Use of a GIS for a County-level Refinement of a Regional Water Management Model

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Presentation Outline

- Current management method for GW allocations in SE PA and the uses of GIS
- Display a developing concern for water availability in part of Bucks County using GIS
- Display GIS use to determine equation coefficients for computing mean annual base flow from potential critical areas
- An application using revised baseflow from diabase areas using GIS tool
- Locating a new beneficial streamflow monitoring location using GIS

FOR MORE INFO...

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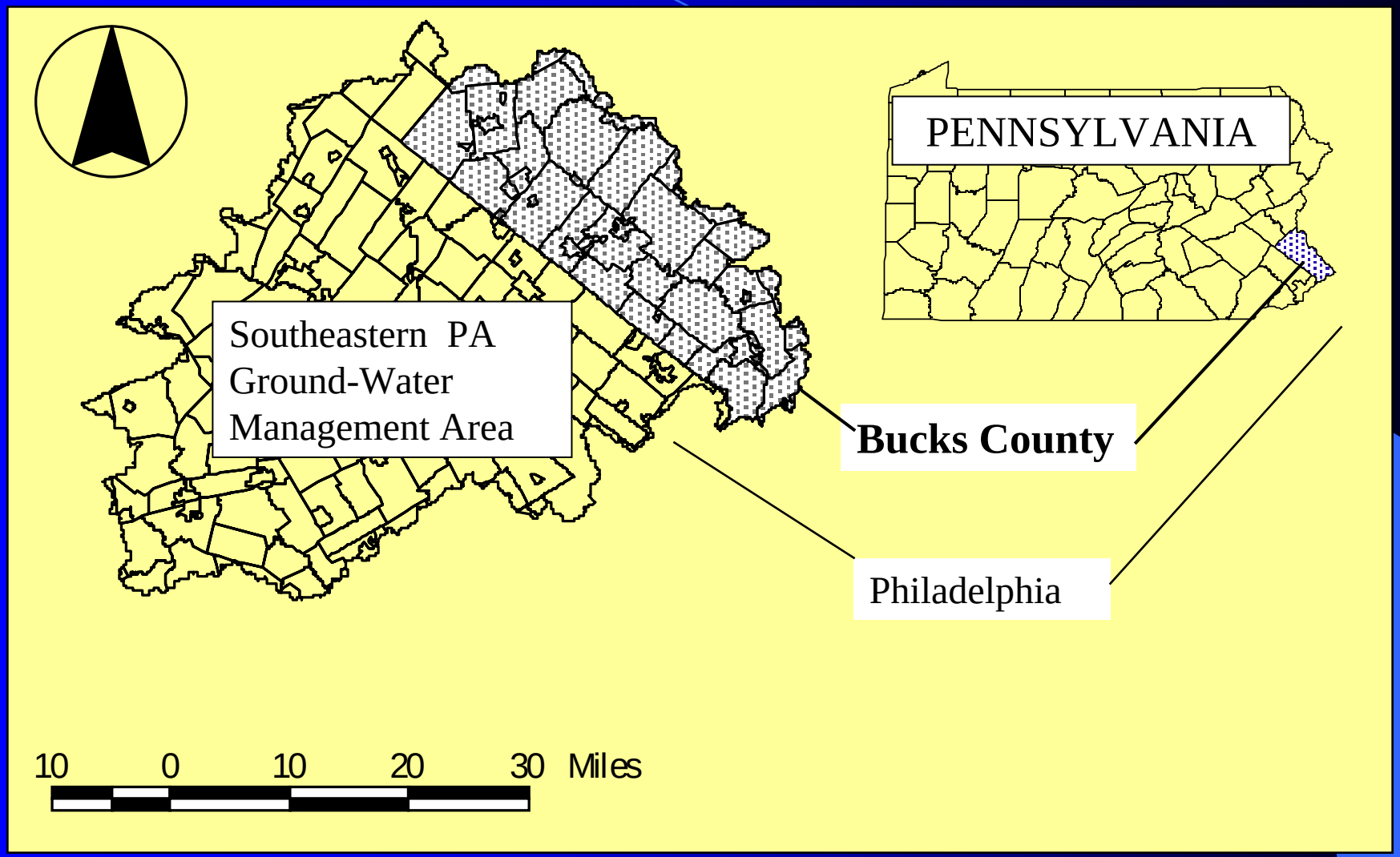
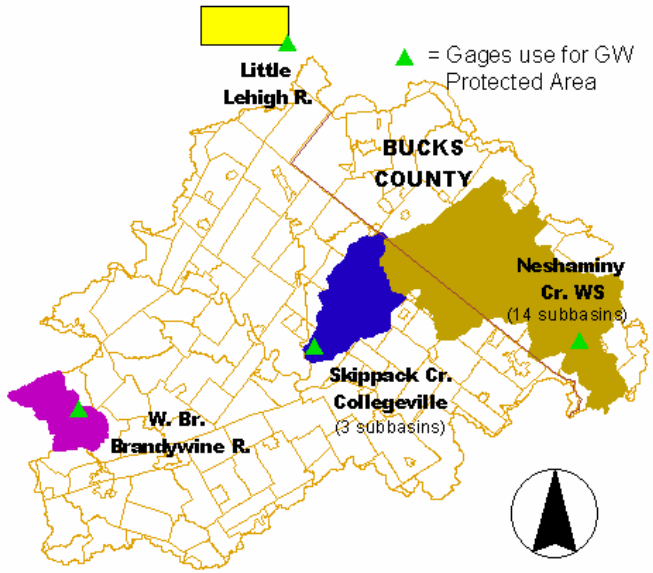
Bucks County Location within 1) SE PA Ground-water Management Area, and 2) Pennsylvania



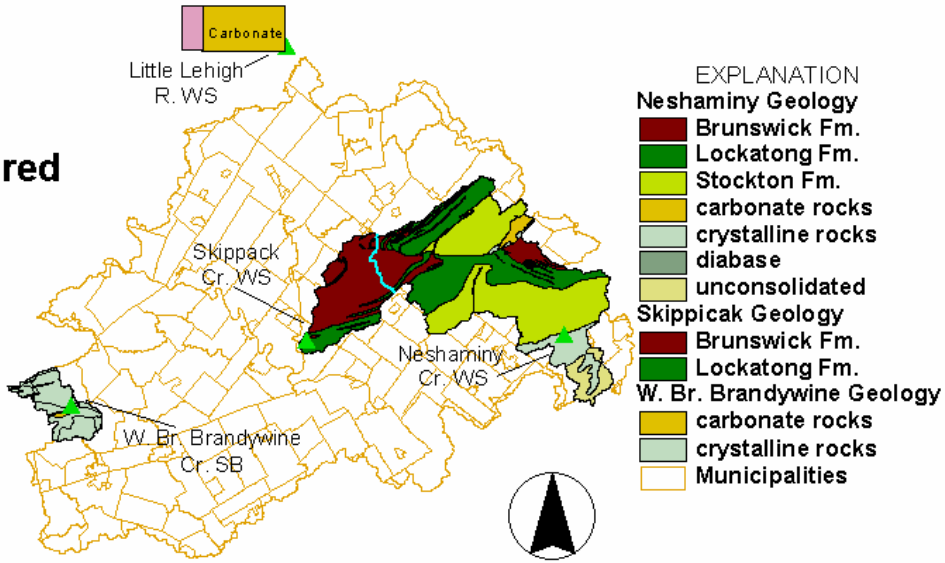
Current management method for GW allocations in SE PA and the uses of GIS

