

Poquessing Creek Watershed Comprehensive Characterization Report (CCR)

March 30, 2011



PWD's Watershed Management Planning Program

PWD has been initiating inter-governmental watershed partnerships since 1999 in an effort create and implement watershed-wide visions for ecological restoration and water quality improvement

Partnerships have been initiated in 6 watersheds

Cobbs (1999)

TTF (2000)

Pennypack – RCP (2003)

Poquessing – RCP (2004)

Wissahickon (2005)

Delaware River Direct – RCP (2007)

Why is a Watershed-Wide Approach Necessary?

Flooding

Impaired Habitat and Biology

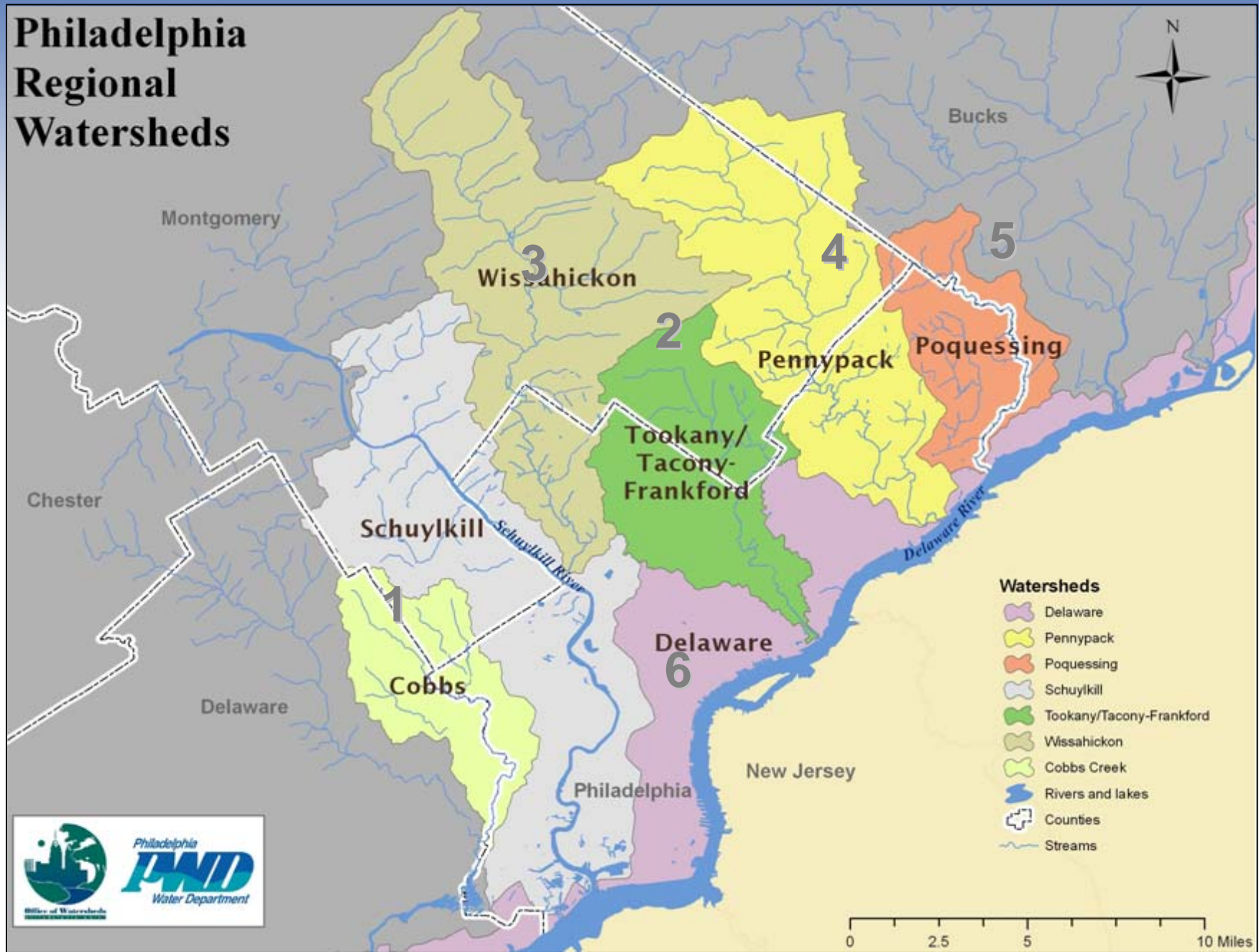
Water Quality

Algal Blooms

Trails, Greenways, & Recreational Opportunities

These issues cannot be overcome within the confines of an individual municipal jurisdiction!!

PWD Watershed Management Program



Comprehensive Characterization Report (CCR)

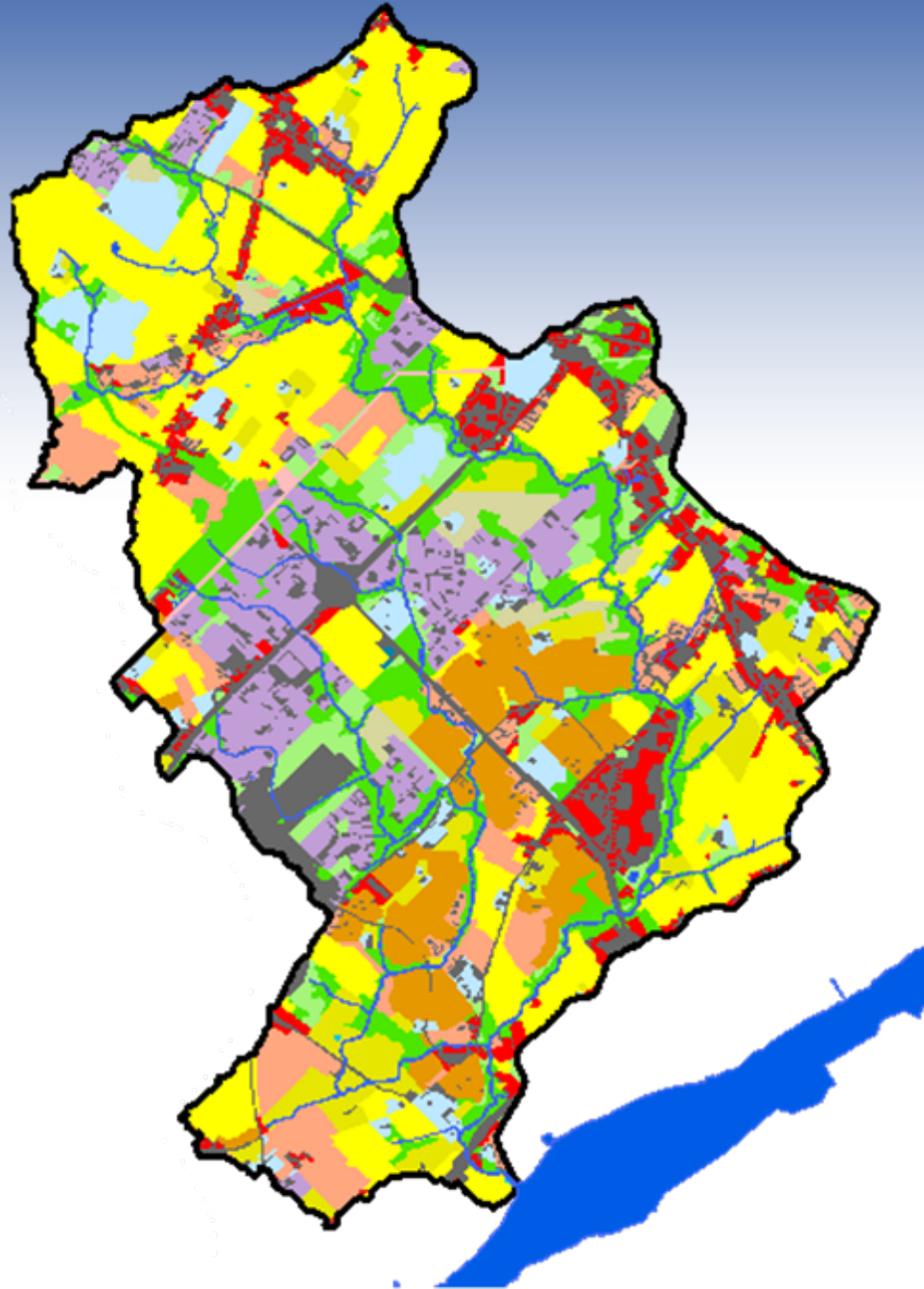
- Descriptive Study
- Basic Information about the stream
- Identify Problems
- Document "Baseline" Conditions
- Complement other efforts
 - (Act 167, RCP, other plans)

Comprehensive Characterization Report (CCR)

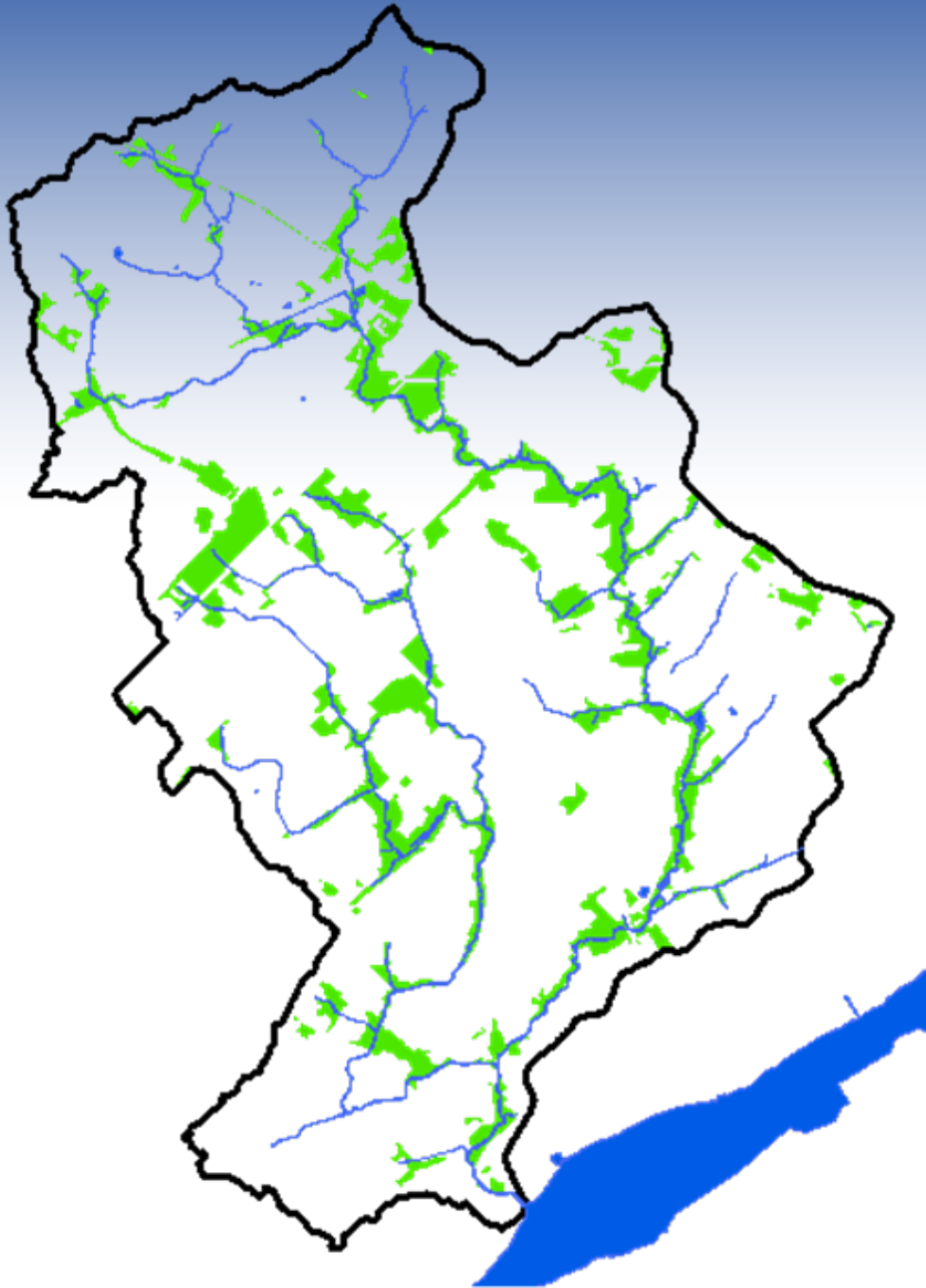
1. Introduction
2. Watershed Characterization
3. Hydrology
4. Water Quality
5. Biological Assessment
6. Physical Assessment
7. Appendices

