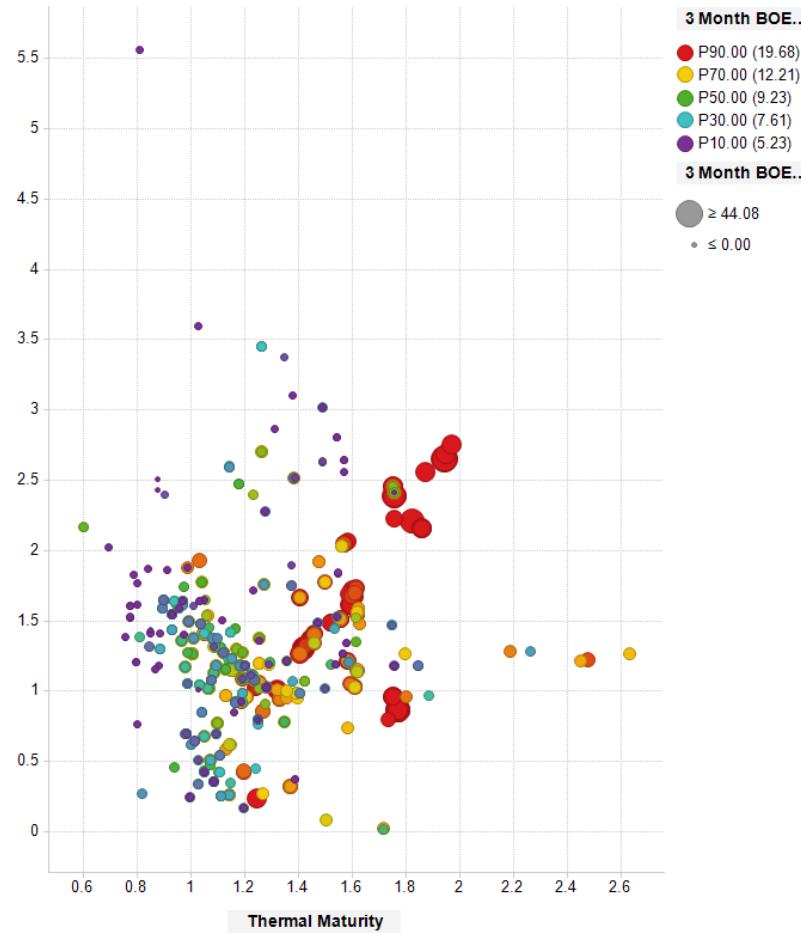


TOC Map

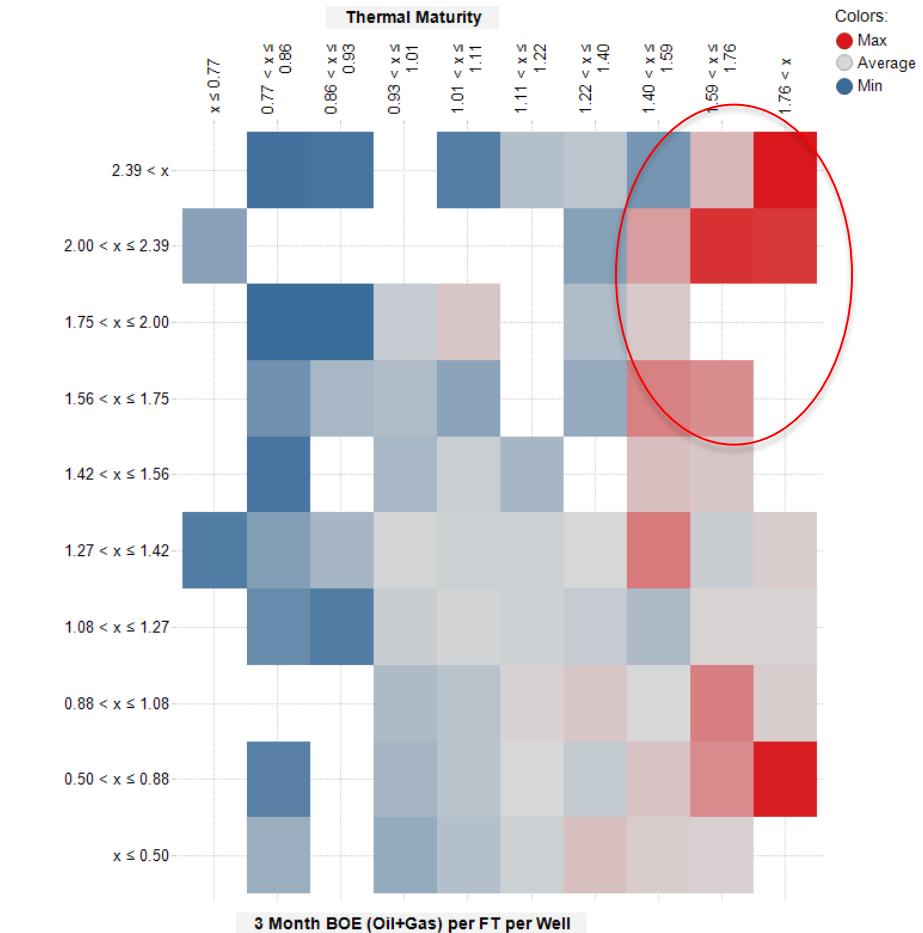


Thermal Maturity vs. TOC by 3 Month BOE/ft

I TOC vs. Thermal Maturity

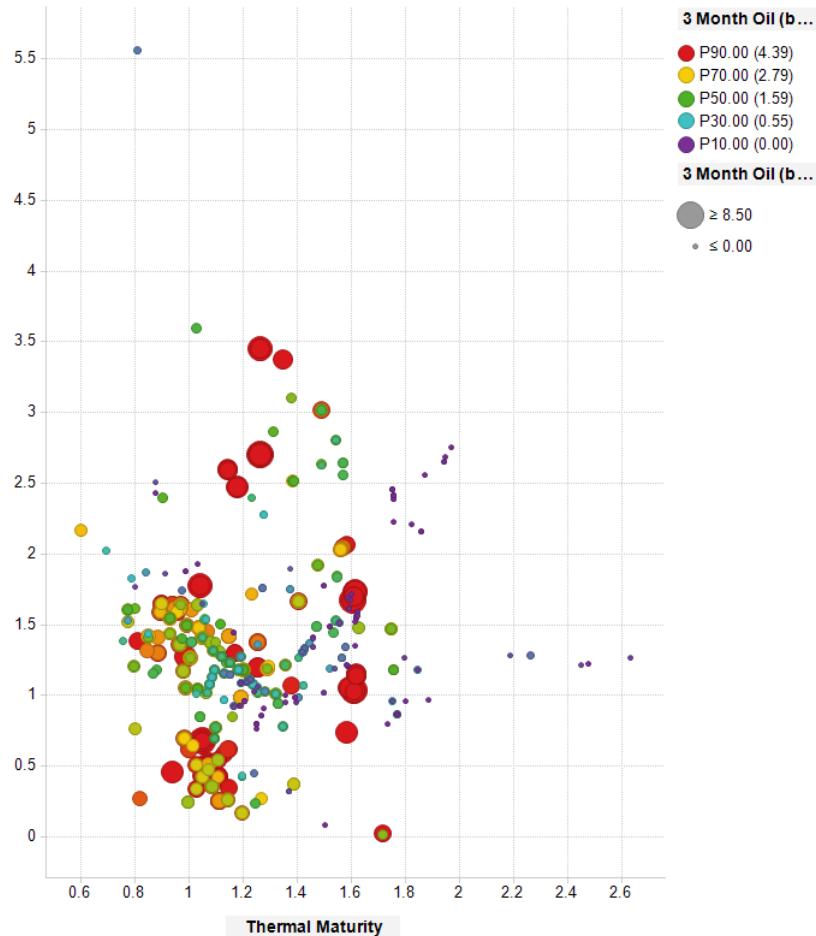


I TOC vs. Thermal Maturity Heat Map

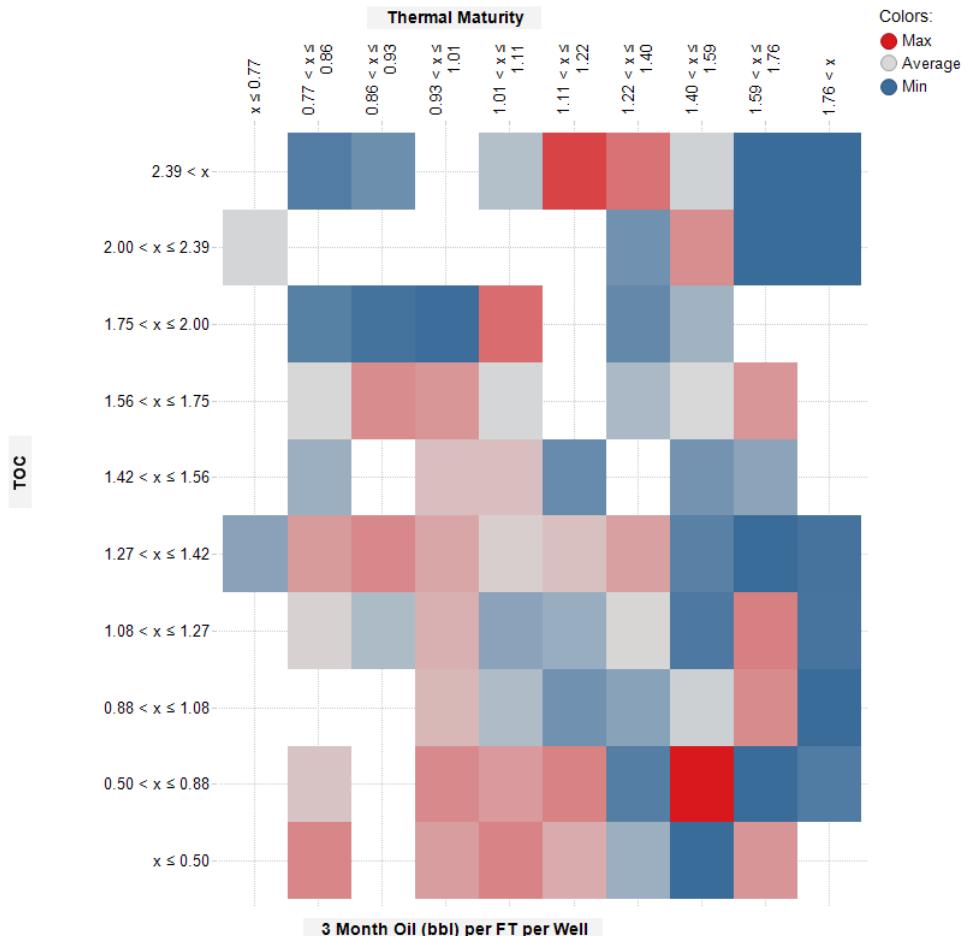


