Maryland's Anacostia Sediment TMDLs - Endpoints and Strategies

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Interstate Commission on the Potomac River Basin

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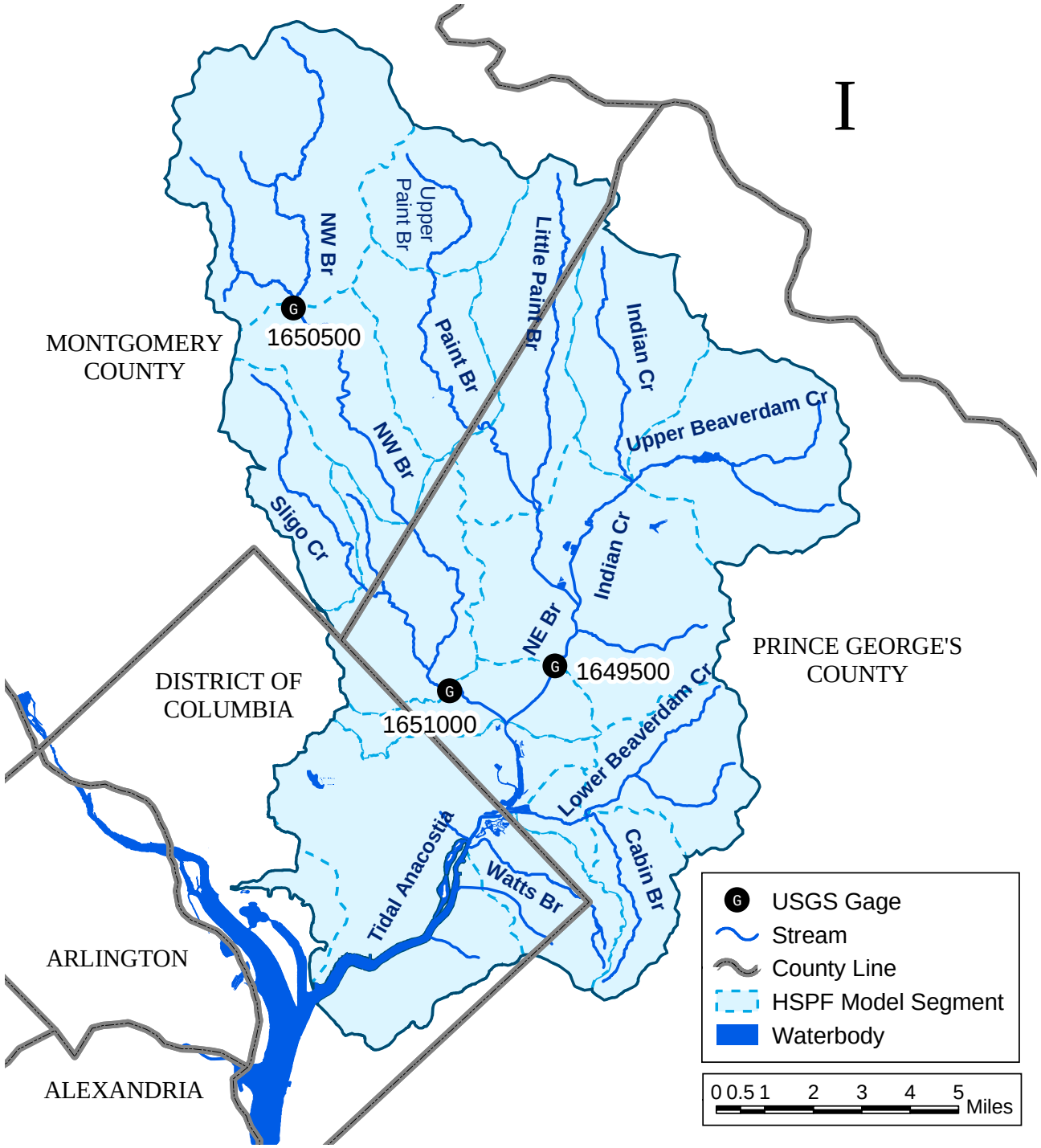
Maryland's Anacostia Sediment TMDLs - Overview

- Biological problems potentially related to sediment
- Hydrologic/water quality/habitat conditions related to sediment
- Water Quality Standards in the Anacostia
- Maryland's Anacostia sediment TMDL strategy