Watershed Characterization

Land Use



- Delaware Valley Regional Planning Commission (DVRPC) 2005 land use data

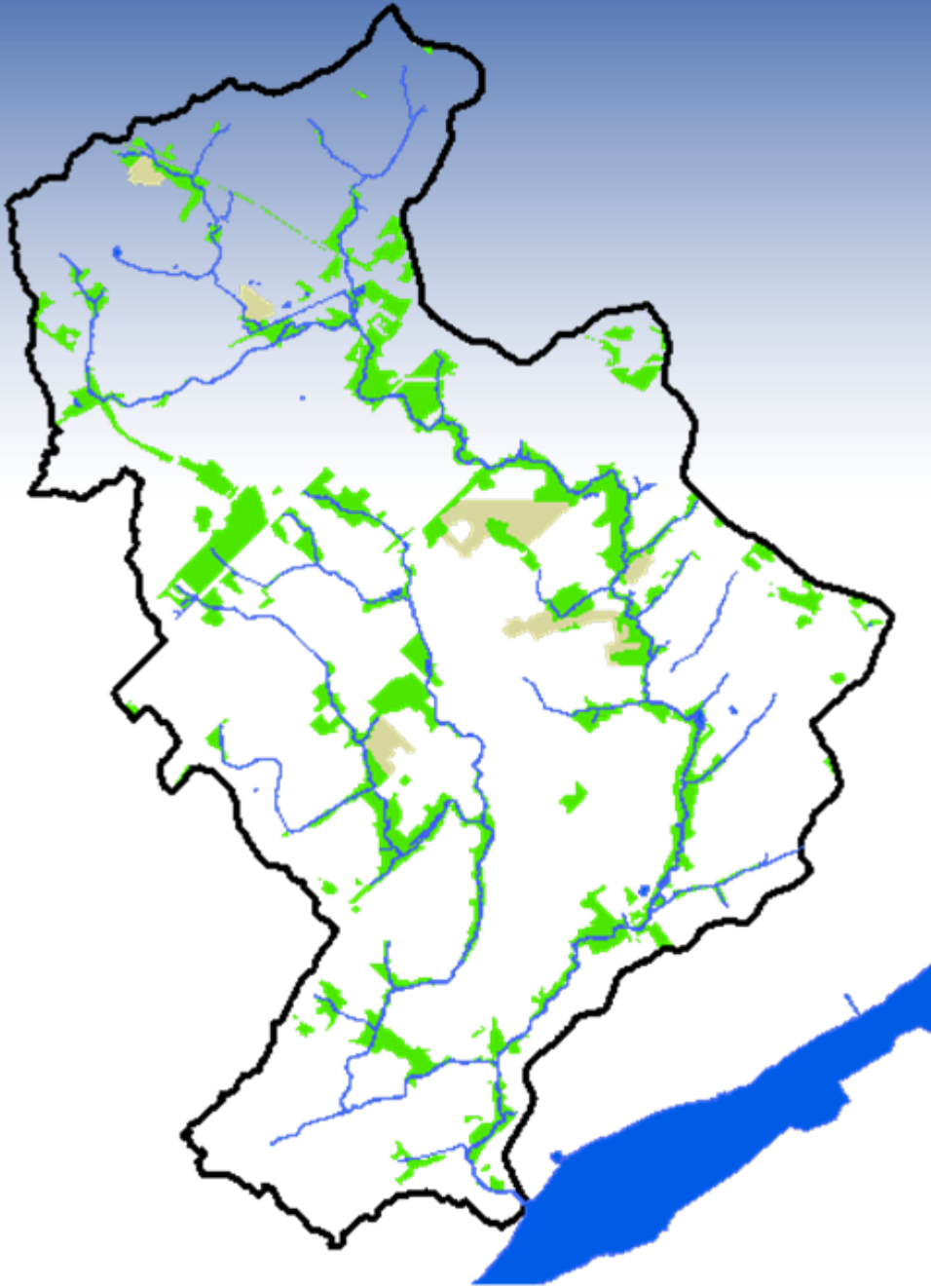


Wooded (13%)

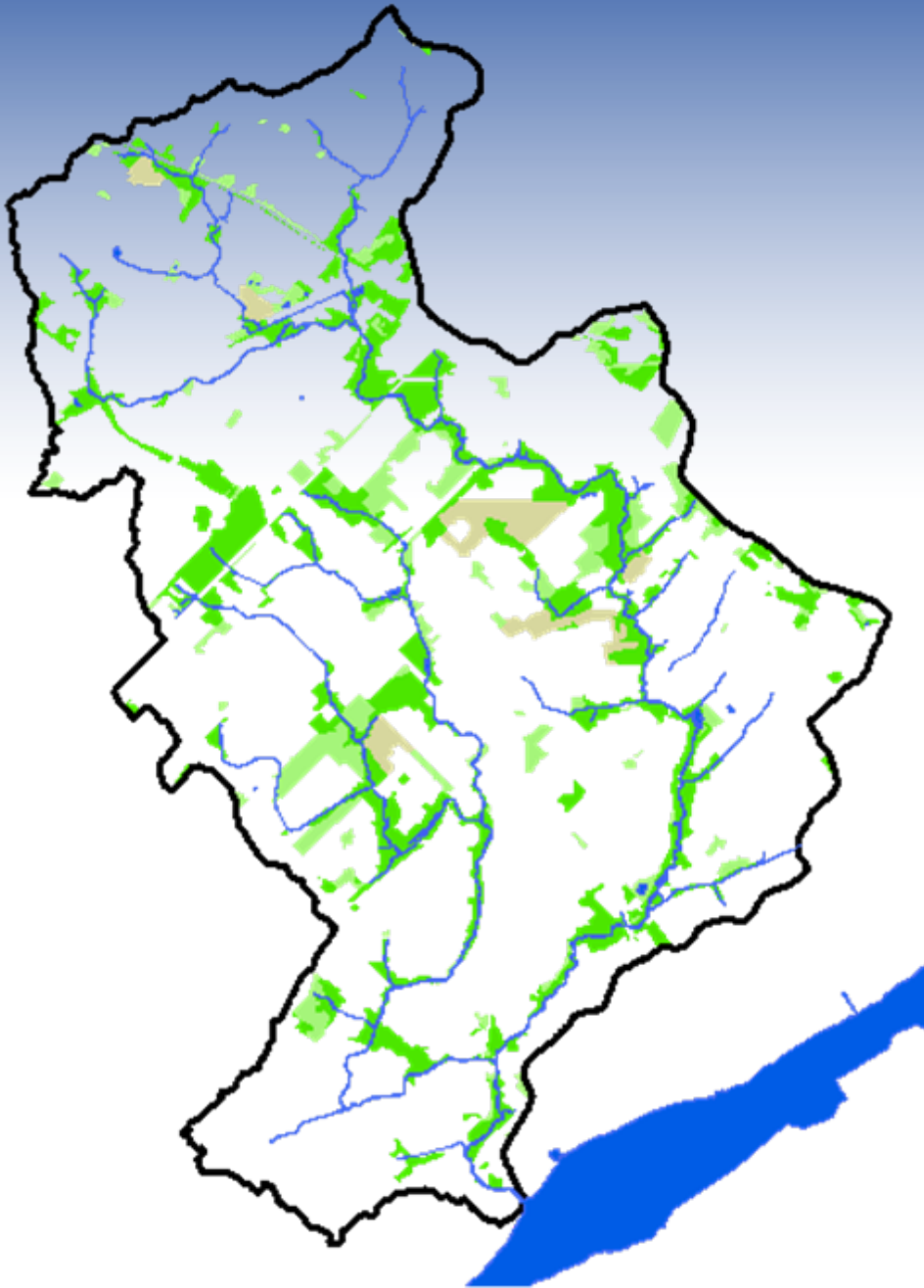
- Narrow parks and few forested parcels
- Least Polluting and Destabilizing Land Use
- Highly Desirable Along Riparian Corridors

Agriculture (<2%)

- Few tracts remaining
- Benjamin Rush State Park

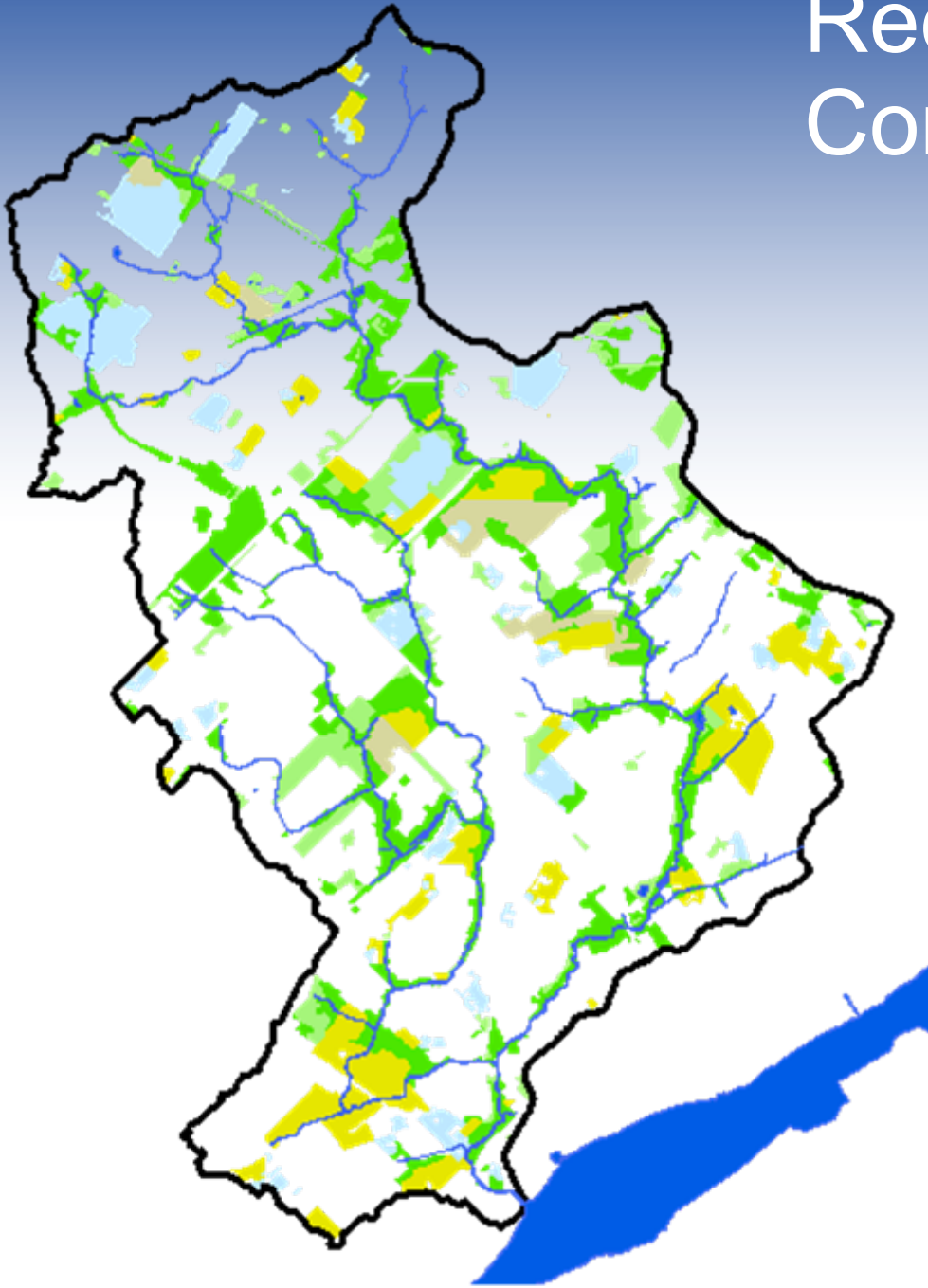


Vacant (5%)