Thermal Maturity vs. TOC by 3 Month Oil/ft

TOC vs. Thermal Maturity

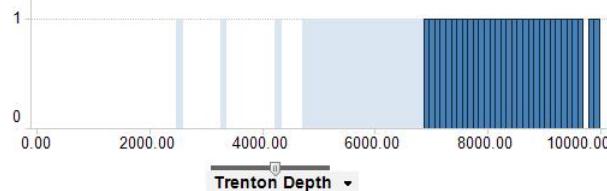


TOC vs. Thermal Maturity Heat Map

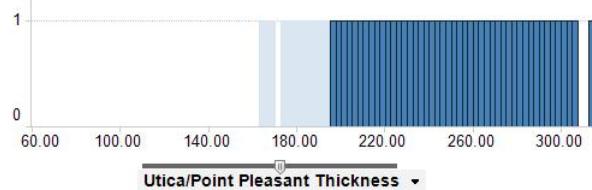


Point Pleasant BOE Sweetspot

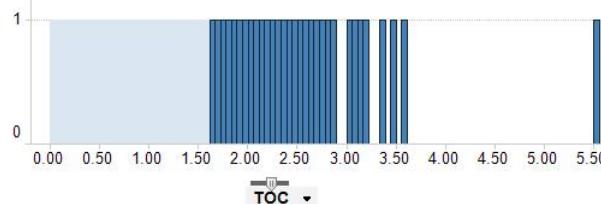