Select Monitored Watersheds

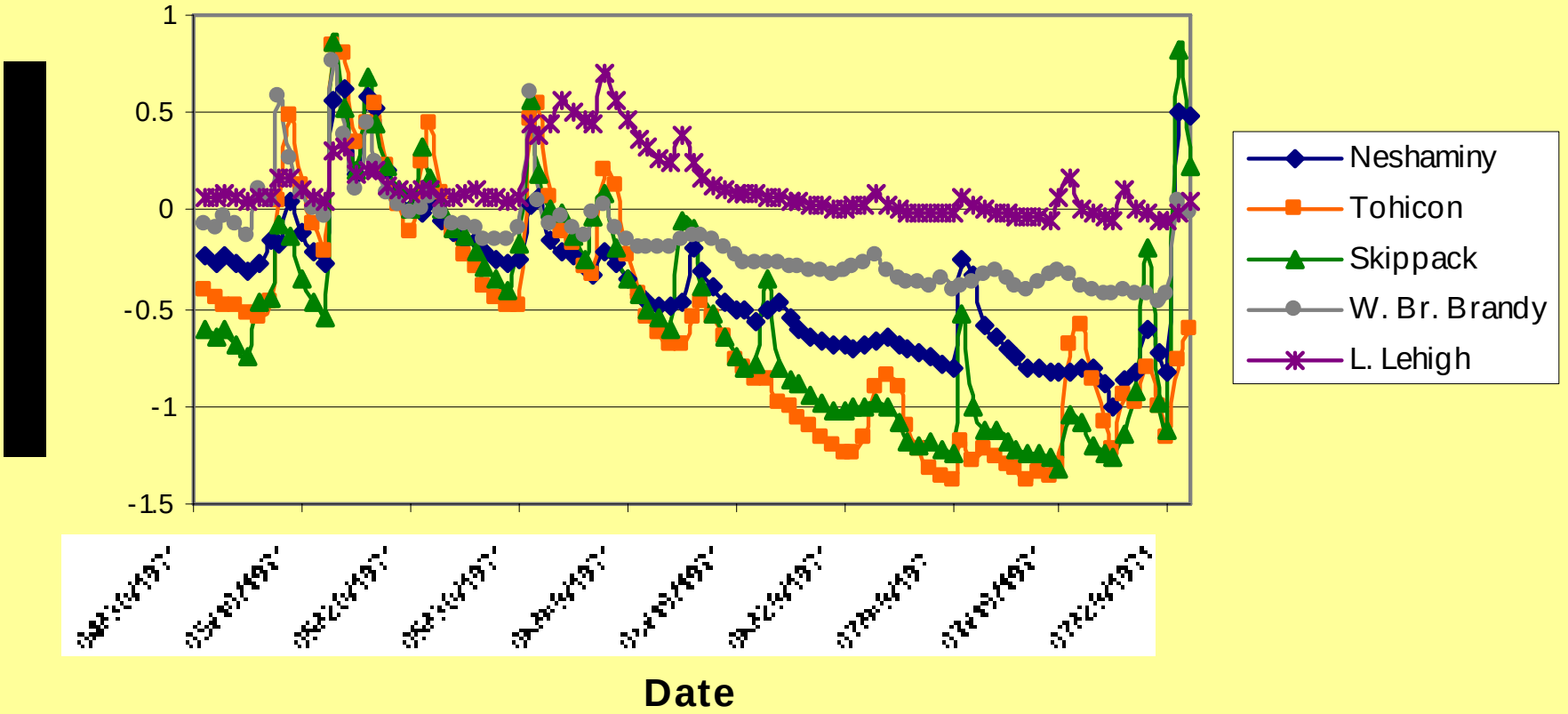
EXPLANATION
- Neshaminy WS
- Skippack Cr. WS
- W. Br. Brandywine R. SB
- Municipalities