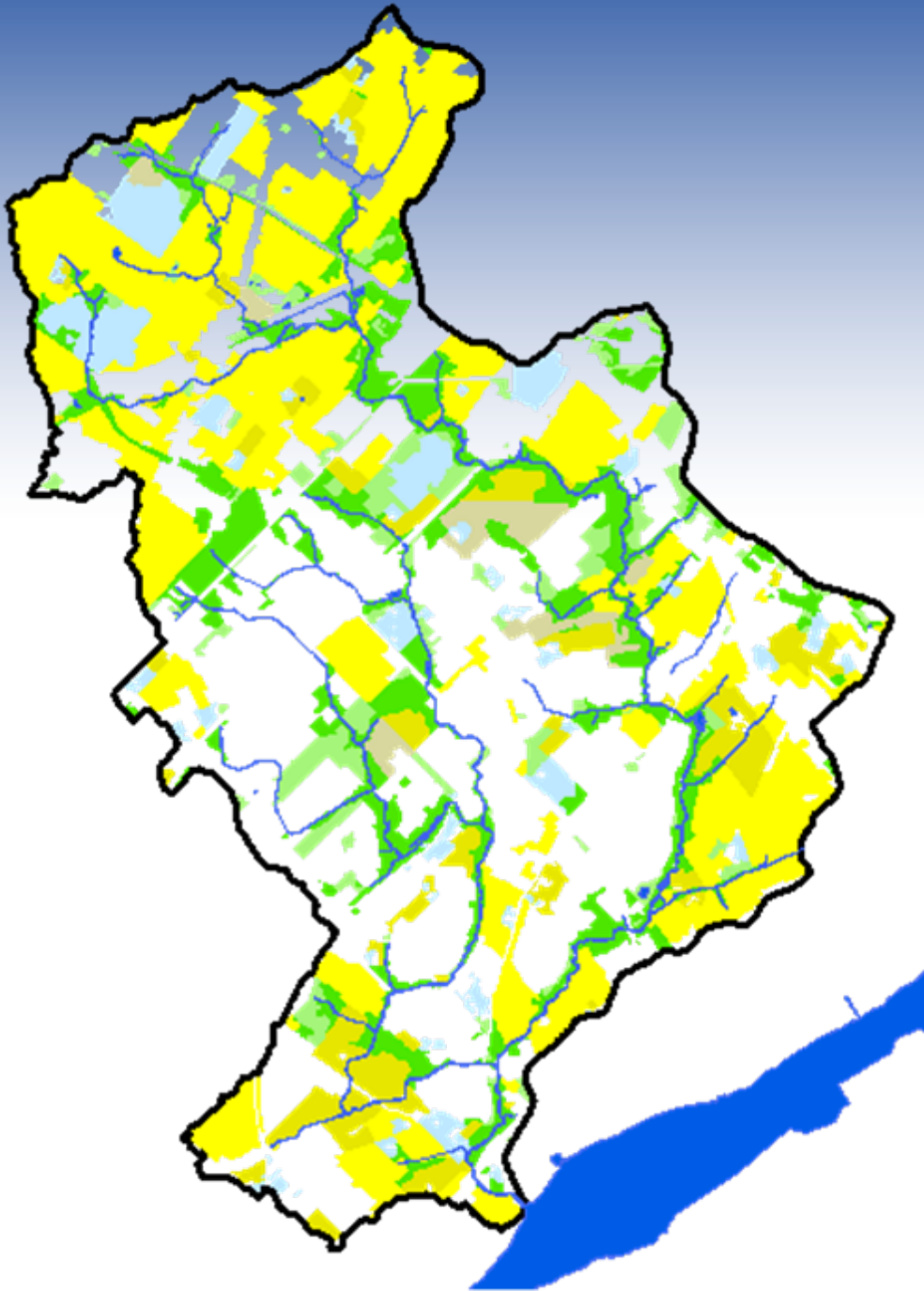
Recreational and Community Services (11%)

- Community Centers
- Ball Fields
- Churches



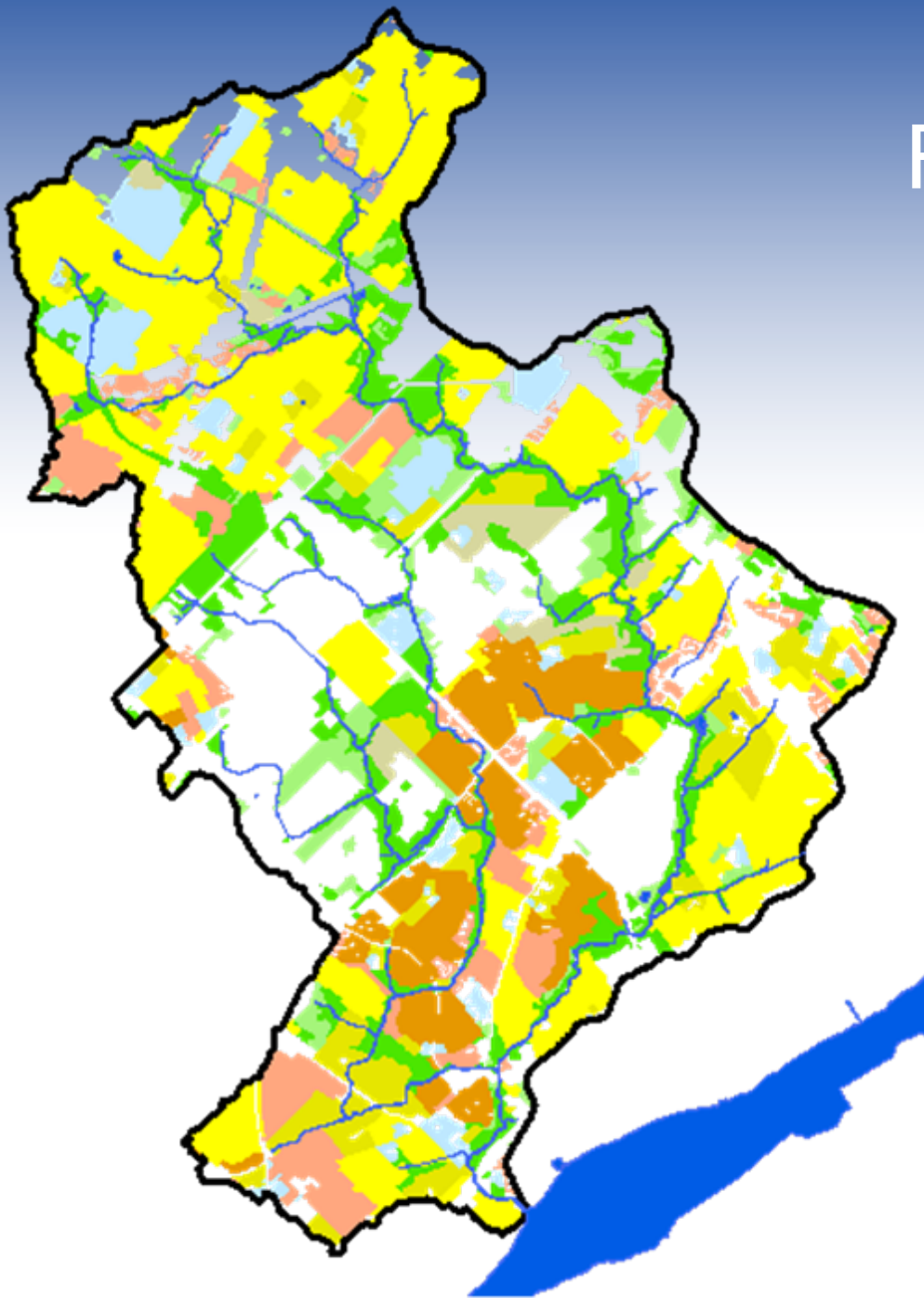
Single Family Residential (27%)

- Most Common Land Use in Watershed
- Stormwater Control and Wetland Protection Regulations

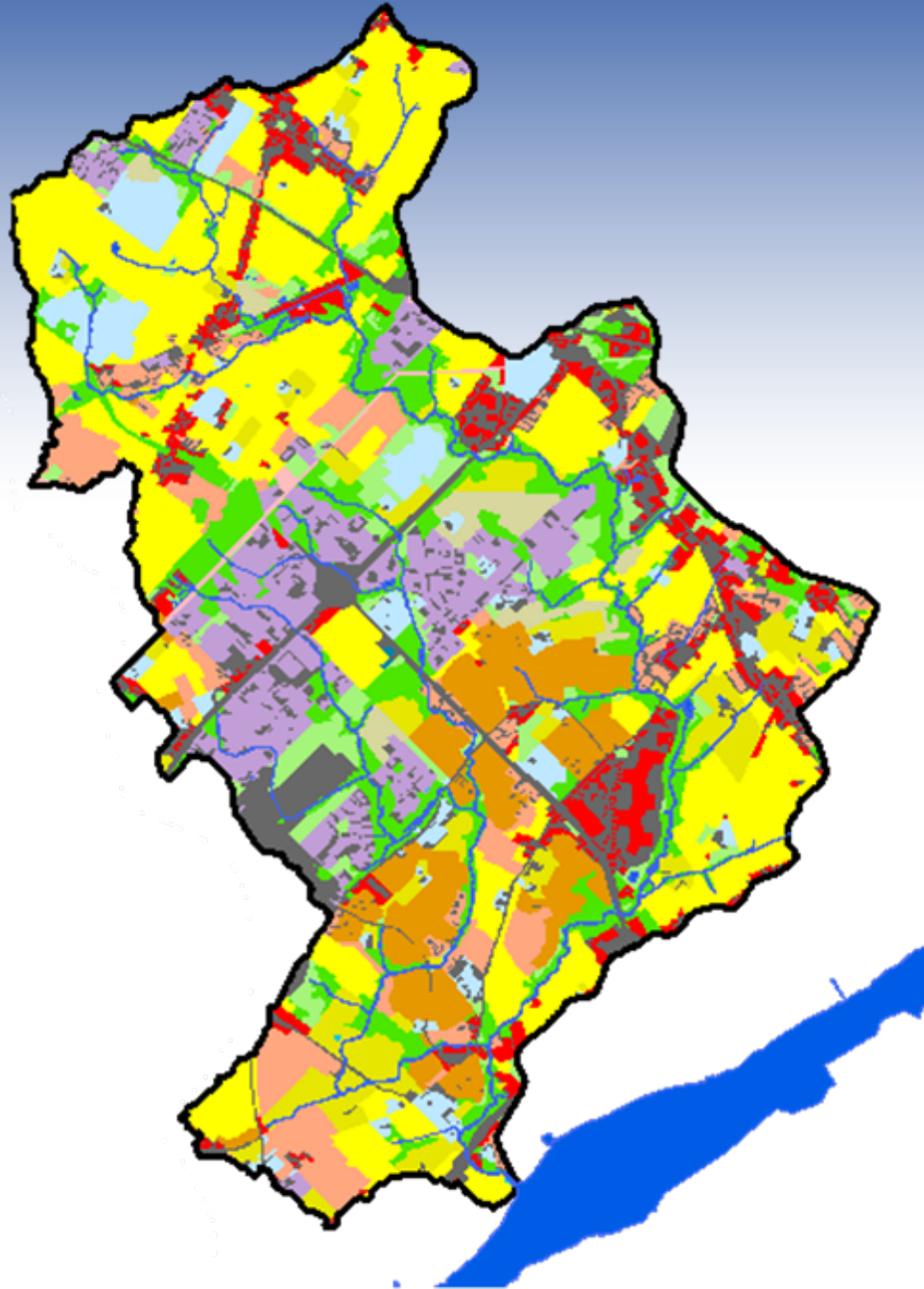


Multi-Family Residential (15%)