Trenton Depth



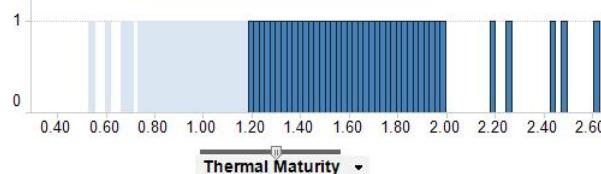
Utica/Point Pleasant Thickness



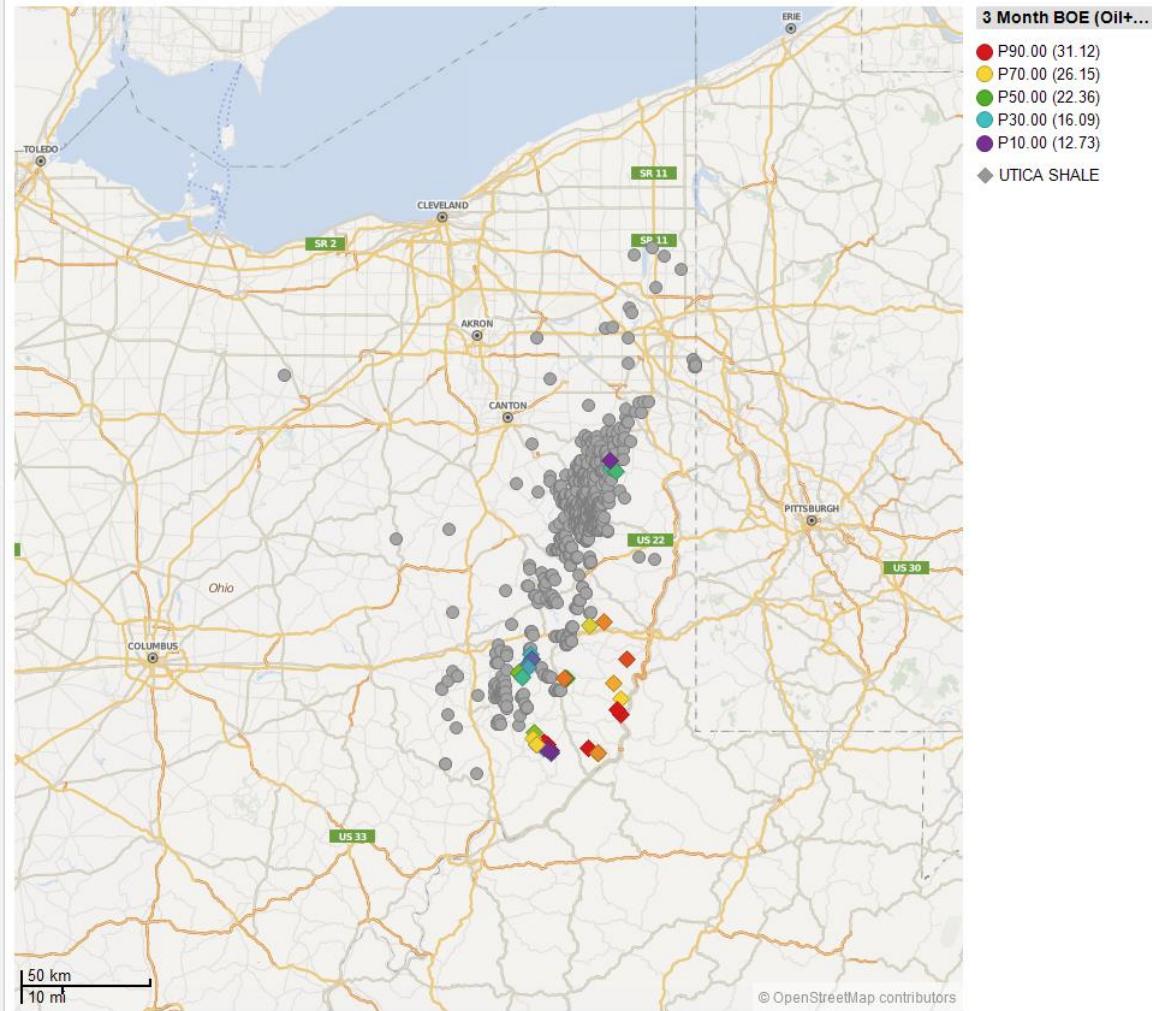
TOC



Thermal Maturity

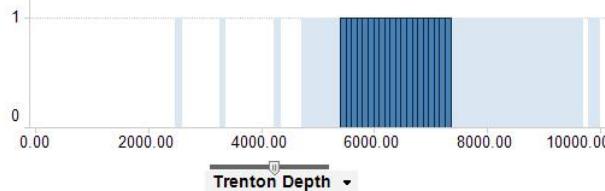


Sweetspot Map

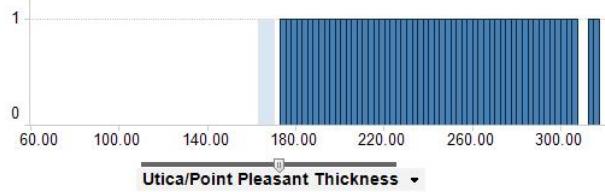