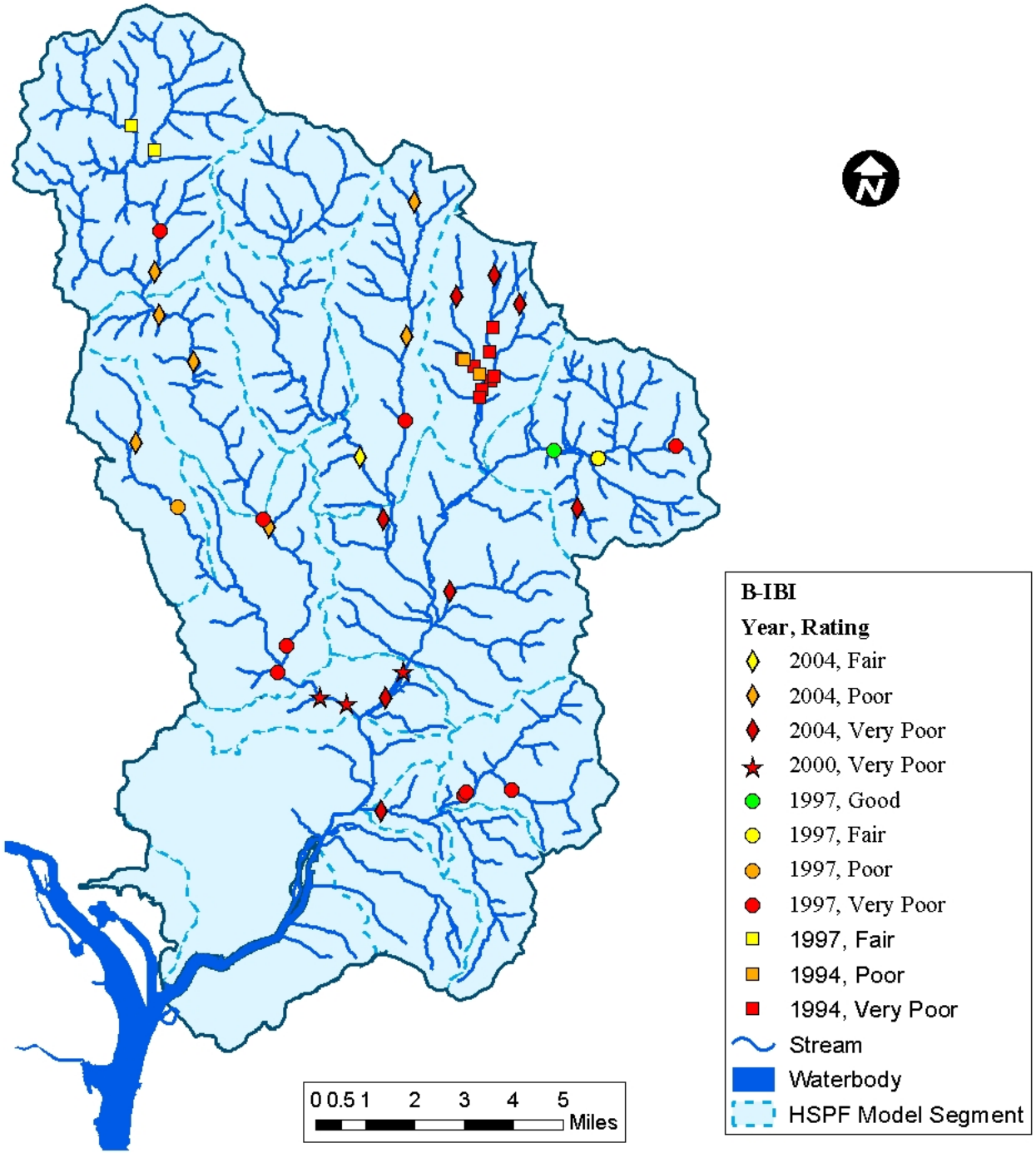
Anacostia Watershed



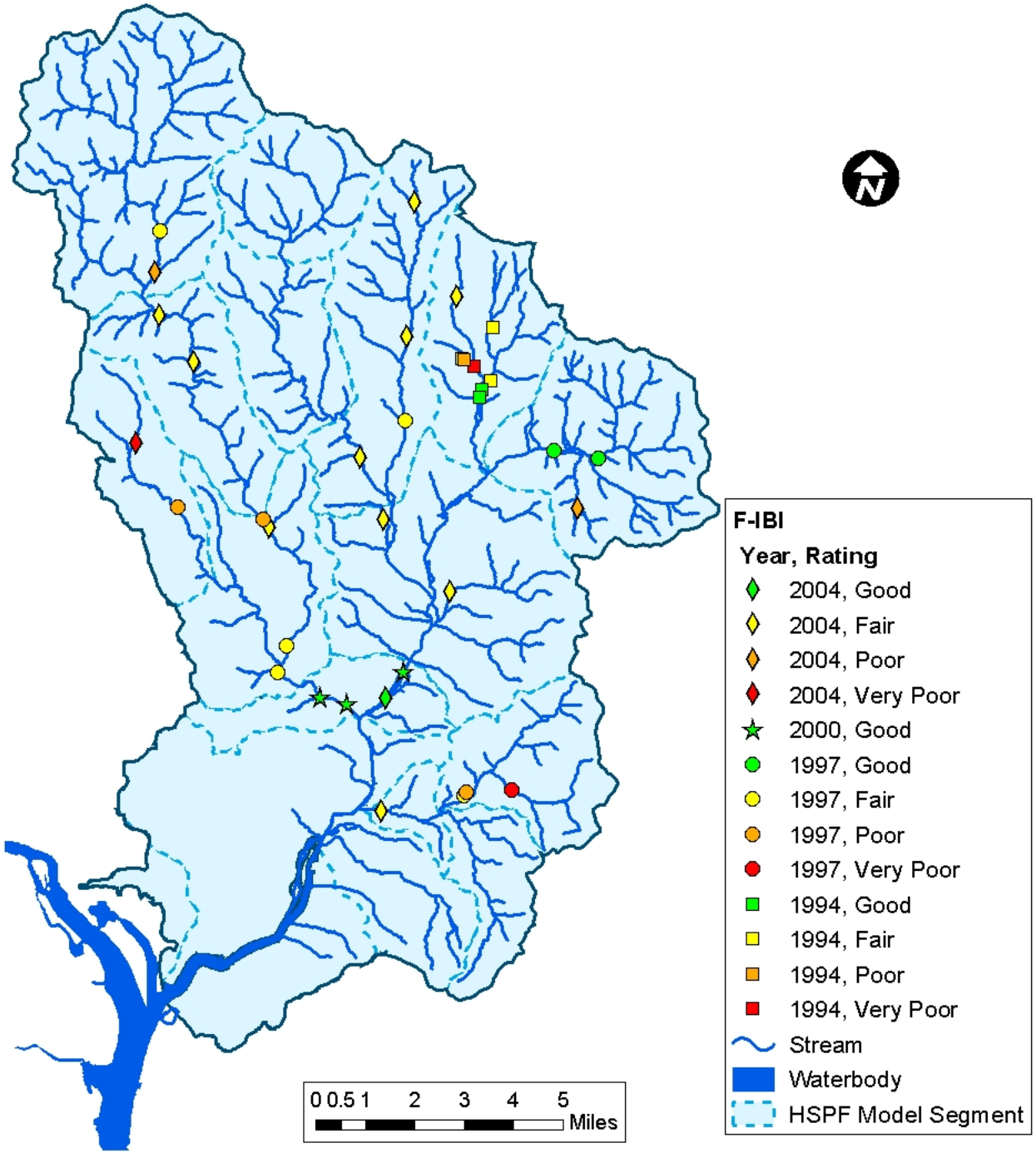
Biological Problems Potentially Related to Sediment