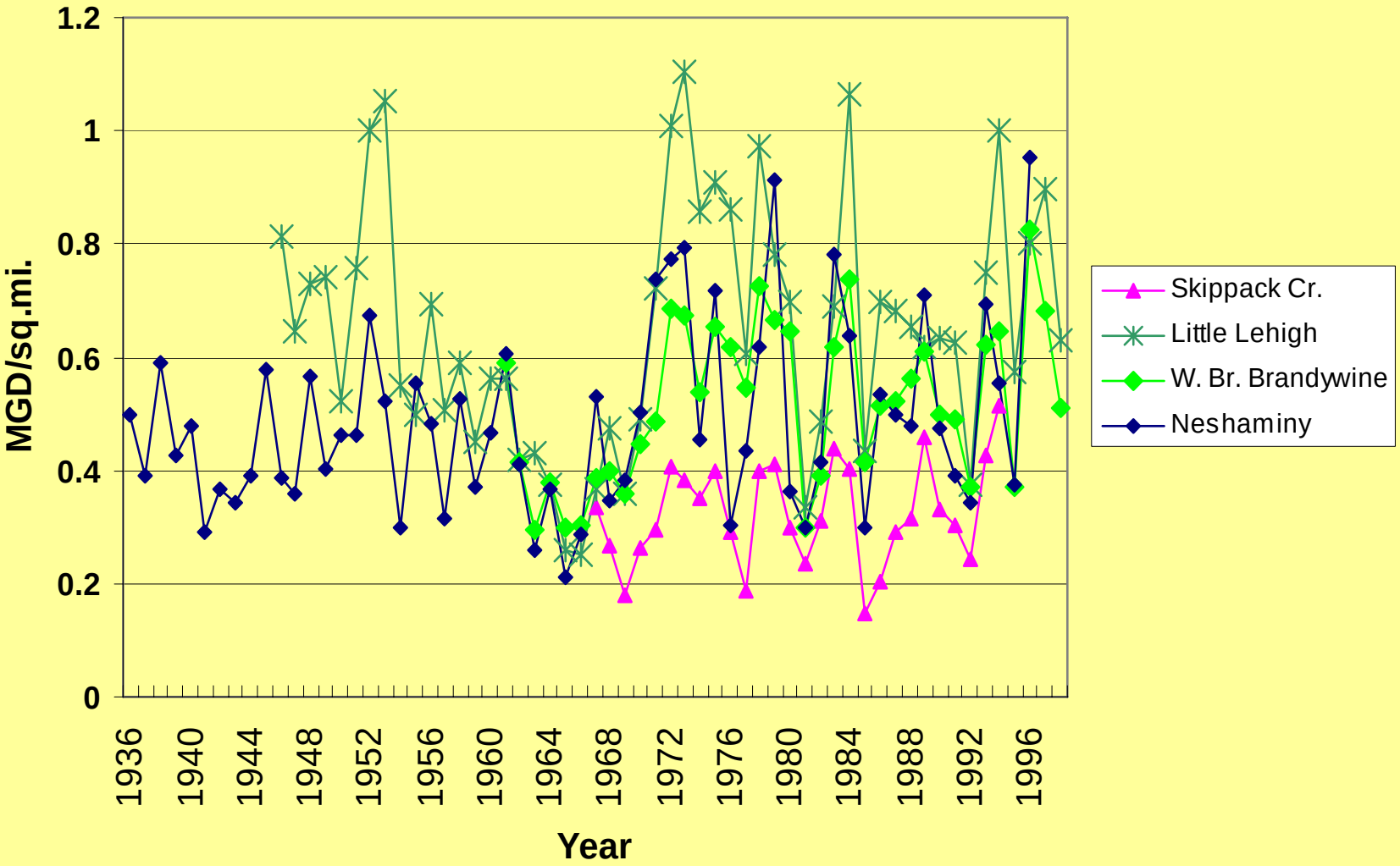
Subcrops in monitored watersheds



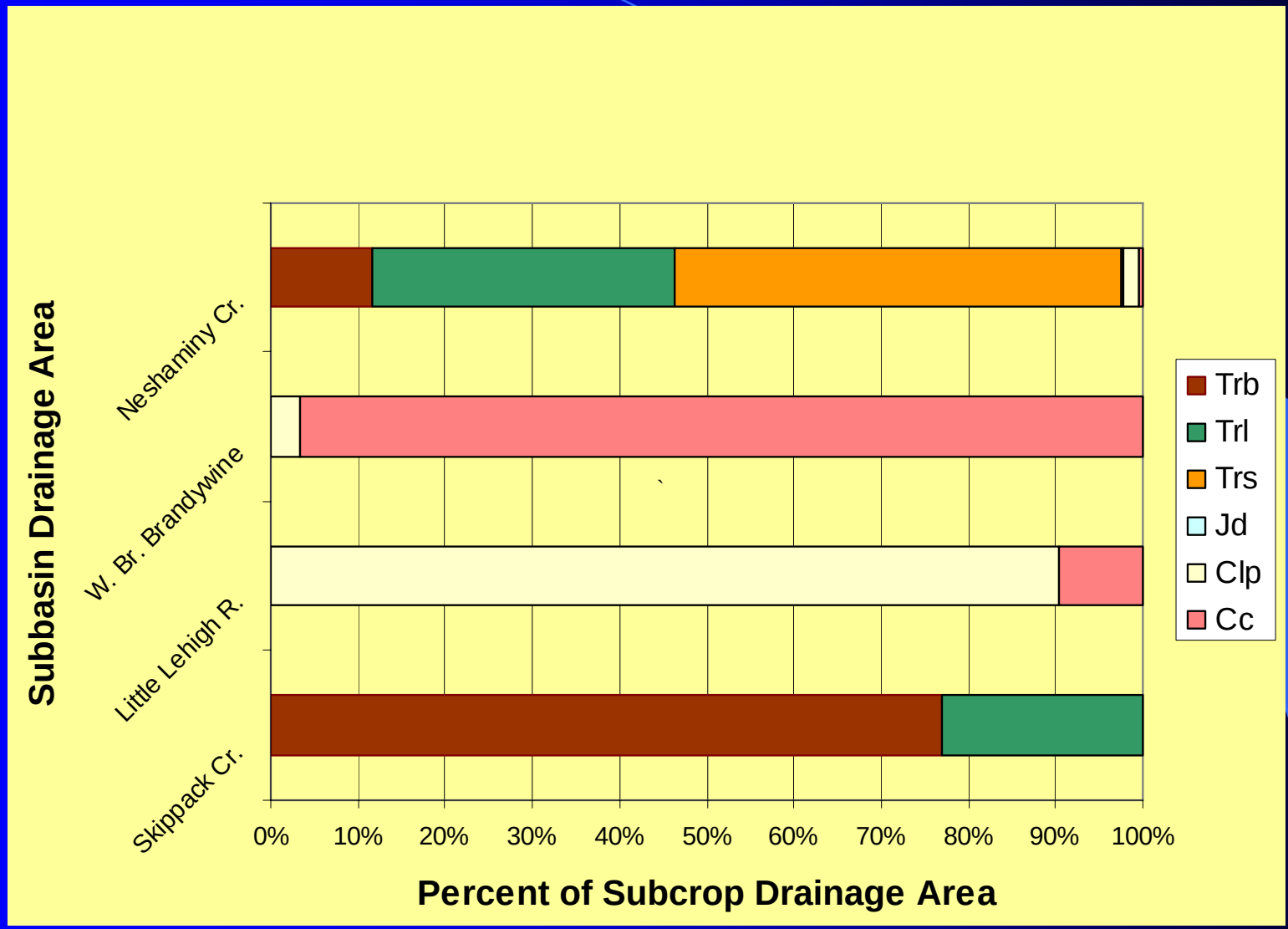
Measured Mean Daily Flows S.E. PA
Continuous Gaging Stations 5/1/71 - 7/31/71



Annual Mean Baseflow in Four Watersheds used for Management Analysis



GIS determined Subcrop Composition in Select Watershed Areas in E PA Ground-water Management Area