Point Pleasant Oil Sweetspot

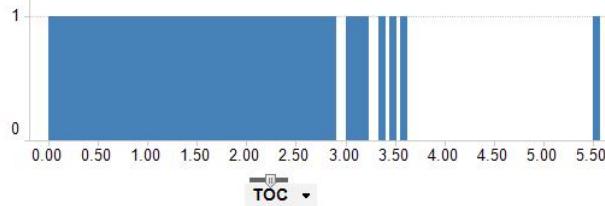
Trenton Depth



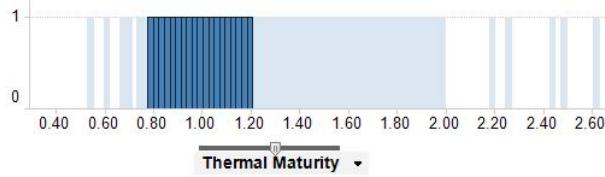
Utica/Point Pleasant Thickness



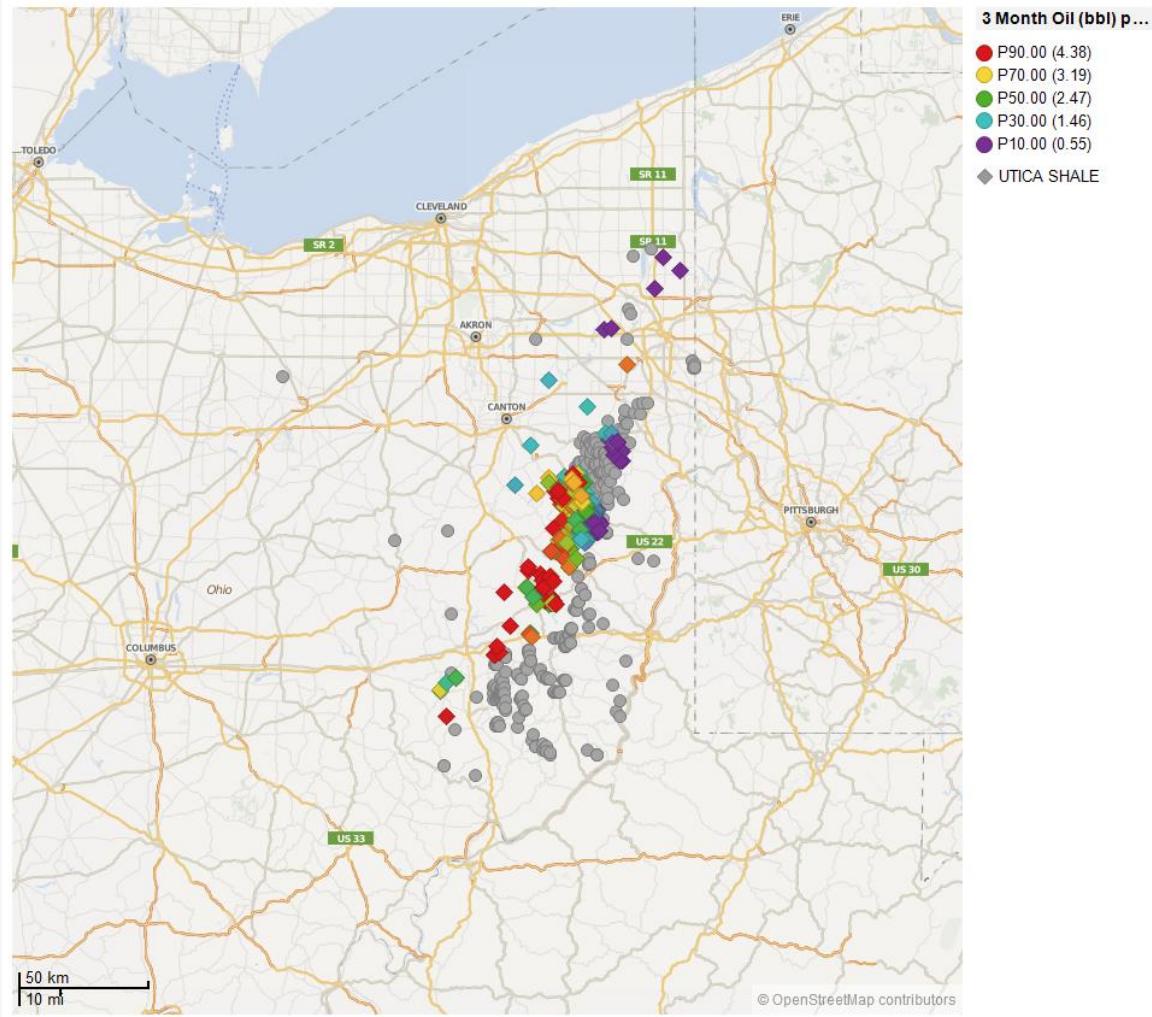
TOC



Thermal Maturity



Sweetspot Map



RIGHT SIZING ENGINEERING FOR GEOLOGY