- **Biological assessment results for non-tidal streams fair to very poor in most areas**
  - MD DNR Maryland Biological Stream Survey (MBSS)
  - Mont. Co. DEP and PG Co. DER biological assessments
- **Submerged aquatic vegetation (SAV) monitoring in tidal river indicate little growth, poor coverage**
  - DC DOH annual surveys
  - Chesapeake Bay Program studies

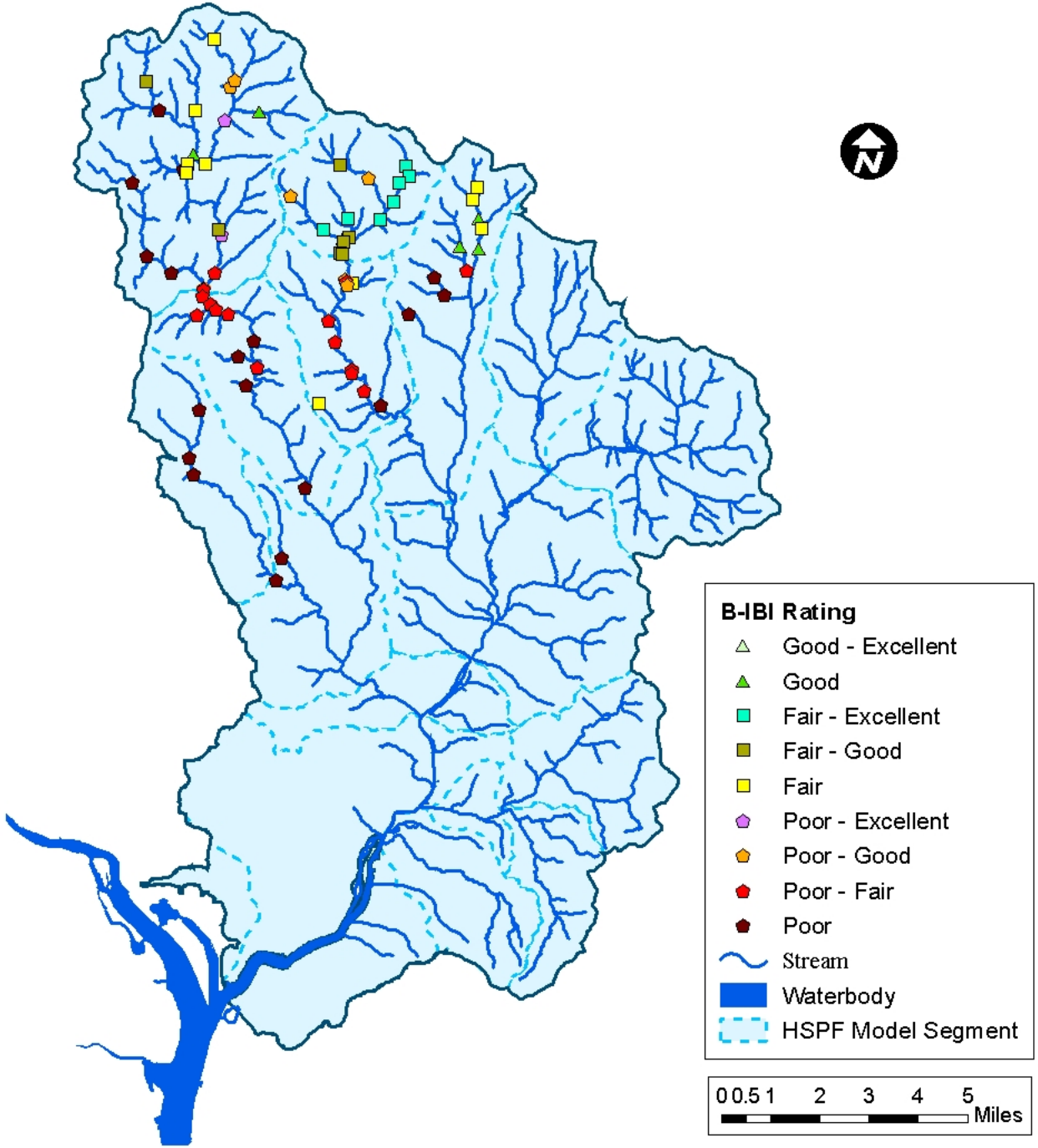
Non-tidal Streams - MBSS Results for Benthic Communities