- Rowhomes Primarily in Philadelphia
- Condominium Developments

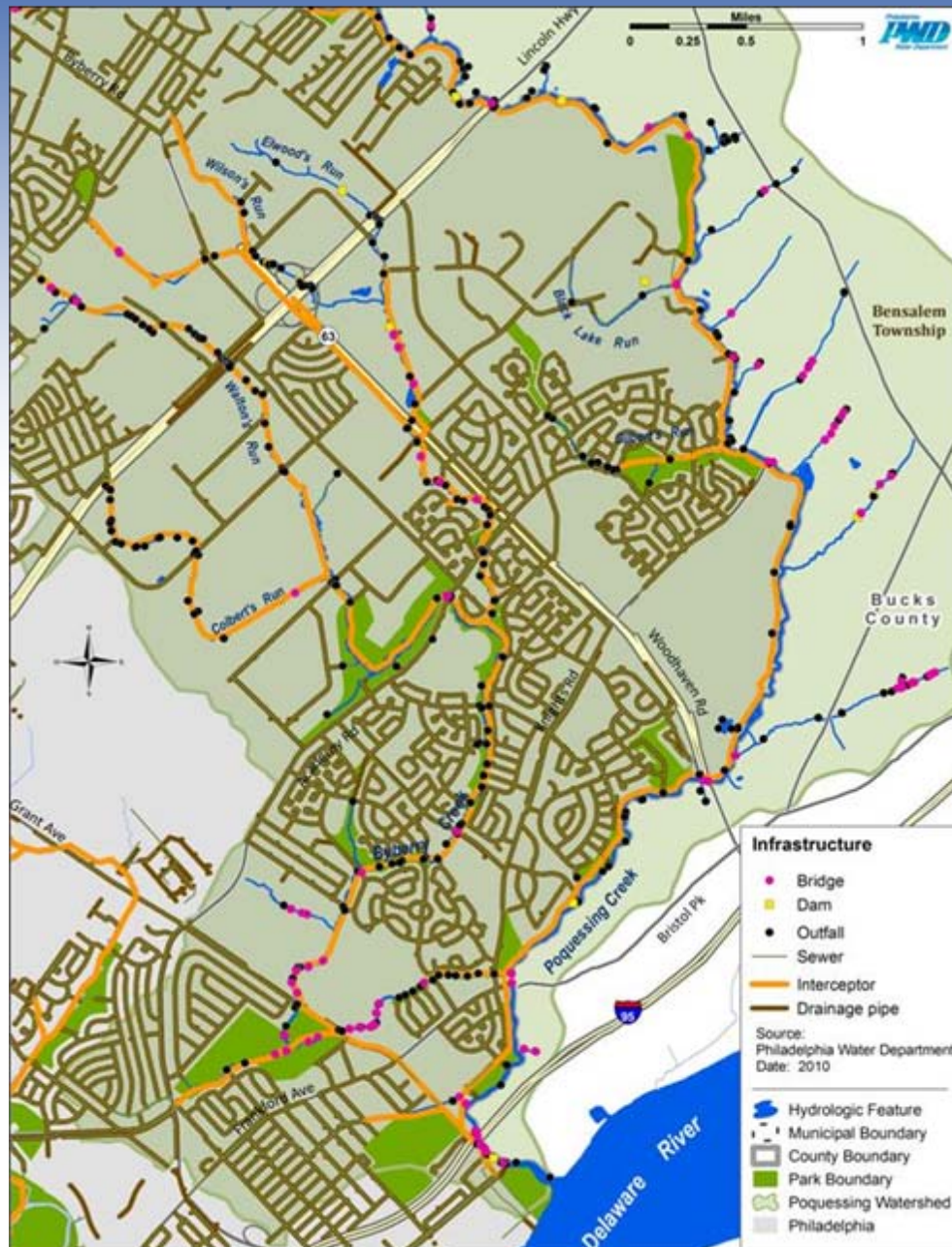


Land Use



- Manufacturing, transportation, Industrial, Retail
- Industrial Corridors along major roads

Infrastructure



Bridge (102)

Channelization
(253, 7.2 mi)

Culvert (155, 3.3mi)

Dam (27)

Impoundment (23)

Manhole (91)

Outfall (485)

Pipe (8)

Urban Stream Problems

- Land Use / Impervious Cover
- Man-Made Features in Stream
- Increased Stormflow
- Depressed Baseflow
- Sediment and Erosion
- Bacteria
- Low Dissolved Oxygen
- Excessive Algal Growth



Sediment and Erosion



Stream Impairments



Entire mainstem P&B
“Excessive Algal
Growth” impairments;
several segments
impaired for “siltation”

Listed 2002 / TMDL
2015

Tidal mouth listed for
“PCB”, toxic pollution

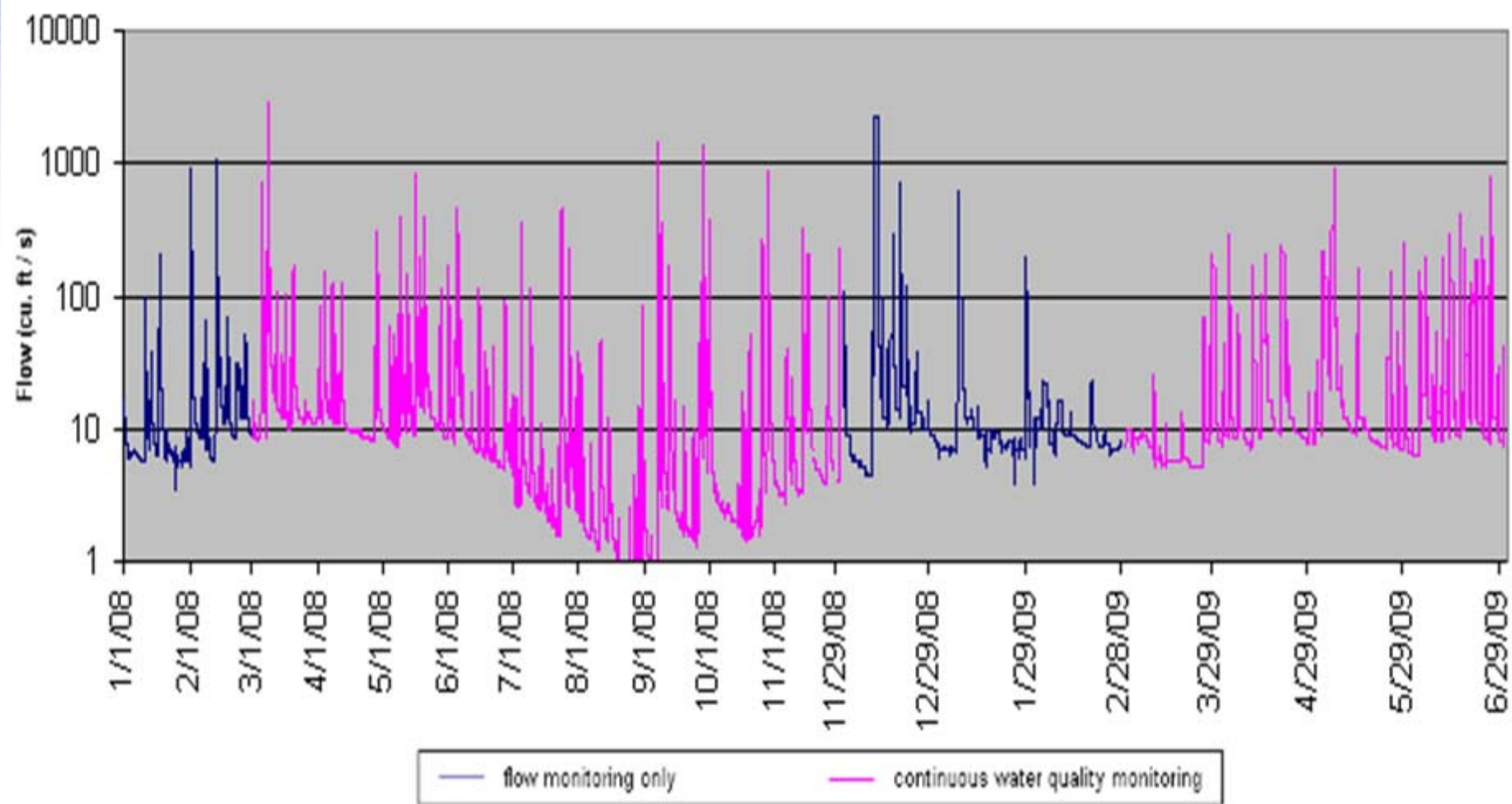
Listed 2006 / TMDL 2019

Watershed Hydrology

Streamflow: USGS Gage Information

Gage	Name	Period of Record	Period of Record (yrs)	Drainage Area (sq. mi.)
01465798	Poquessing Creek at Grant Avenue, Philadelphia, PA	7/1/1965 to Present	45	21.4
01465780	Poquessing Creek above Byberry Creek, Philadelphia, PA	7/1/1964 to 12/15/1970	6	13.2
01465790	Byberry Creek at Chalfont Road, Philadelphia, PA	6/1/1965 to 10/19/1978	13	5.34
01465785	Walton Run at Philadelphia, PA	6/1/1964 to 10/19/1978	14	2.17
01465770	Poquessing Creek at Trevose Road, Philadelphia, PA	6/1/1964 to 10/9/1981	17	5.08