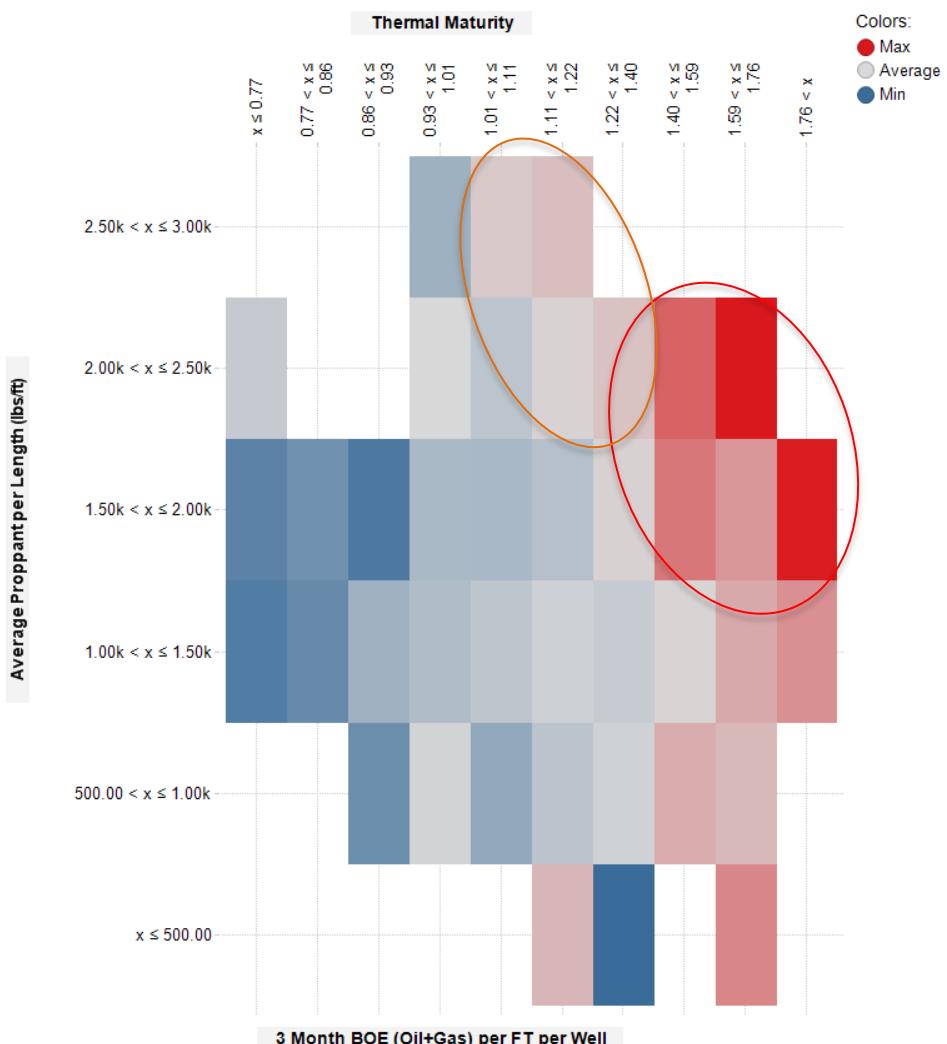
GROUND TRUTH

Proppant/Length vs. Thermal Maturity by 3 Month BOE/ft

Average Proppant per Length (lbs/ft) vs. Thermal Maturity

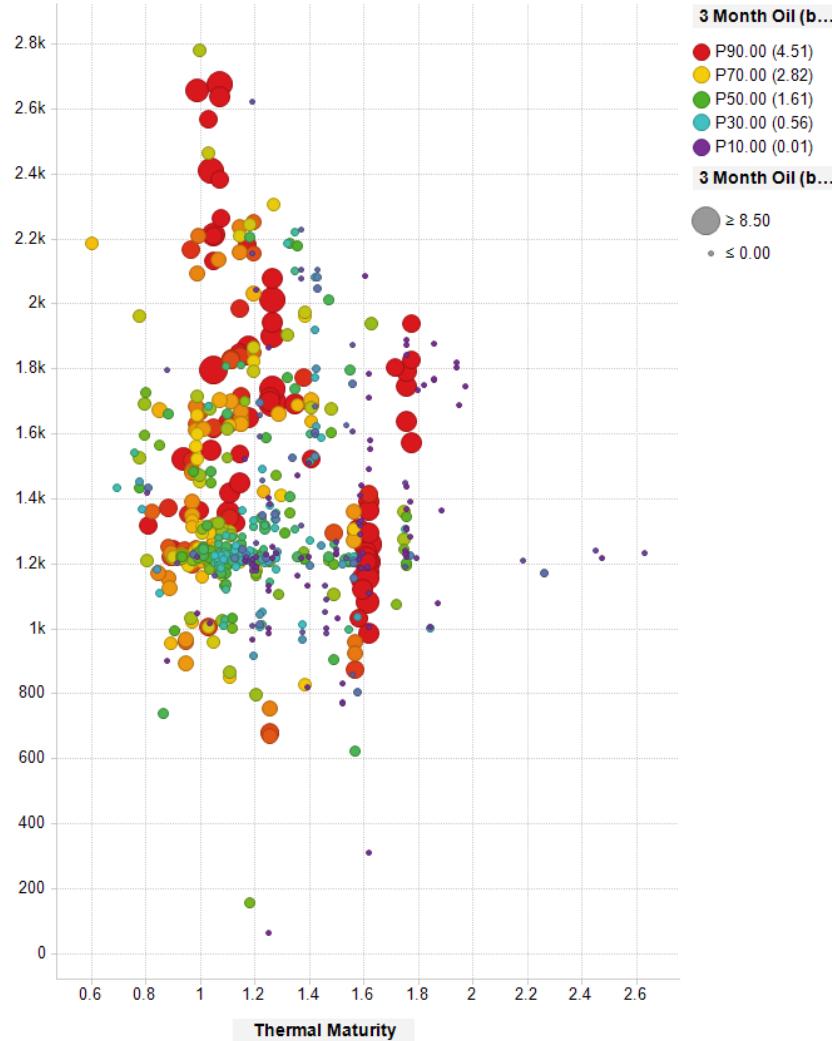


Average Proppant per Length (lbs/ft) vs. Thermal Maturity He...