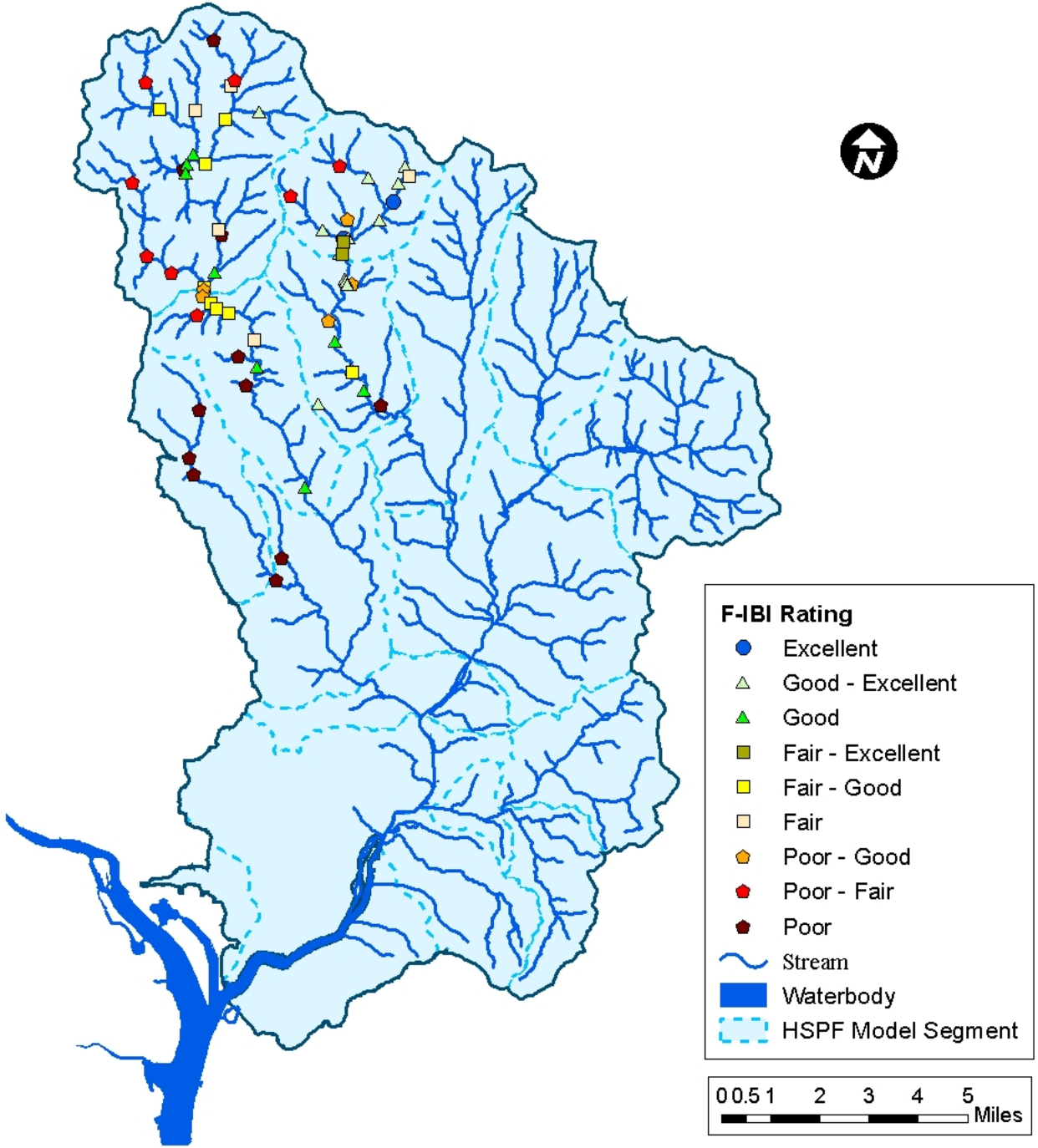
Non-tidal Streams - MBSS Results for Fish Communities