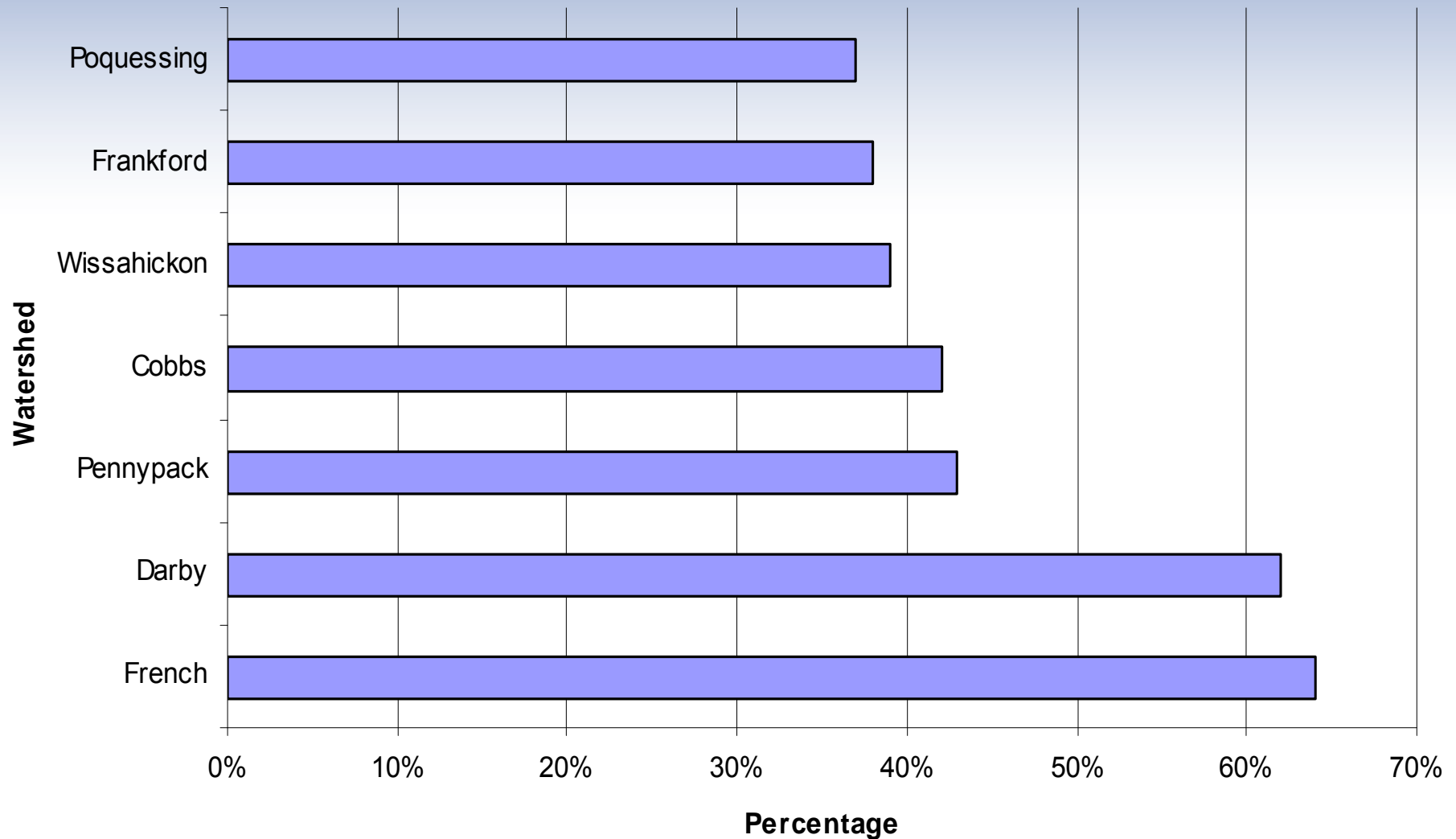
Streamflow: CCR Trends





Hydrograph Separation

Mean Baseflow (% of Annual Total Flow)



Water Quality Assessment

Water Quality Data

Water Chemistry “Grab” Samples

Continuous Water Quality Monitoring

Wet Weather Targeted Sampling

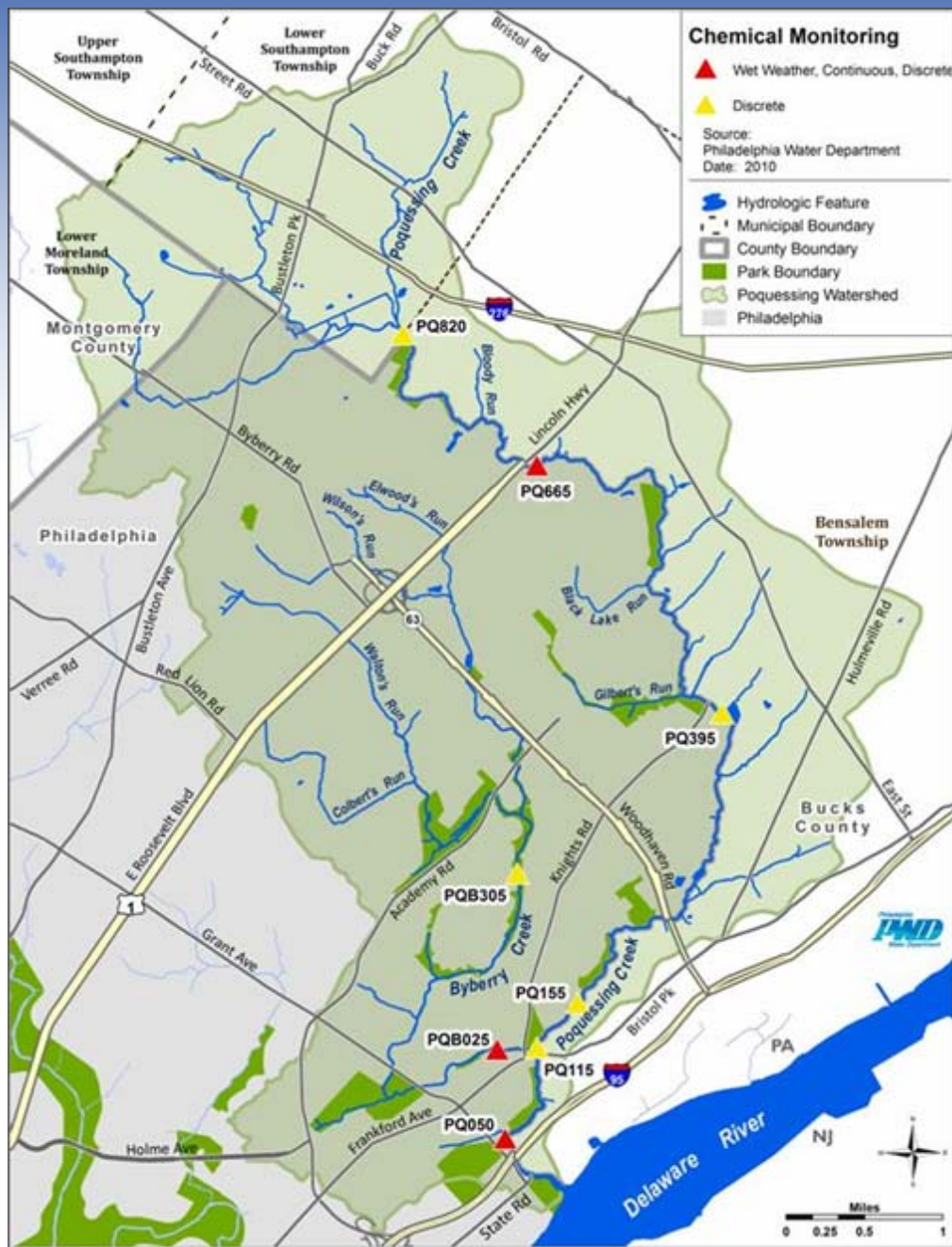
Data Analysis

PA Code Title 25 Chapter 93 Standards

USEPA Guidance Documents

Other Reference Values

Water Quality Monitoring Sites



8 locations for
grab sampling

- 6 Poquessing
- 2 Byberry

3 locations for
wet weather &
continuous
monitoring

- 2 Poquessing
- 1 Byberry

Water Quality Monitoring – Continuous Data

- Dissolved Oxygen
- Temperature
- pH
- Conductivity
- Turbidity
- Usually no historic data for comparison



Dissolved Oxygen

- PADEP Warmwater Fishery (WWF)

Aquatic Life Criteria

- Daily average 5mg/L, minimum 4mg/L
- Dry weather - 2.5% of hours in violation
 - Violations primarily at site PQ665
- Wet weather <1% of hours in violation

Water Quality Monitoring – Other Continuous Data

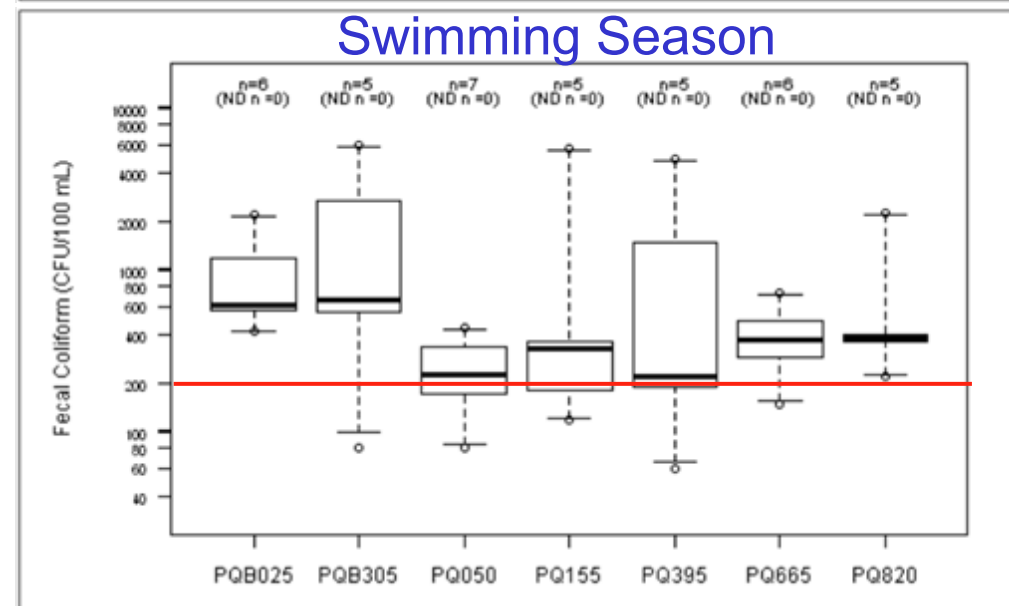
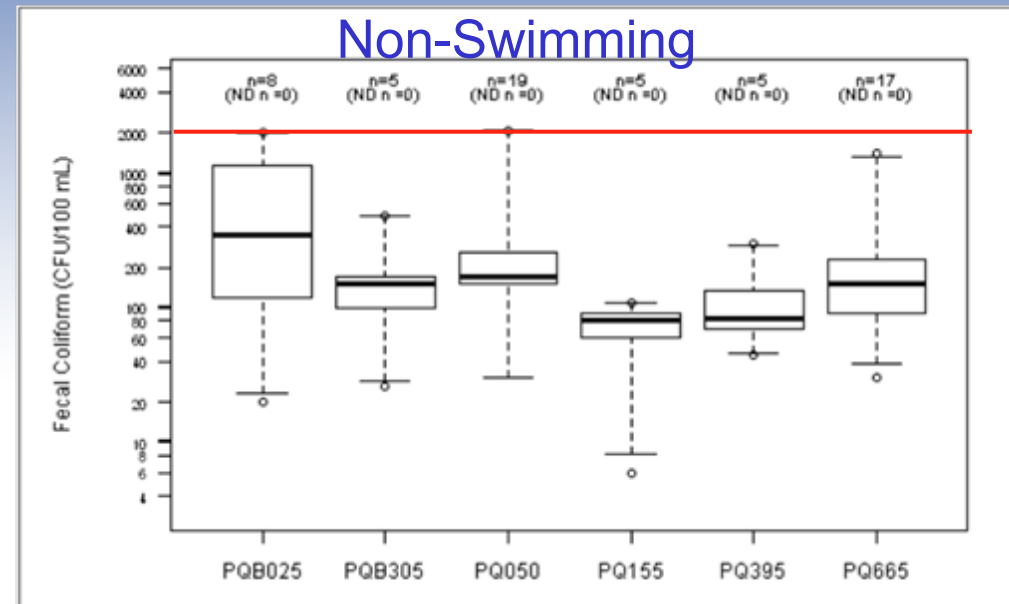
- Temperature violations occurred mostly March-April 2009 (not during critical summer period)
- pH fluctuation not a water quality problem
- High conductivity in dry weather
- Turbidity high in wet weather
 - No WQ standards, levels are typical of urban streams