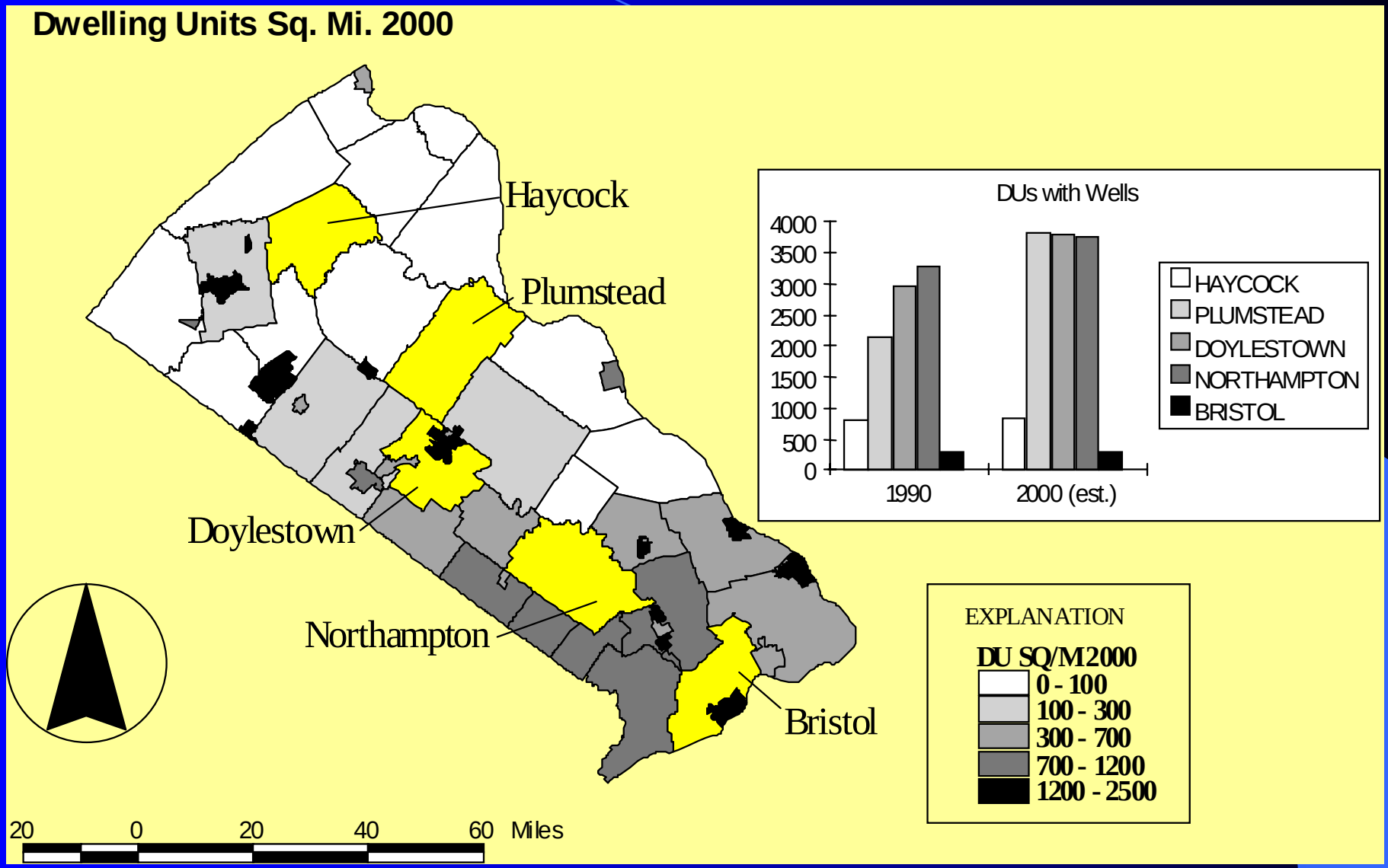
Mean Annual Baseflow in MGD/mi^2 Various Return Periods in Hydrogeologic Subcrop Areas

	Return Period				
Formation	2-yr	5-yr	10-yr	25-yr*	50-yr
Carbonate rocks	.706	.481	.408	.289	.278
Crystalline rocks	.524	.381	.302	.299	.206
Lockatong/Brunswick	0.314	0.241	0.189	0.154	0.144
Stockton	0.627	0.401	0.343	0.189	0.159

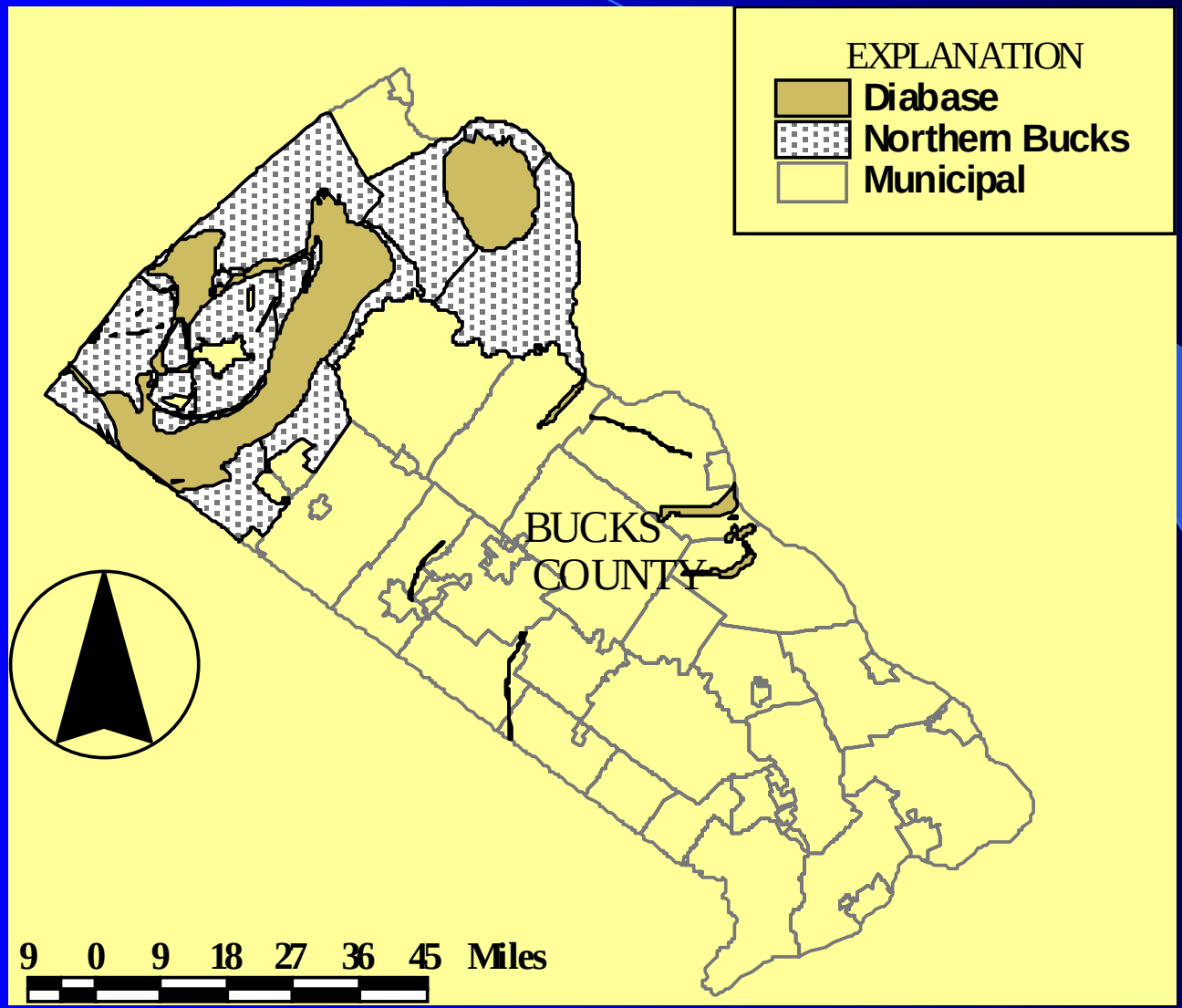
* Values used for water management model