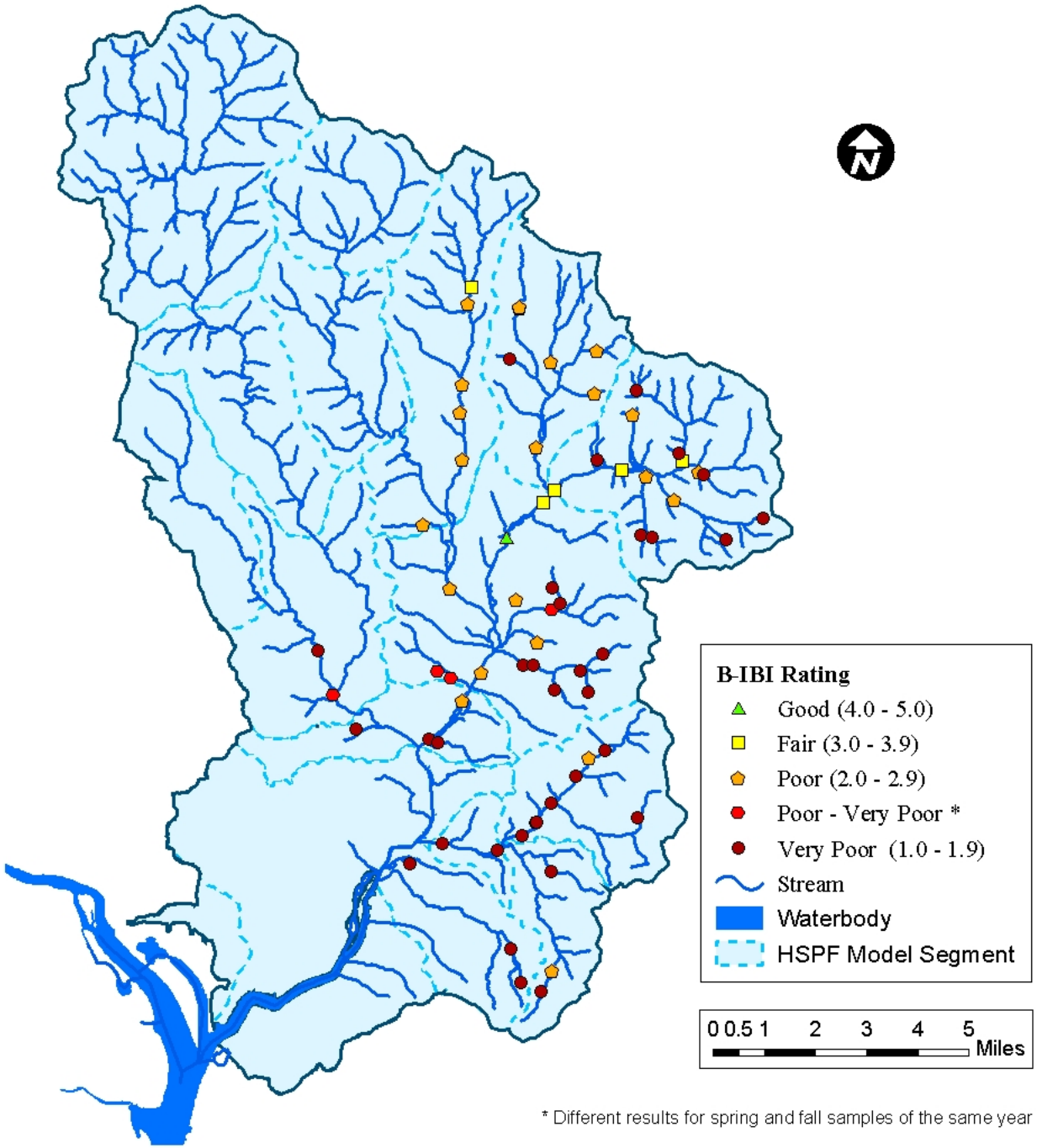
Non-tidal Streams - Mont. Co. Results for Benthic Communities