Fecal Coliform Standards

- PA Code Chapter 93 Standard
 - Swimming season May 1 – September 30
 - Geometric Mean 200 CFU/100mls
 - Non-swimming season October 1 – April 30
 - Geometric Mean 2,000 CFU/100mls
- Weather Has Strong Influence
 - PWD categorizes samples as wet or dry
 - wet and dry samples analyzed separately
- Automated Sampling Necessary

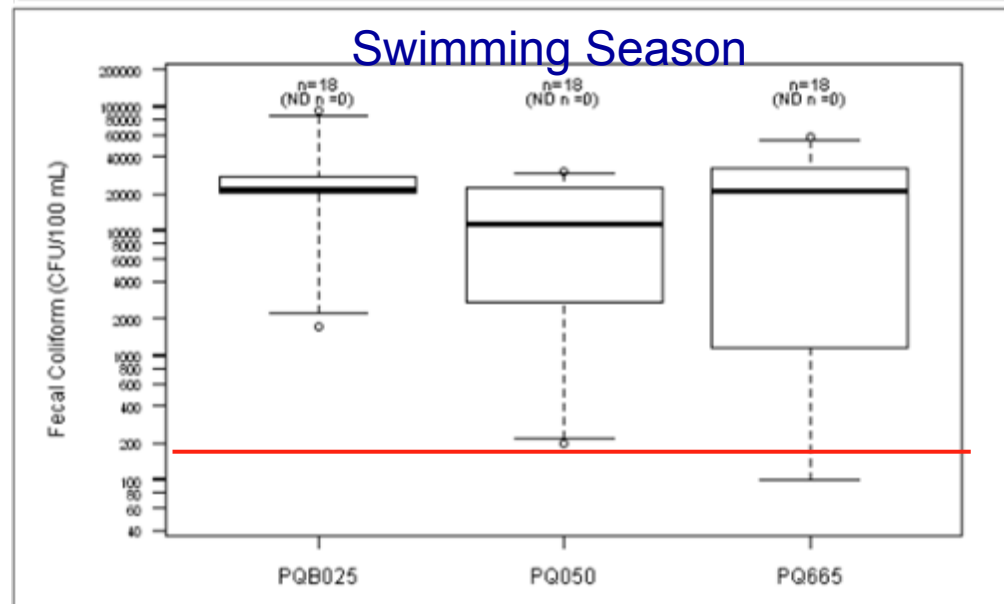
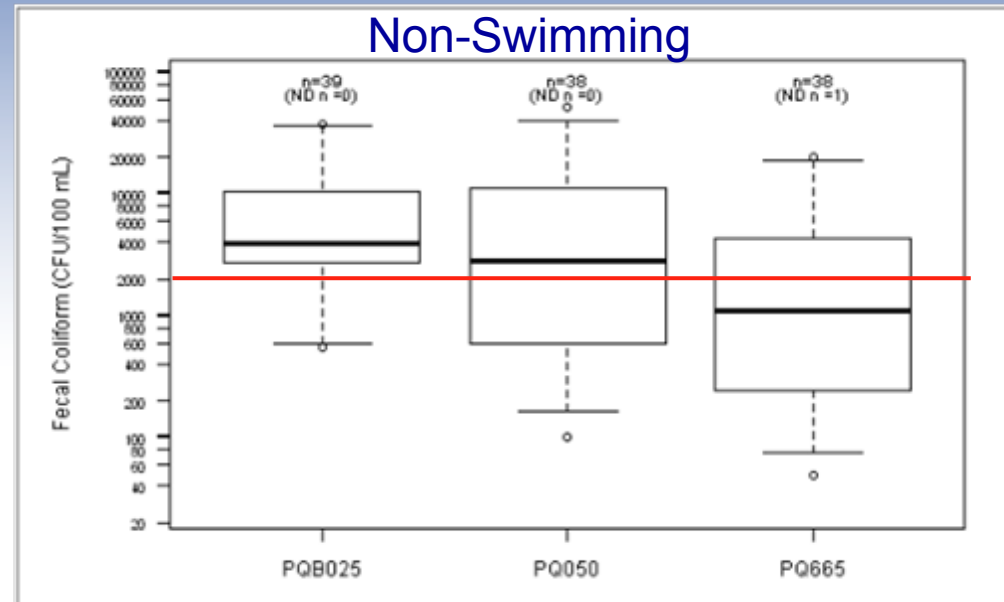
Fecal Coliform Results – Dry Weather

- Dry weather fecal coliform standards usually exceeded in swimming season



Fecal Coliform Results – Wet Weather

- Wet Weather Fecal coliform standards nearly always exceeded during swimming season
- Very few wet non-swimming samples



Fecal Coliform Results

- Wet and dry analysis has no regulatory significance
- All sites in violation of WQ criteria
- Show some improvement compared to historical samples

Season	Site	No. Obs.	No. Exceed	Percent Exceedance	PADEP criterion
Non Swimming	PQB025	47	34	72.3	non-attaining
	PQB305	6	0	0	ID n<8
	PQ050	57	26	45.6	non-attaining
	PQ155	6	0	0	ID n<8
	PQ395	6	0	0	ID n<8
	PQ665	55	17	30.9	non-attaining
	PQ820	6	0	0	ID n<8
Swimming	PQB025	24	24	100	non-attaining
	PQB305	6	5	83.3	ID n<8
	PQ050	25	21	84	non-attaining
	PQ155	6	4	66.7	ID n<8
	PQ395	6	4	66.7	ID n<8
	PQ665	24	21	87.5	non-attaining
	PQ820	6	6	100	ID n<8

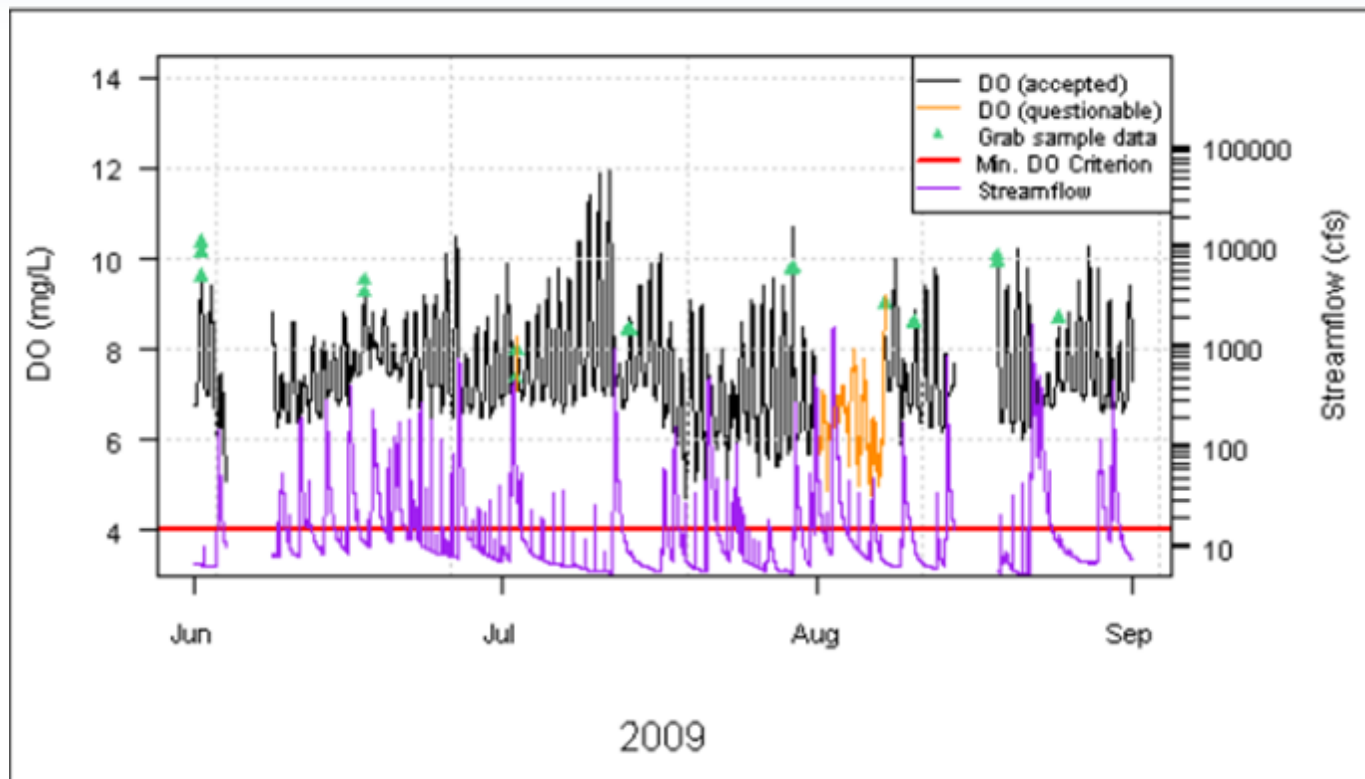
ID n <8: Insufficient Data to make an assessment due to fewer than 8 samples

Nutrients

- Nitrogen and Phosphorus stimulate excessive algal growth
- No PADEP WQ Standards for nutrients
- Other local watersheds have been listed for nutrients / algae, TMDLs developed
- No major point sources, but levels in stormwater may be sufficient to cause impairment

Nutrient Impacts

- Fluctuations in DO observed, but not as severe as streams (e.g., Wissahickon Creek) affected by wastewater discharge



Nutrient Impacts

- Dissolved Oxygen is not the only concern
- Undesirable changes to algae, invertebrate, fish communities
- Stream listed for “excessive algal growth”, presumably TMDL will address nutrients

Biological Assessment

Biological Assessment

- Benthic Macroinvertebrates (aquatic insect larvae, crustaceans, etc.)
- Fish
- Algal Periphyton (algae growing on stream substrates such as rocks)

Benthic Invertebrate Sites



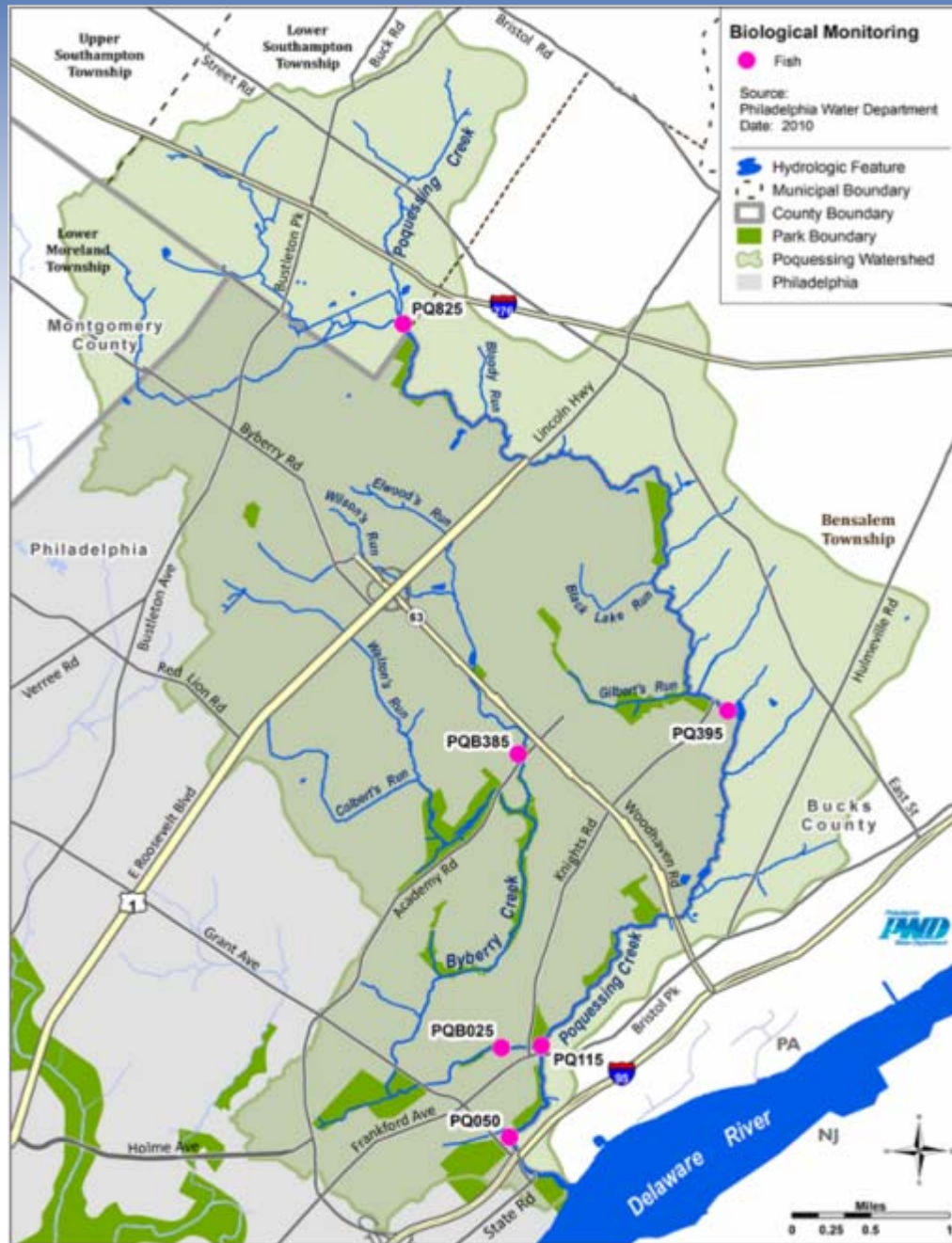
7 Poquessing
4 Byberry Creek
1 Unnamed Trib