Display a developing concern for water availability in part of Bucks County using GIS

Dwelling Units/sq. mi for Bucks Co. Municipalities, 2000

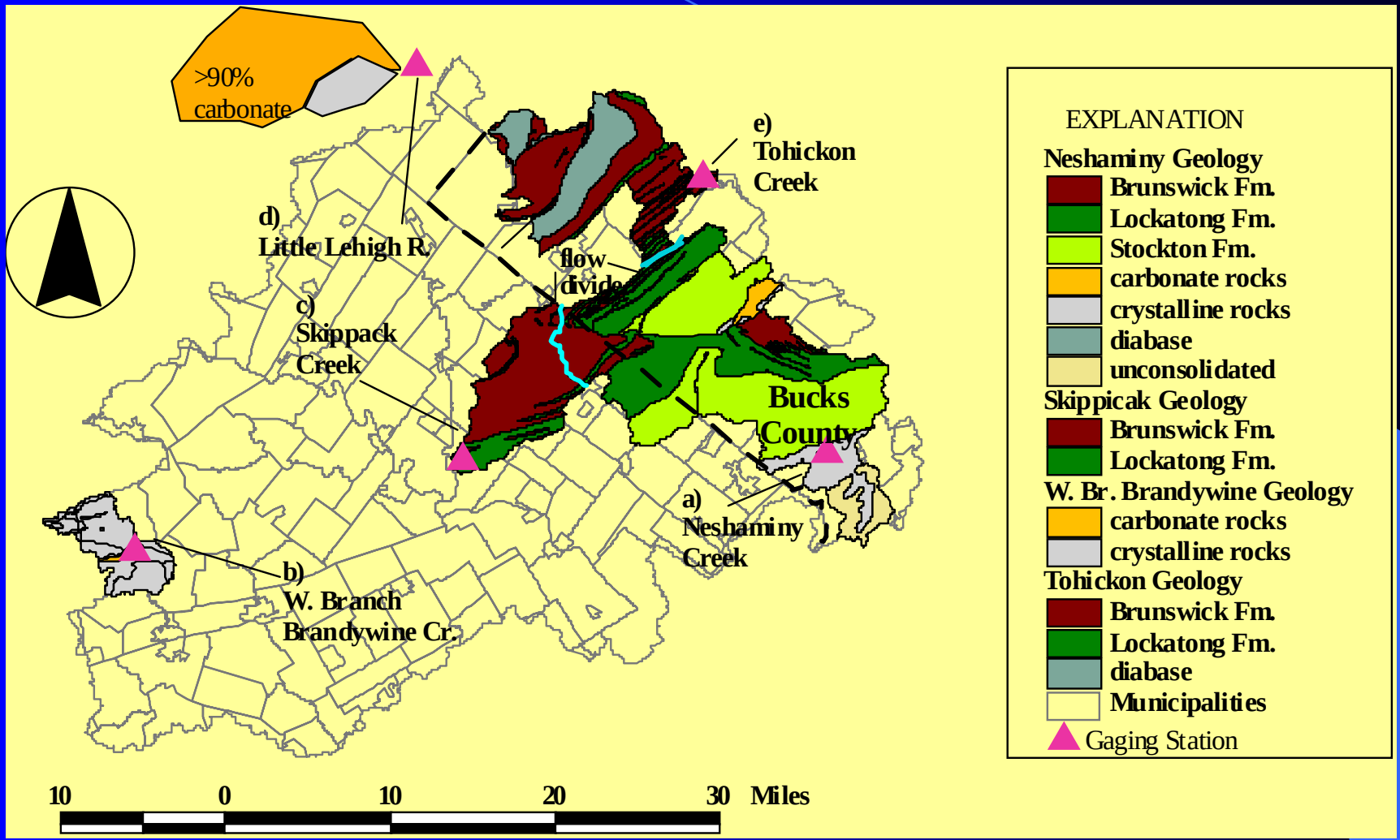


Nine Bucks Co. Municipalities where Diabase is most Extensive



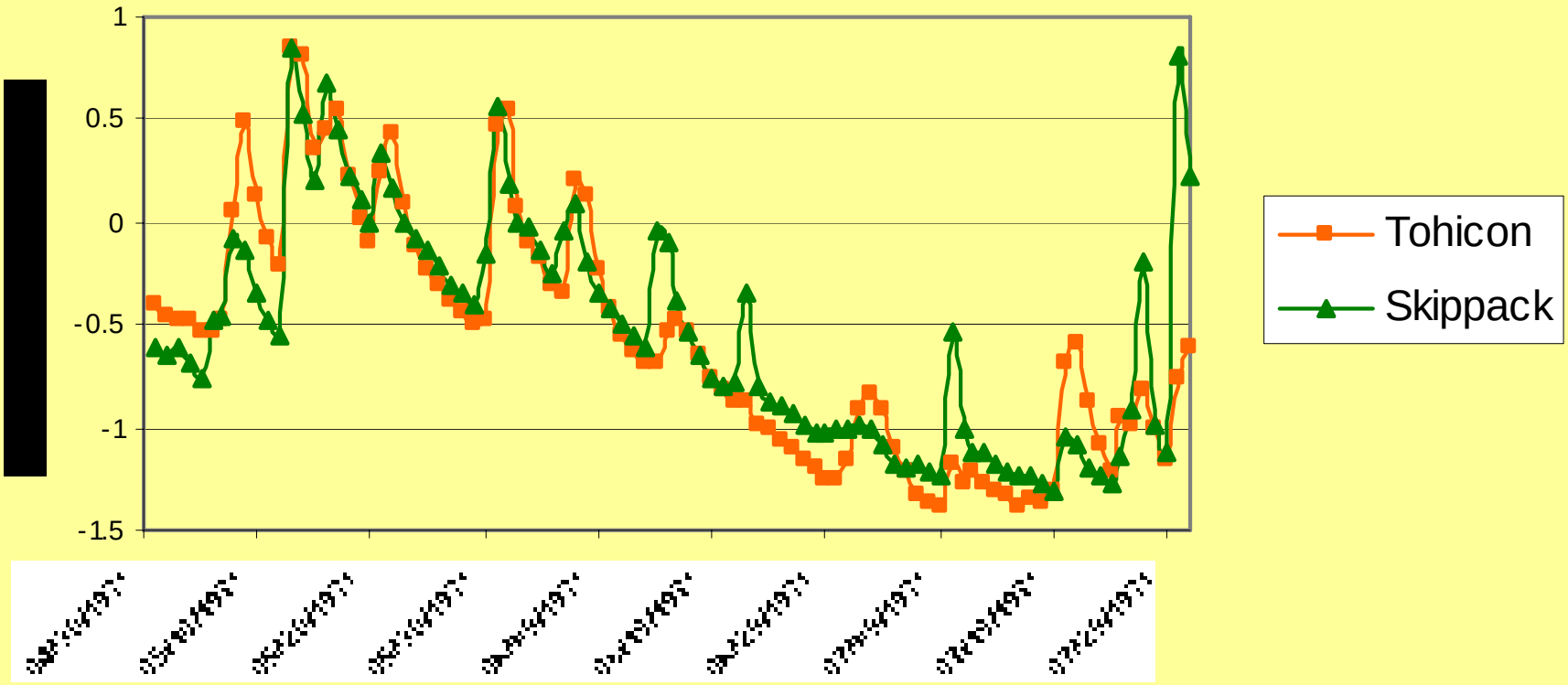