Non-tidal Streams - Mont. Co. Results for Fish Communities

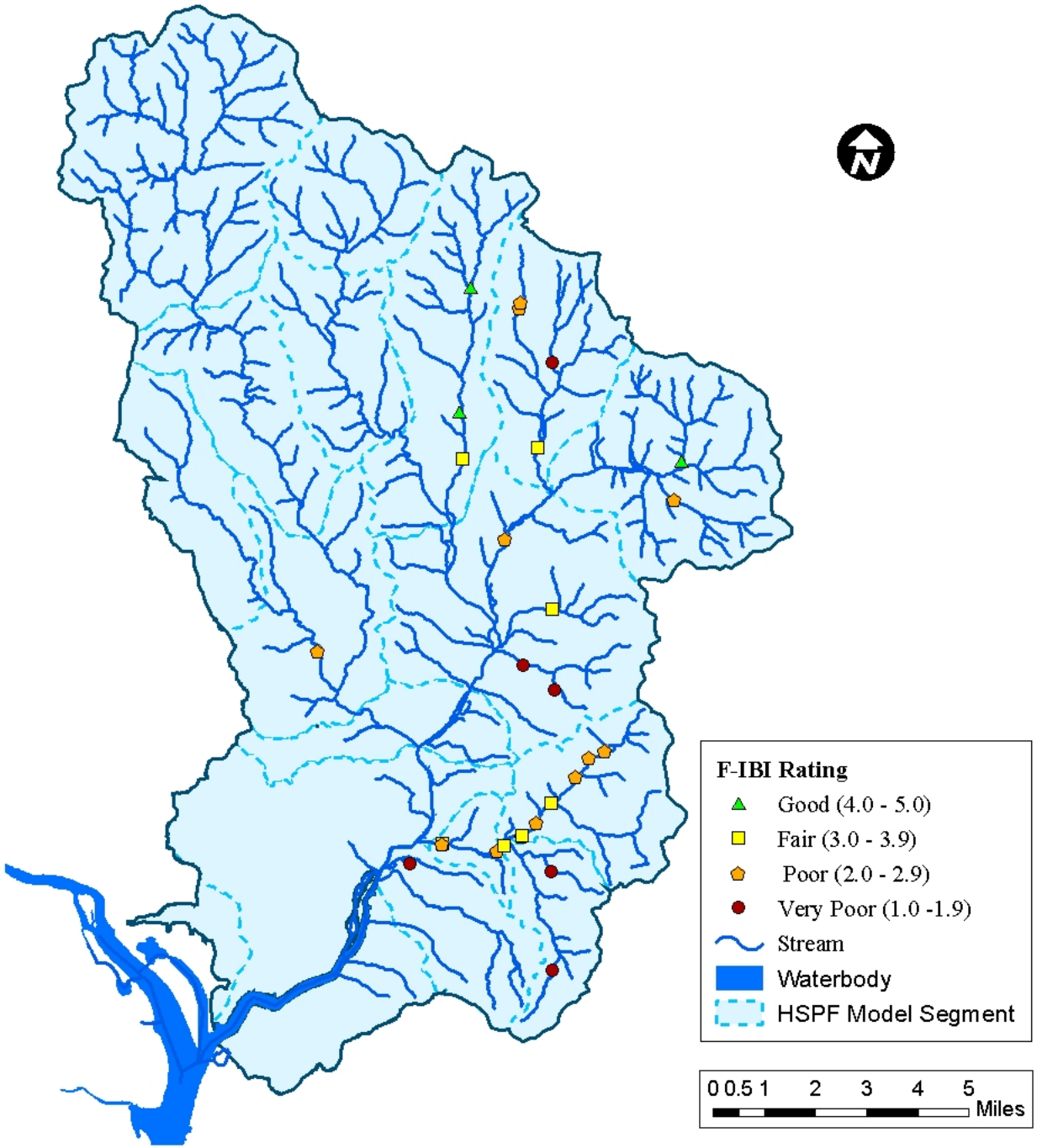


Non-tidal Streams - PG Co. Results for Benthic Communities



* Different results for spring and fall samples of the same year

Non-tidal Streams - PG Co. Results for Fish Communities

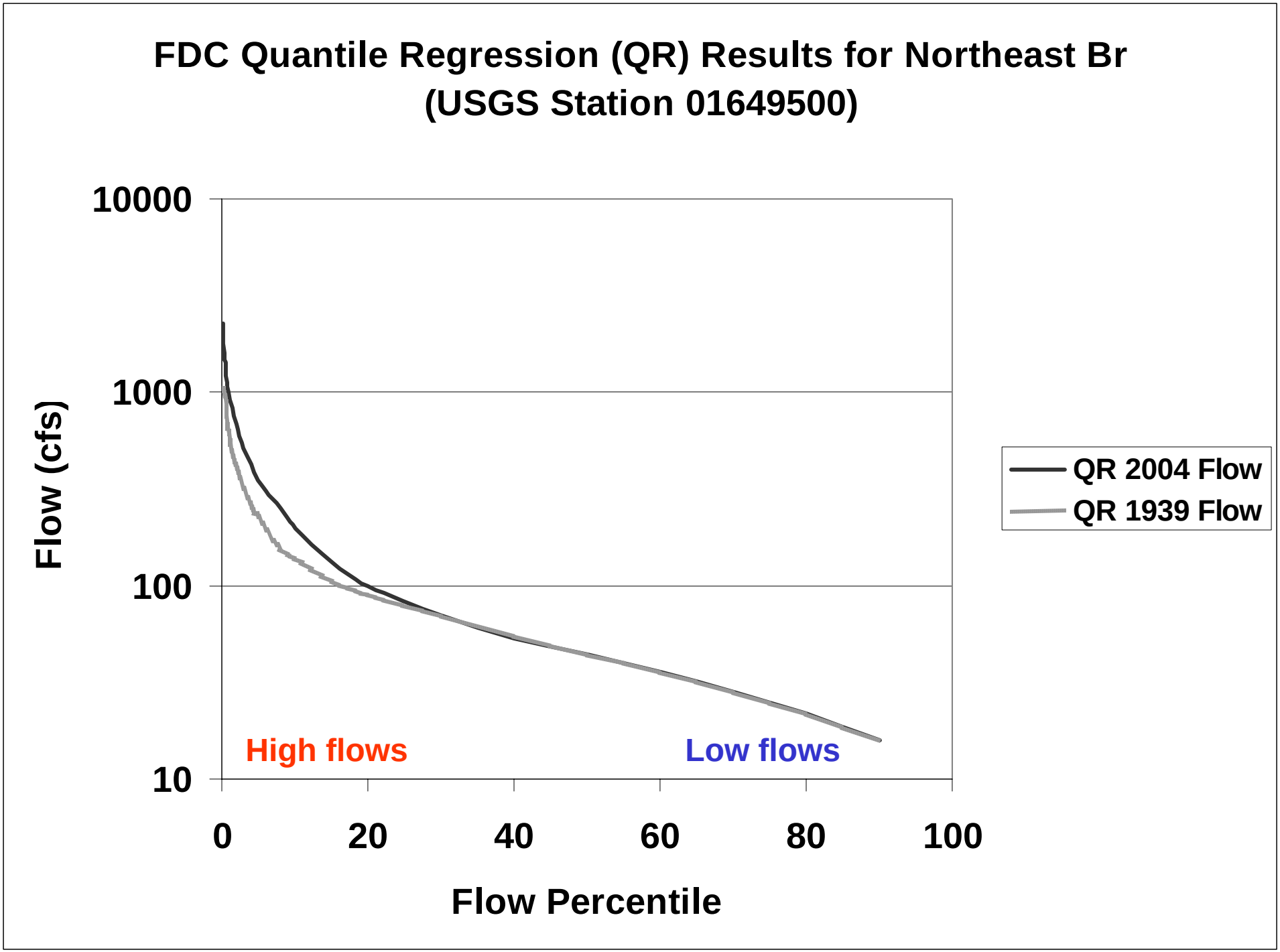


Tidal Anacostia – SAV Monitoring Results

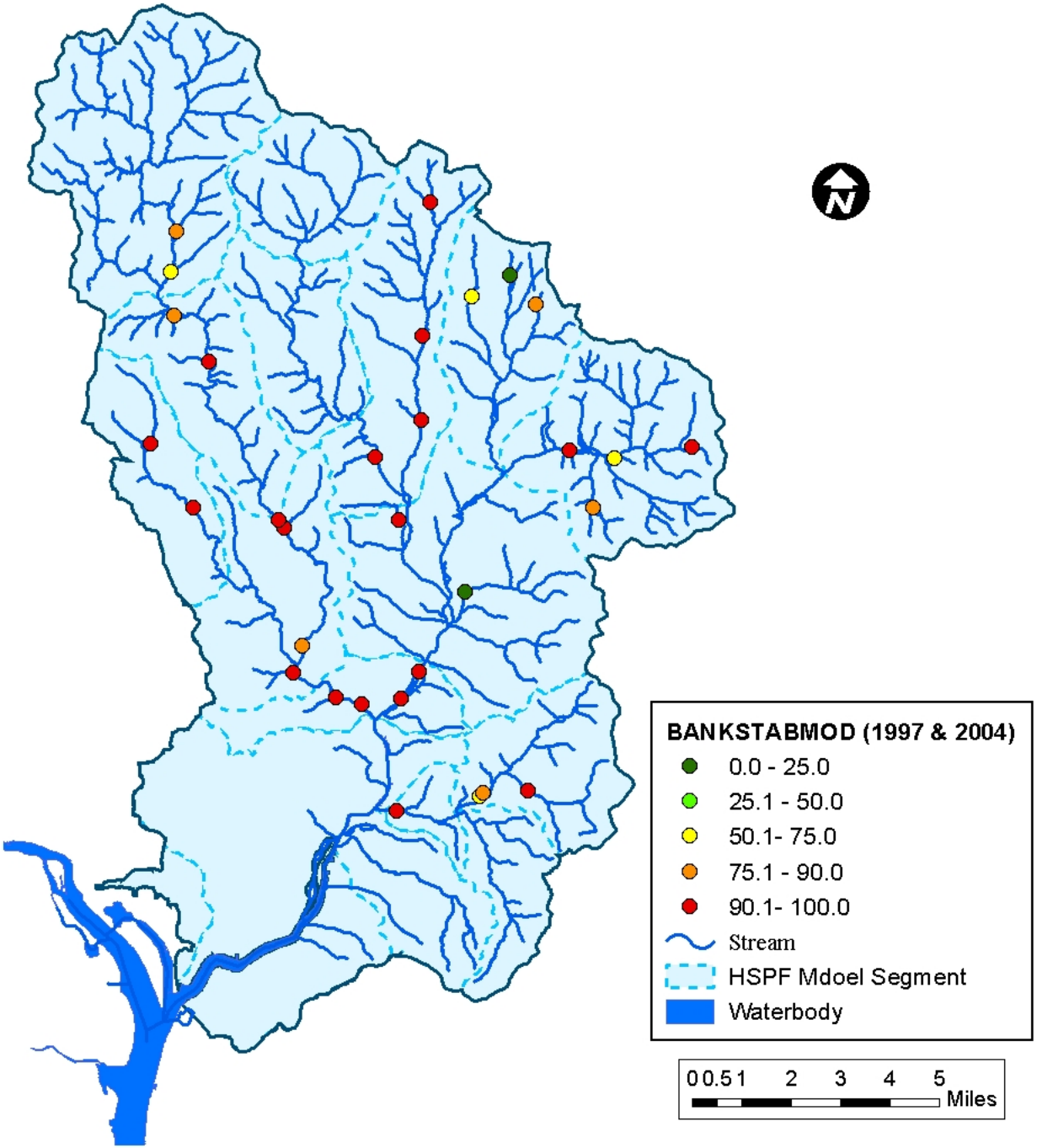
- **Importance of SAV:**
  - Provides habitat and food for aquatic organisms
  - Improves water clarity by hastening sediment settling
- **Status of SAV in tidal Anacostia:**
  - Chesapeake Bay Program estimates SAV in Anacostia for years 1984 through 2000 ranging from 5 to 15 acres; potential acreage of 321
  - DCDOC reports no SAV in upper river and little species diversity and poor cover density in mid and lower river