Sites similar to
PWD 2001
assessment

Benthic Invertebrate Results

- All sites “severely impaired” compared to PADEP Index of Biotic Integrity
- Low overall abundance at some sites
- No Mayflies or Stoneflies collected
- Community dominated by moderately tolerant midges
- Most sites deteriorated from 2001 to 2008 (slightly different methods used)

Fish Sites



4 Poquessing
2 Byberry Creek

Sites similar to
PWD 2001
assessment

Fish Results

- Low overall abundance at some sites, in some cases much lower than 2001 assessment

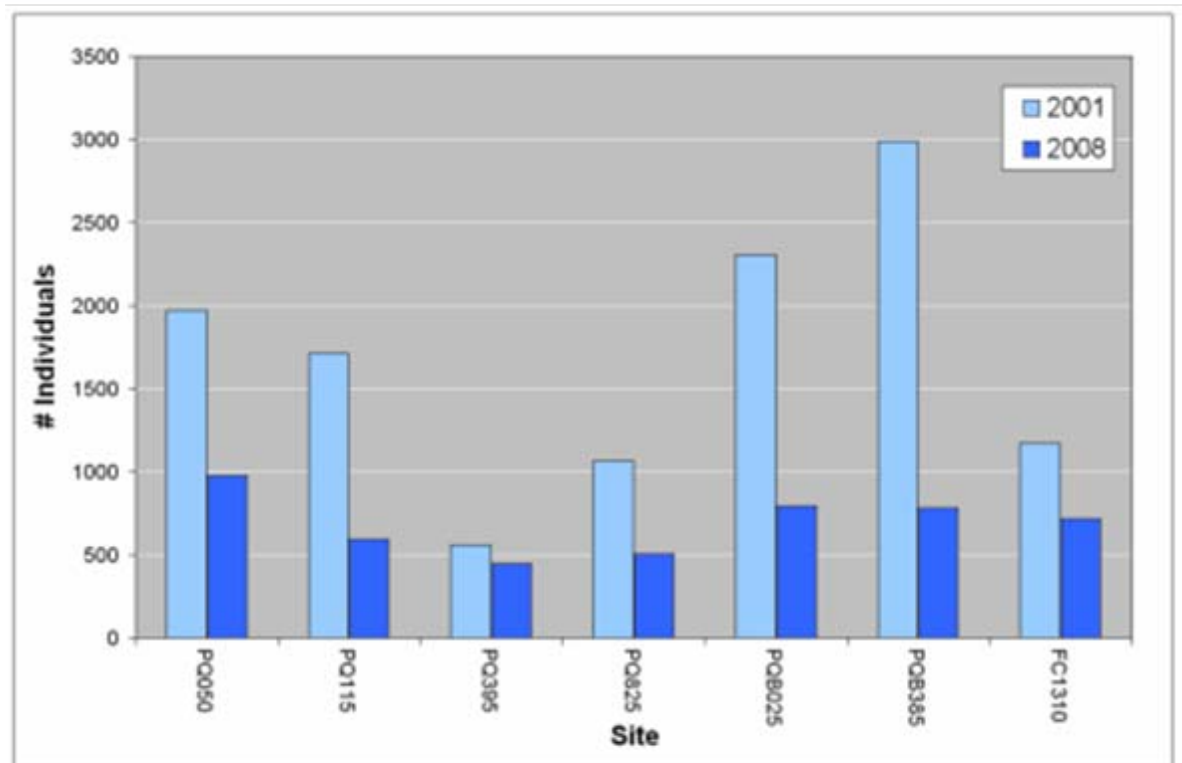


Figure 5.16 Total Fish Abundance at Poquessing Creek Watershed and French Creek Reference Sites, 2001 and 2008

Fish Results

- All sites “fair” or “good” compared to French Creek site
- Elevated % of deformities & tumors
- American eel abundant in watershed

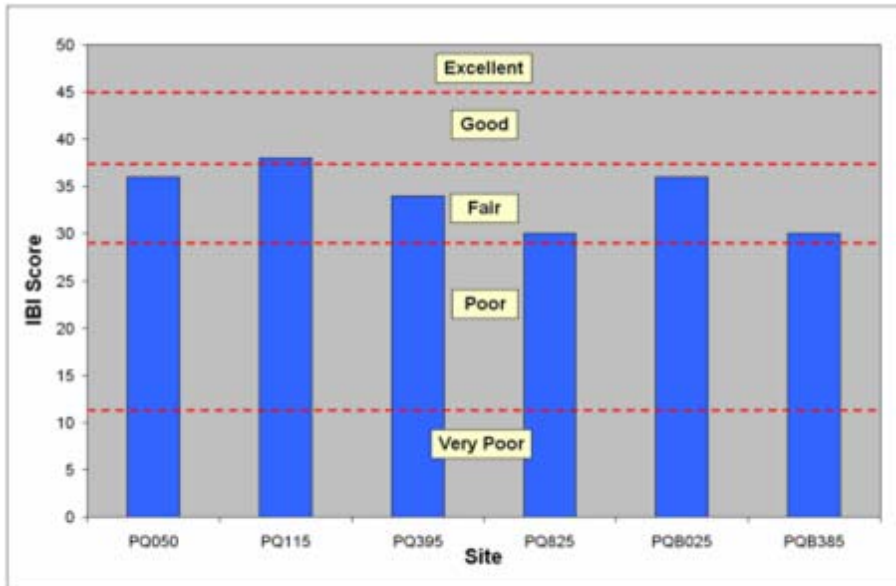


Figure 5.25 Fish Index of Biotic Integrity (IBI) for six Poquessing Creek Watershed Sites, 2008

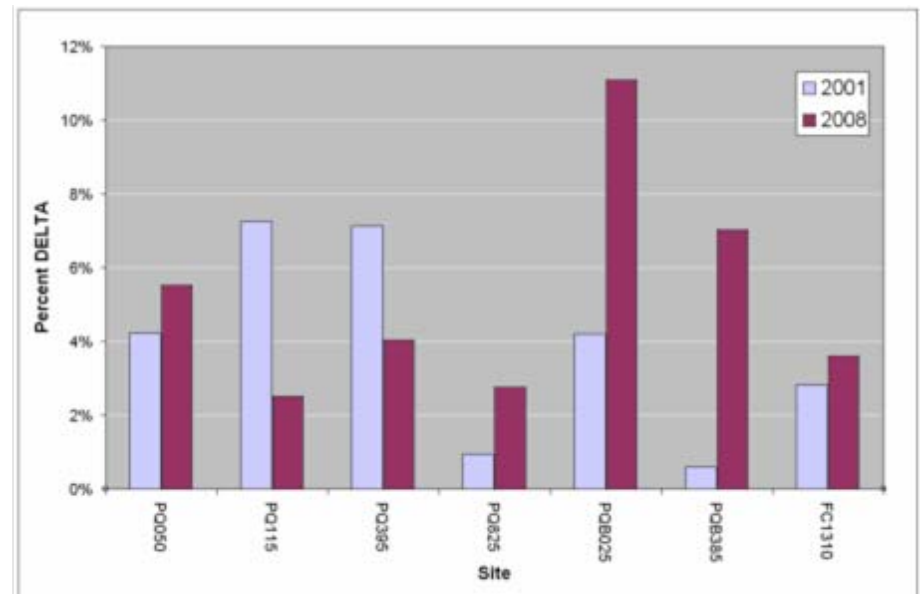
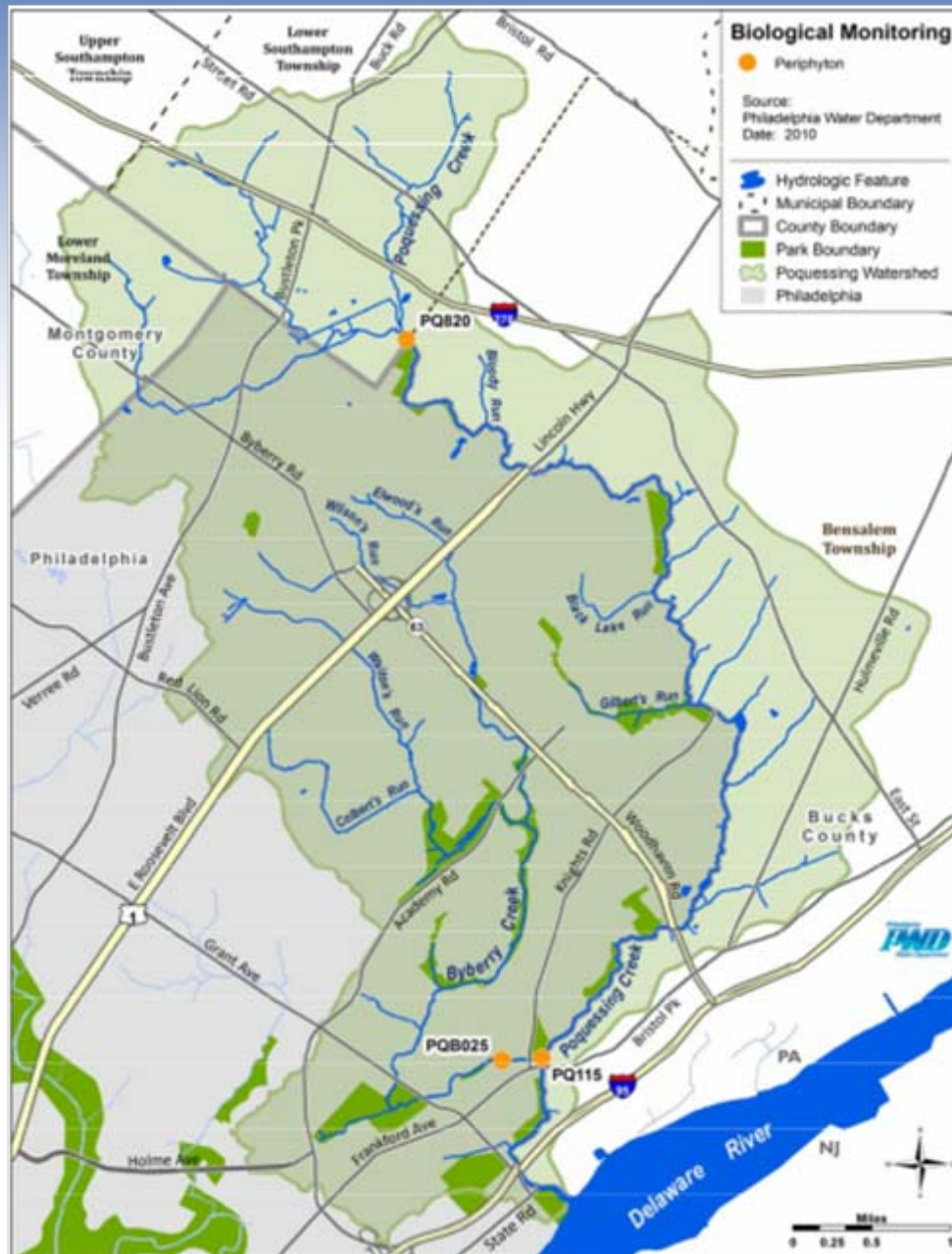