Display GIS use to determine equation coefficients for computing mean annual base flow from potential critical areas

Four Watersheds used for Management Analysis, & Tohickon Creek Watershed, with Subcrop Geology

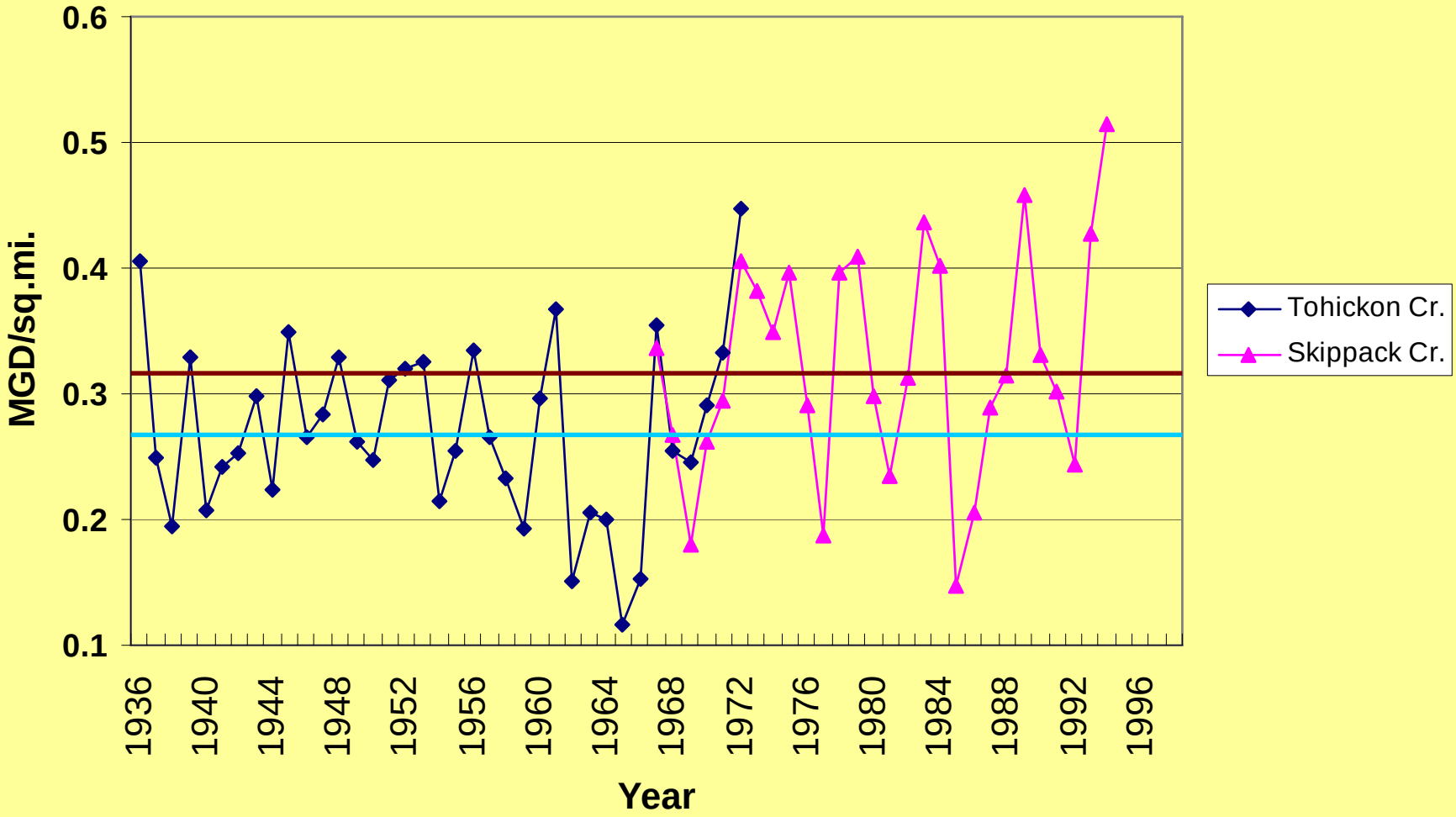


(Note-outline of Little Lehigh is shown as type and not accurate.)