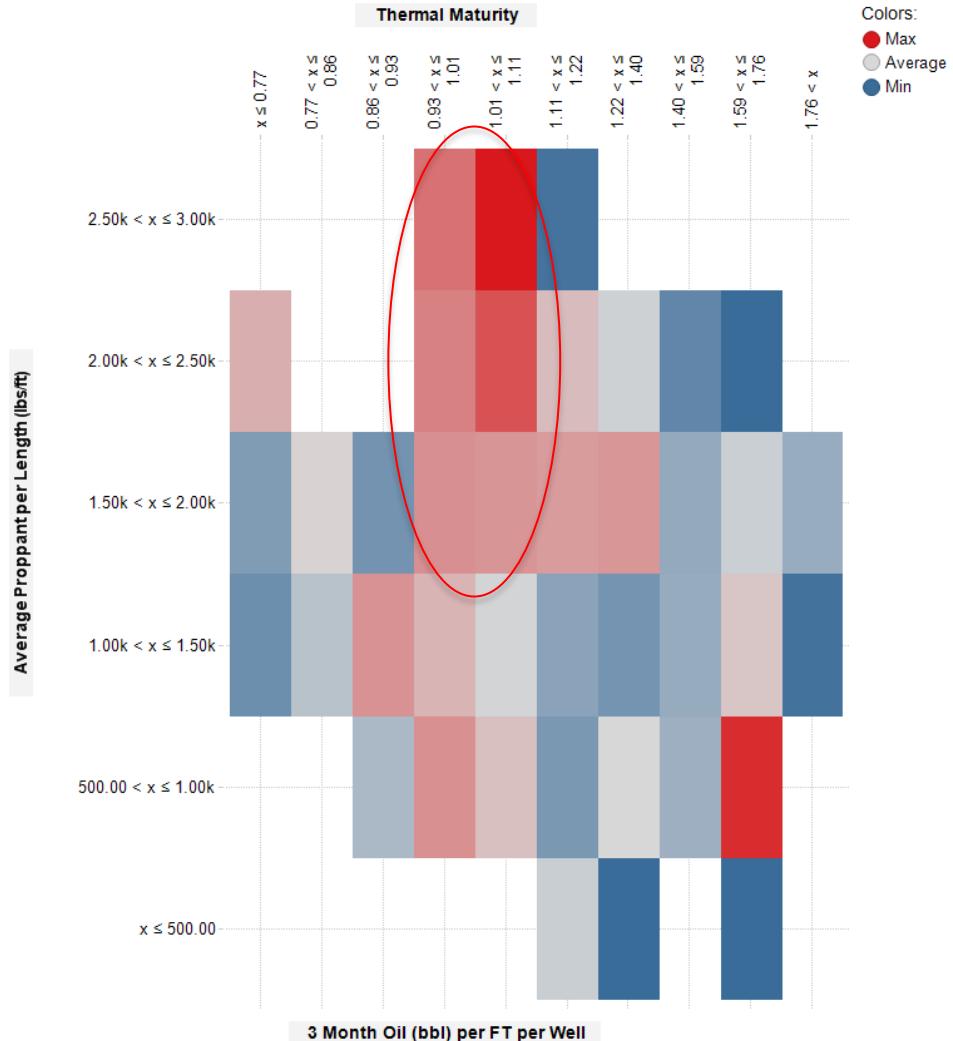


Proppant/Length vs. Thermal Maturity by 3 Month Oil/ft

Average Proppant per Length (lbs/ft) vs. Thermal Maturity



Average Proppant per Length (lbs/ft) vs. Thermal Maturity He...

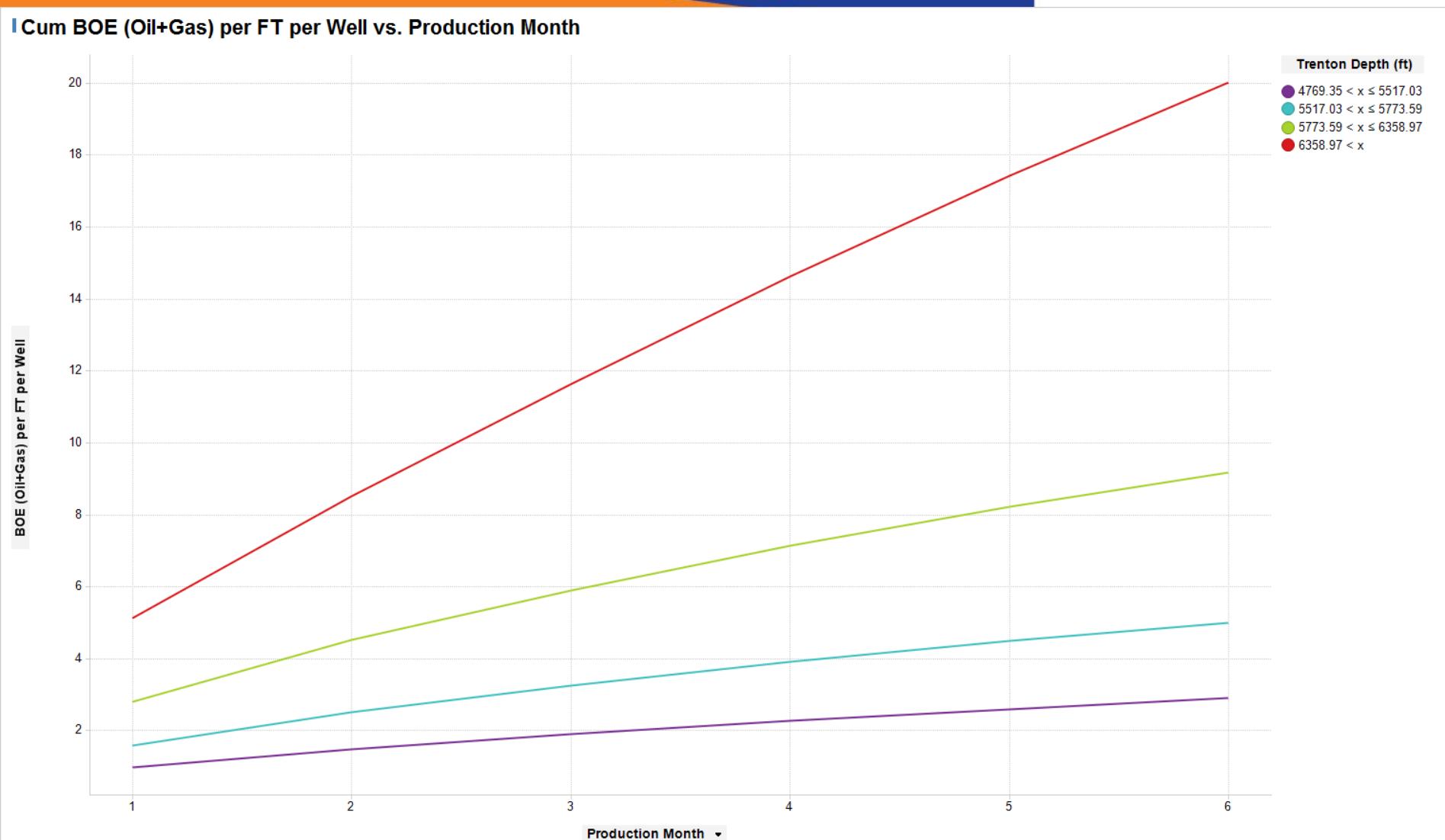


IN THE END – WHAT DIFFERENCE DOES GEOLOGY MAKE?