Figure 5.26 Percentage of Fish with Disease, Tumors, Fin Damage, or Anomalies

Algae Sites



2 Poquessing
1 Byberry Creek

Continuous
and wet weather
chemistry sites

Algae Results

- All sites had dense coverage of algae
- Community dominated by algae tolerant of high nutrients, conductivity, sediment
- Fairly balanced C:N:P ratio

Table 5.17 Mean C, N, P, and Chl-*a* Concentrations of Periphyton Samples from 3 Poquessing Creek Sites, 2008

Site ID	River Mile	C (g/m ²)	N (g/m ²)	P (g/m ²)	C:N:P	Chl-a (mg/m ²)
PQB025	0.25	14.55	2.03	0.26	56:8:1	124.636
PQ820	8.2	7.11	0.95	0.17	42:6:1	107.781
PQ115	1.15	8.01	1.06	0.173333	46:6:1	91.056
Redfield Ratio	---	---	---	---	41:7:1	---

Physical Assessment

Physical Assessment

- Qualitative Habitat Assessment
 - same sites as benthic invertebrates
- River2D Modeling of fish habitat
- Fluvial Geomorphology (FGM)
- Infrastructure Assessment

Physical Assessment Results

- Habitat at most sites rated as "marginal"
- Most scores 20% lower than in 2001 assessment, may indicate year-year bias

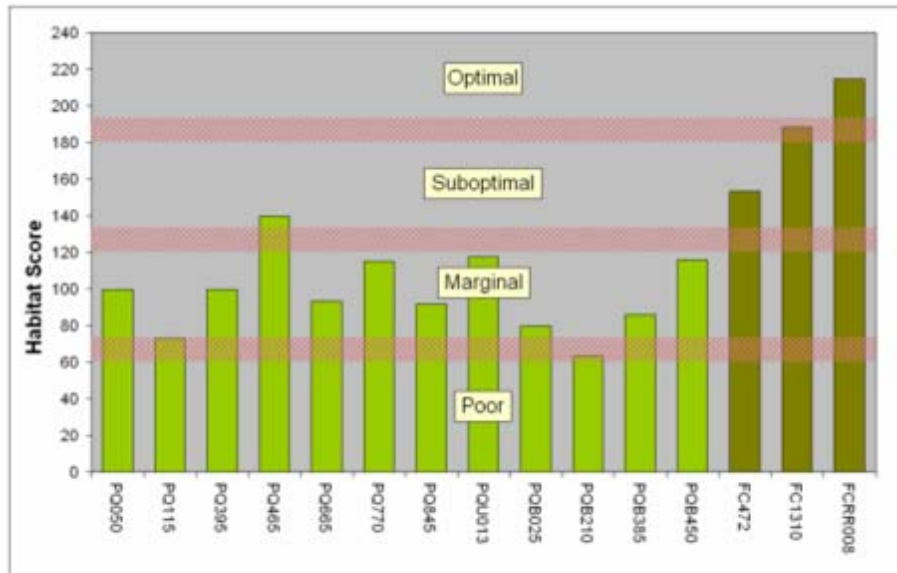


Figure 6.3 PADEP ICE Protocol Total Habitat Quality Score for Poquessing Creek Watershed and French Creek Reference Sites, 2008

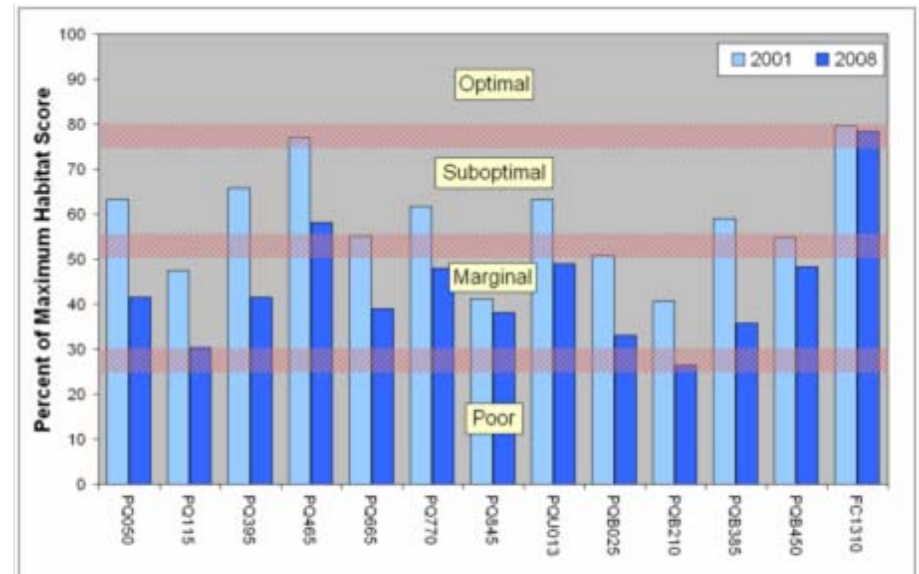


Figure 6.5 Normalized Habitat Scores for Poquessing Creek Watershed and French Creek Reference Sites, 2001 and 2008

River2D Fish Habitat Analysis

- Highly detailed physical survey of site
- Post-processing to develop model mesh
- Quantitative assessment of suitable habitat area for various fish groups

Table 6.4 River 2D Weighted Usable Area for 3 Generalized Fish Guilds at 5 Sites in Poquessing Creek Watershed, 2008

SITE	Q (m ³ /s)	Length (m)	Area (m ²)	Depth _{max} (m)	Velocity _{ma} ^x (m/s)	WUA _p (m ²)	WUA _r (m ²)	WUA _g (m ²)	H _p (%)	H _r (%)	H _g (%)
PQ050	0.15	114.91	1179.42	0.73	0.62	149.34	30.27	284.74	12.66	2.56	24.14
PQ115	0.10	115.21	816.16	0.64	0.45	94.17	18.93	255.71	11.54	2.32	31.33
PQ825	0.146	109.12	545.09	0.74	0.65	117.34	43.26	237.52	21.53	7.94	43.5
PQB025	0.25	106.07	822.04	1.69	0.96	162.89	60.84	250.46	19.82	7.40	30.47
PQB385	0.146	110.95	705.37	0.63	1.47	90.64	84.08	197.36	12.87	11.92	27.98

River2D Fish Habitat Analysis

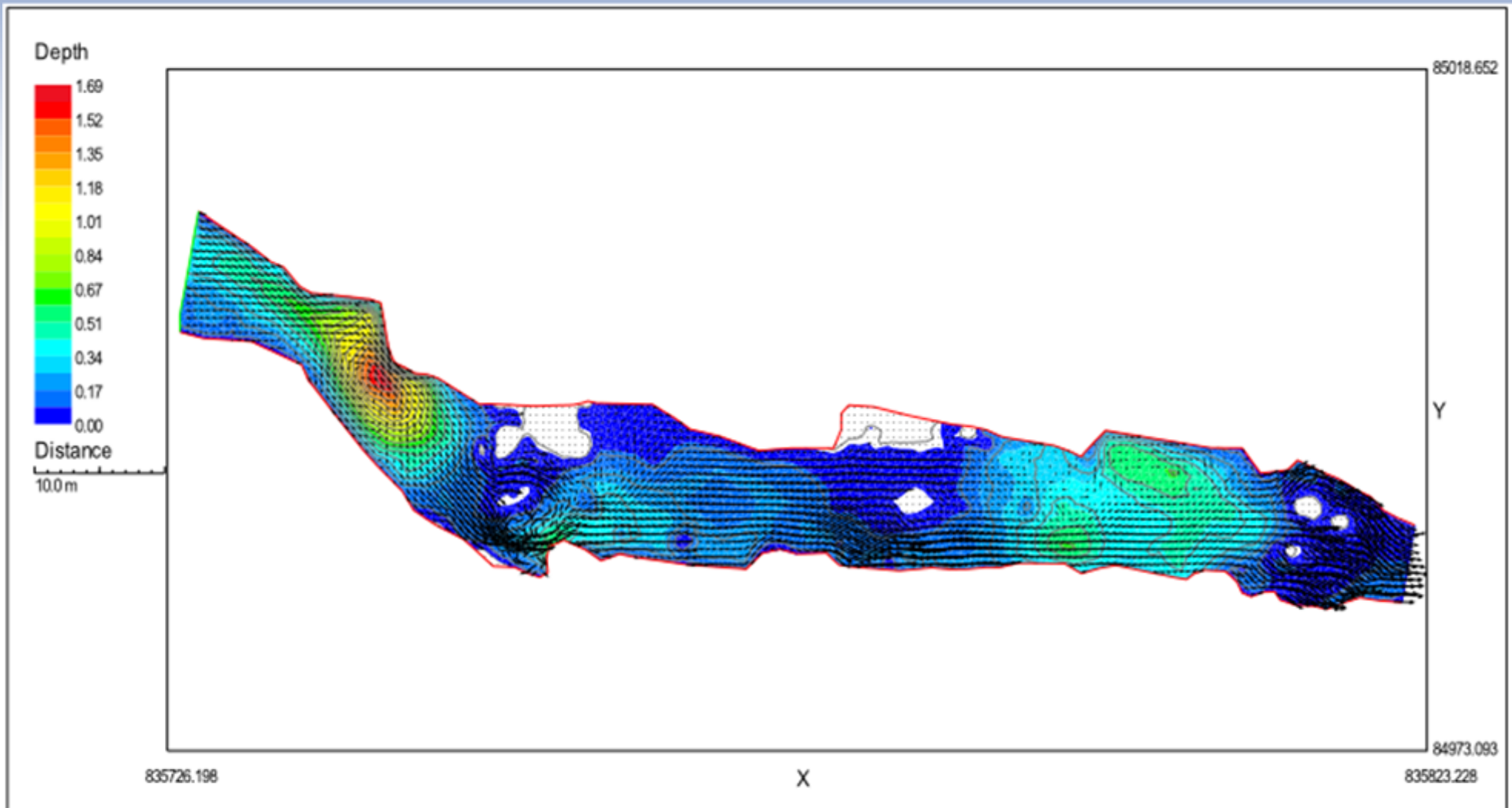


Figure 6.13 River2D Modeled Depth and Velocity Profile of Byberry Creek Site PQB025

Poquessing CCR Online

http://www.phillywatersheds.org/doc/Poquessing_CCR.pdf

Appendix

http://www.phillywatersheds.org/doc/Poquessing_CCR_Appendix.pdf

Questions?