Measured Mean Daily Flows S.E. PA
Continuous Gaging Stations 5/1/71 - 7/31/71



Annual Baseflow for Select Subbasins in SE PA with Relative Low Mean Annual Discharge

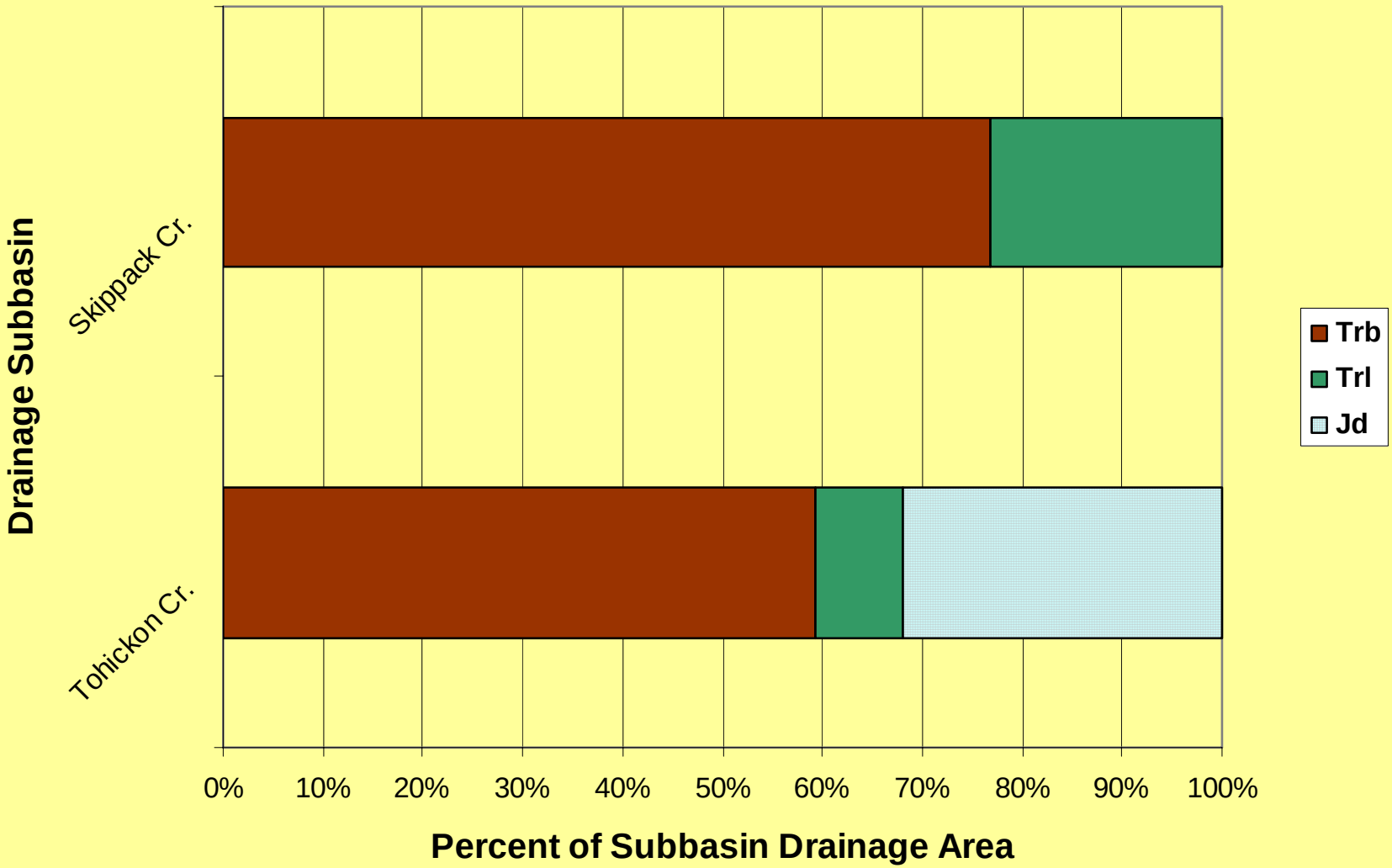


Statistical Test of the Difference in Mean Annual Baseflow for Tohickon Creek and Skippack Creek.

- H_0: $m_1 = m_2$ Mean of Log values of Mean Annual Runoff is same
- H_1: $m_1 \neq m_2$ Mean of Log values of Mean Annual Runoff is not the same
  - t-Test: Two-Sample Assuming Unequal Variances

	Tohickon	Skippack
Mean of Log Q Values	-1.345	-1.169
Variance	0.080	0.093
Observations	37	28
Pearson Correlation	NA	
Pooled Variance	0.085	
df	56	
t	-2.382	
P(T<=t) two-tail	0.021	
t Critical two-tail	2.003	

Subcrop Composition in Select Subbasin Drainage Areas



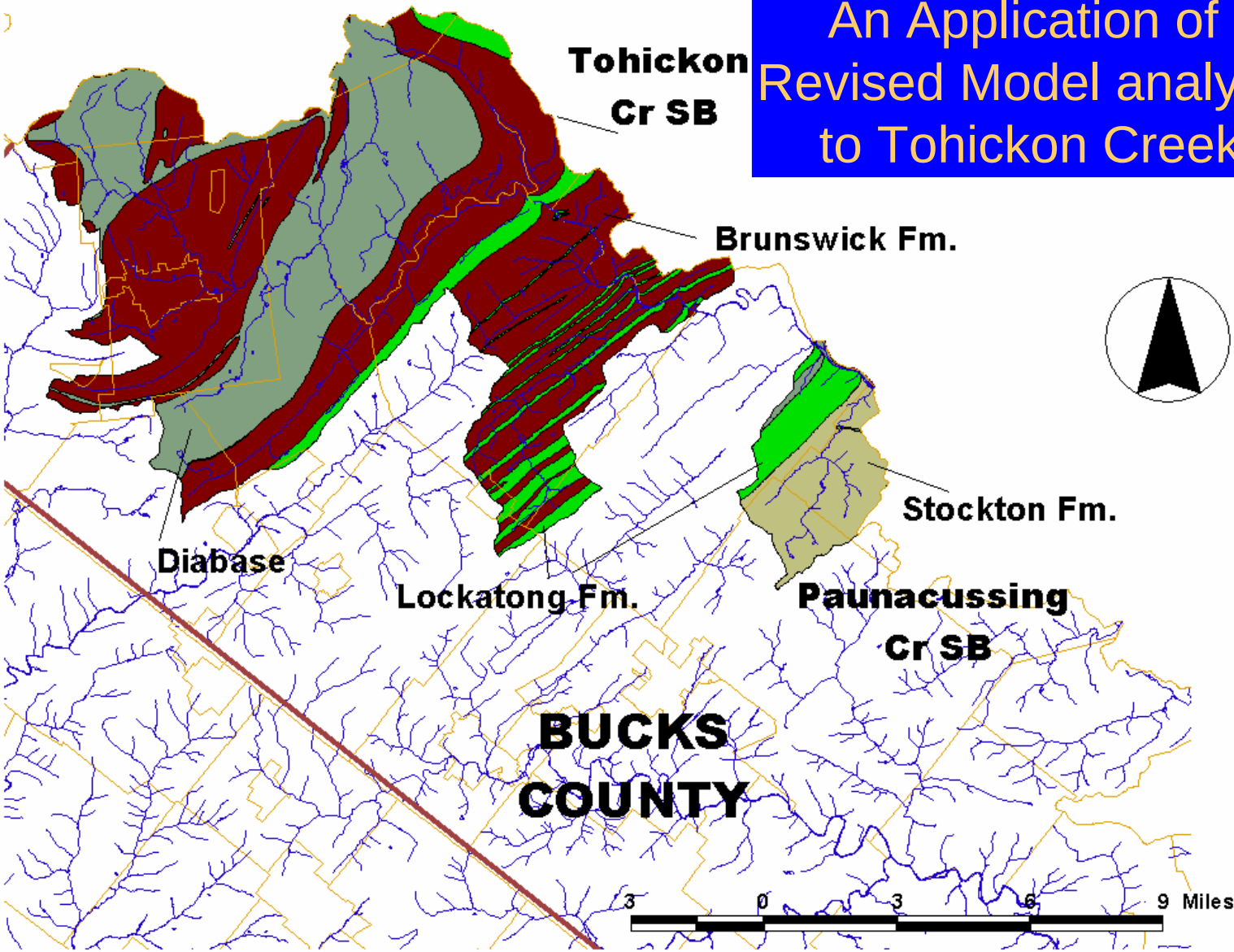
Mean Annual Baseflow in MGD/mi^2 Various Return Periods in Hydrogeologic Subcrop Areas