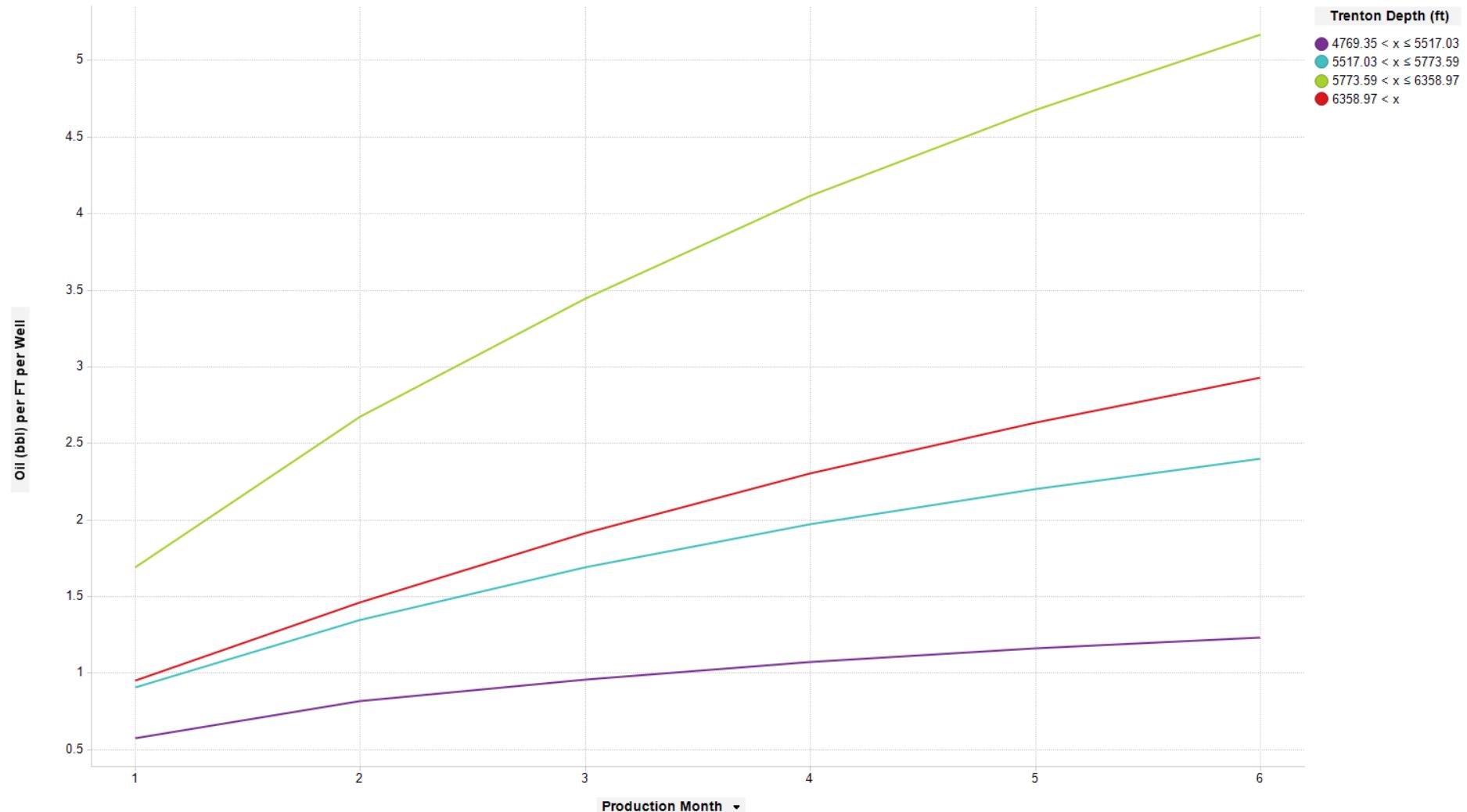
GROUND TRUTH

BOE/ft Cumulative Production Curve by Trenton Depth

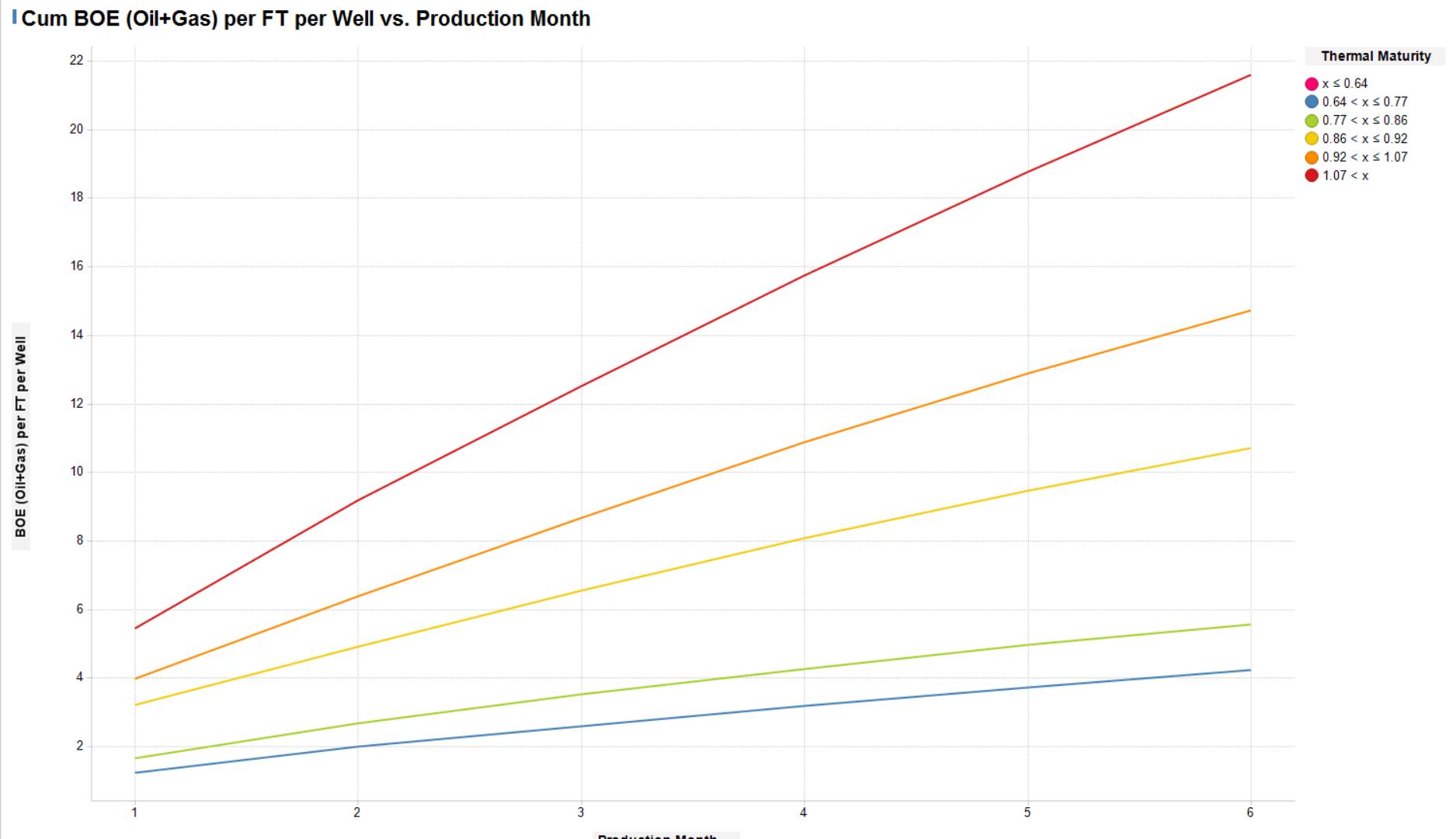


Oil/ft Cumulative Production Curve by Trenton Depth

Cum Oil (bbl) per FT per Well vs. Production Month

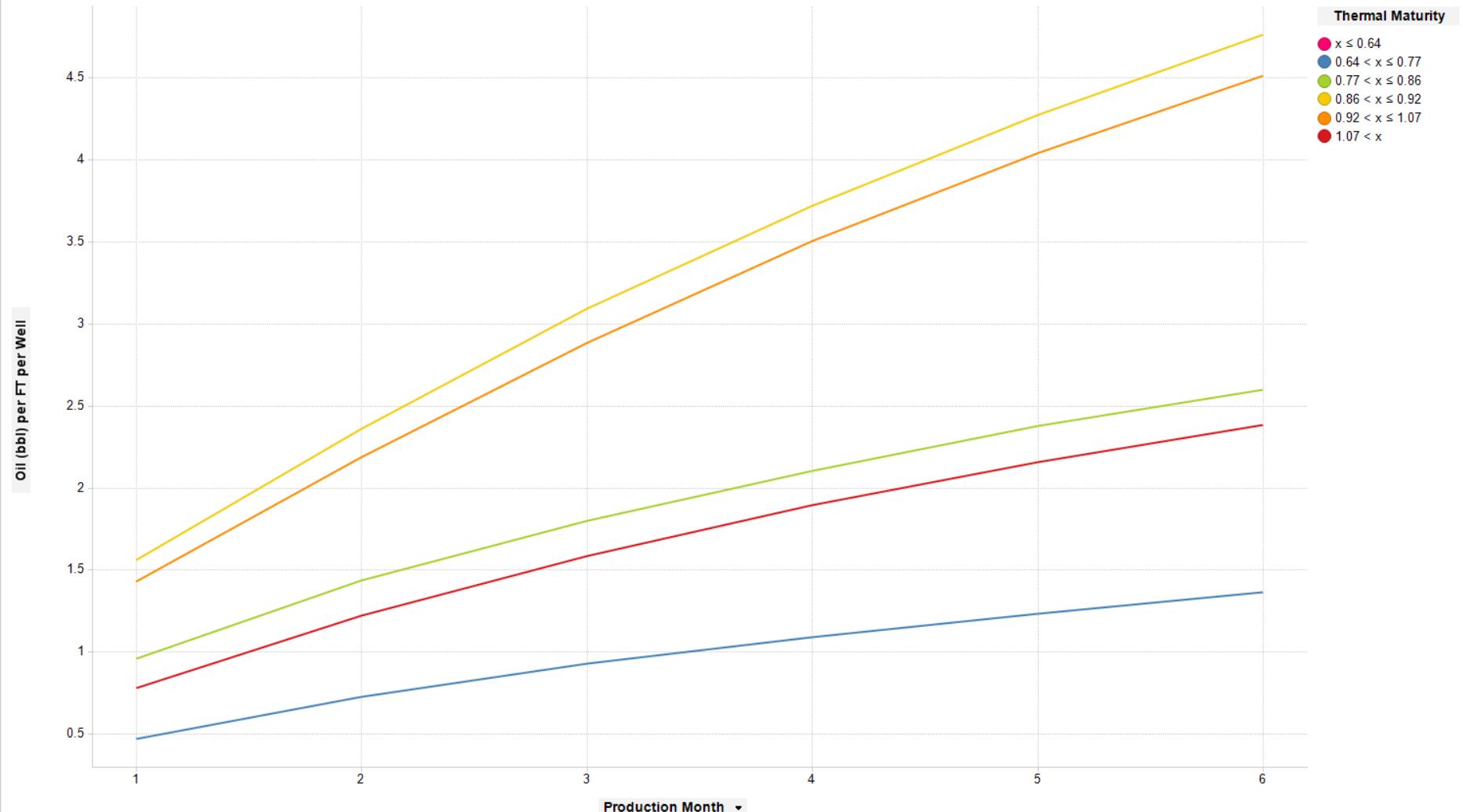


BOE/ft Cumulative Production Curve by Thermal Maturity



Oil/ft Cumulative Production Curve by Thermal Maturity

Cum Oil (bbl) per FT per Well vs. Production Month



Conclusions



- BOE Sweetspot defined by:
 - Trenton Depth (>7,000')
 - Utica/Point Pleasant Thickness (>190')
 - Thermal Maturity (>1.2)
 - TOC (>1.5)
- Oil Sweetspot defined by:
 - Trenton Depth (5,400'-7,000')
 - Thermal Maturity (.8-1.2)
- Inside the sweetspots, wells with > 1,500lbs of proppant/ft have the best performance
- Outside the sweetspots, heavier engineering (> 2,000lbs/ft) may be required for optimal performance
- Geology can drive a 3-fold increase in well performance
- Optimizing engineering can provide an additional 2-fold increase in production