	Return Period				
Formation	2-yr	5-yr	10-yr	25-yr*	50-yr
Diabase	0.181	0.119	0.094	0.073	0.062
Lockatong/Brunswick	0.314	0.241	0.189	0.154	0.144
Crystalline rocks	0.524	0.381	0.302	0.299	0.206

* Values used for water management model

An application using revised baseflow from diabase areas applying GIS tool

An Application of Revised Model analysis to Tohickon Creek



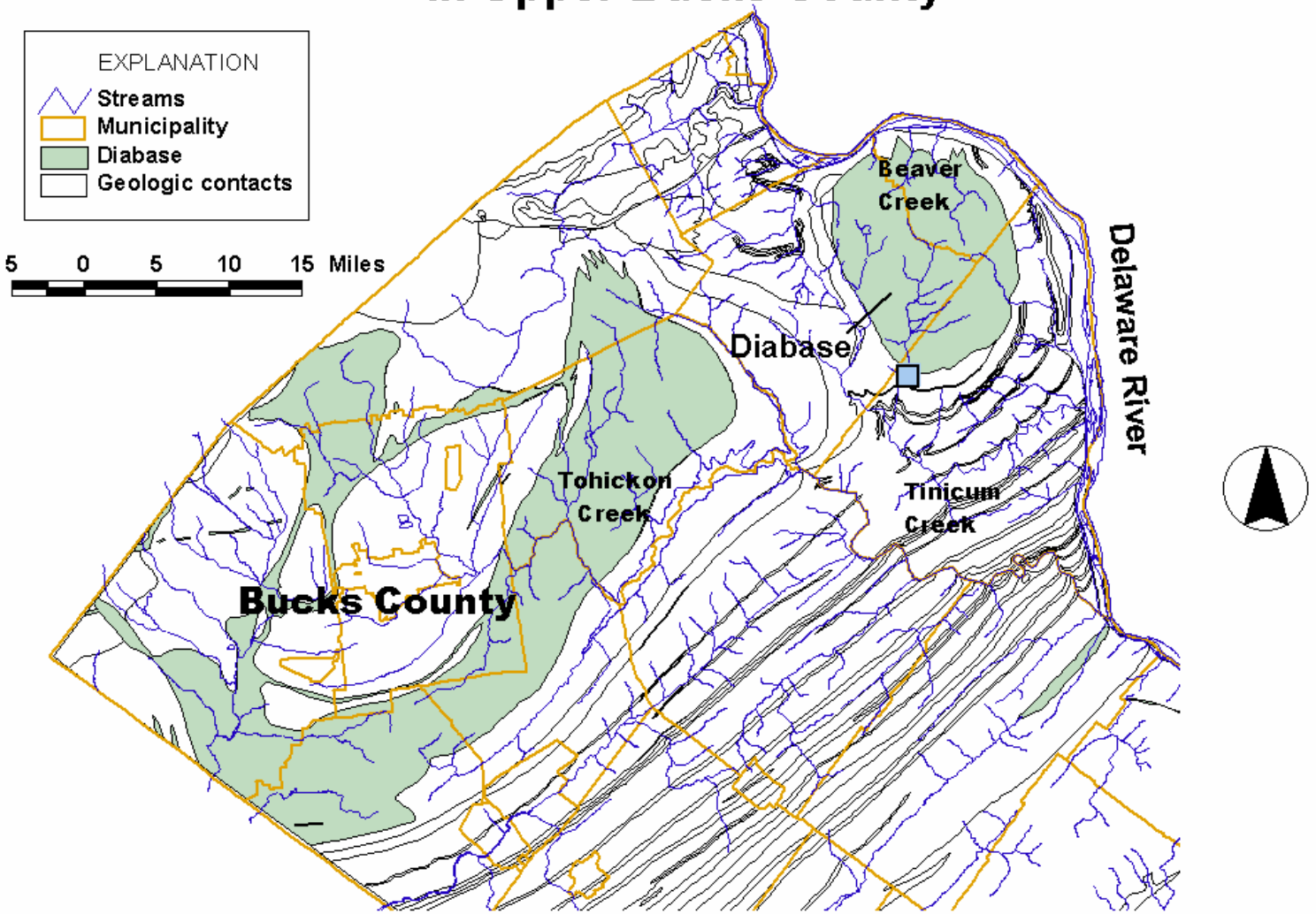
Tohickon Creek Mean Annual Baseflow MGD for Various Return Periods w/wout Distinct Diabase Baseflow

	Return Period				
Watershed	2-year	5-year	10-year	25-year*	50-year
Tohickon Cr. (6 subbasins 97.74 mi^2)	30.59	23.56	18.47	15.04	14.07
Revised Model					
Tohickon Cr. With distinct diabase(~32% Diabase)	26.54	19.74	15.52	12.53	11.51

* Values used for water management model

Locating a new beneficial stream monitoring location using GIS Tool

Proposed Diabase Monitoring Location in Upper Bucks County



Conclusions

- Ground-water management method for SE PA is a reasonable “zeroth order” budget approach
- Baseflow revised estimates from diabase areas was significantly less than is currently used in current GW Management Model
- GIS tool greatly facilitated revision of the GW Management Model and model application