Hydrologic/Water Quality/Habitat Conditions Related to Sediment

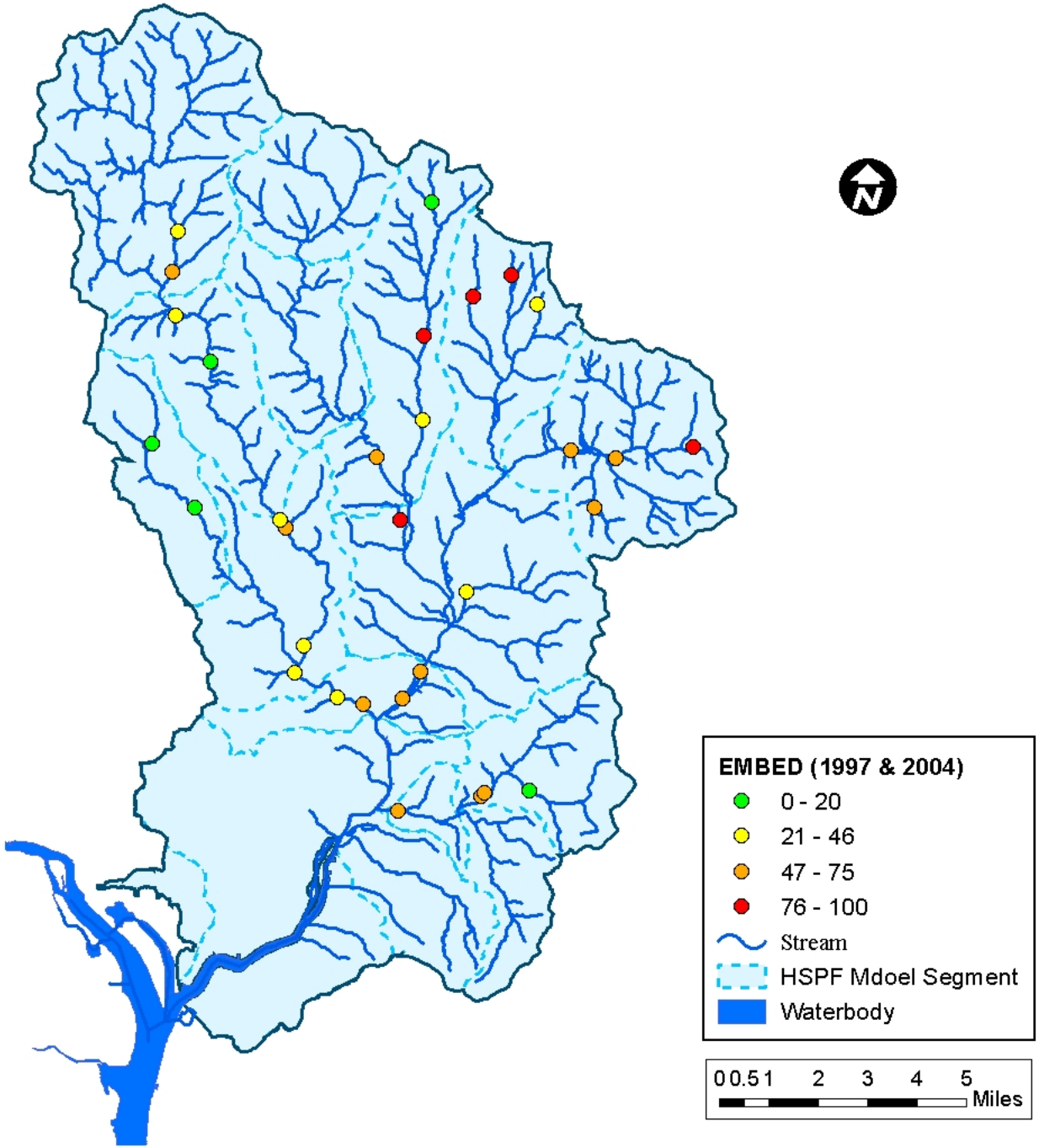
- **Statistical analyses (using "quantile regression") of flow duration curves (FDC) indicate higher storm flows after urban development/altered hydrology**
  - USGS daily flow data from stations on main branches
- **Physical habitat assessments of non-tidal streams finds eroded/altered stream channels**
  - MD DNR's MBSS data
  - Mo. And PG Counties assessment data
  - MWCOG bank stability pilot study for Upper Beaverdam Cr
  - Suspended sediment monitoring data at USGS gages
- **Water quality monitoring of tidal river indicates poor water clarity**
  - DC DOH routine monitoring program
  - MD DNR routine monitoring program

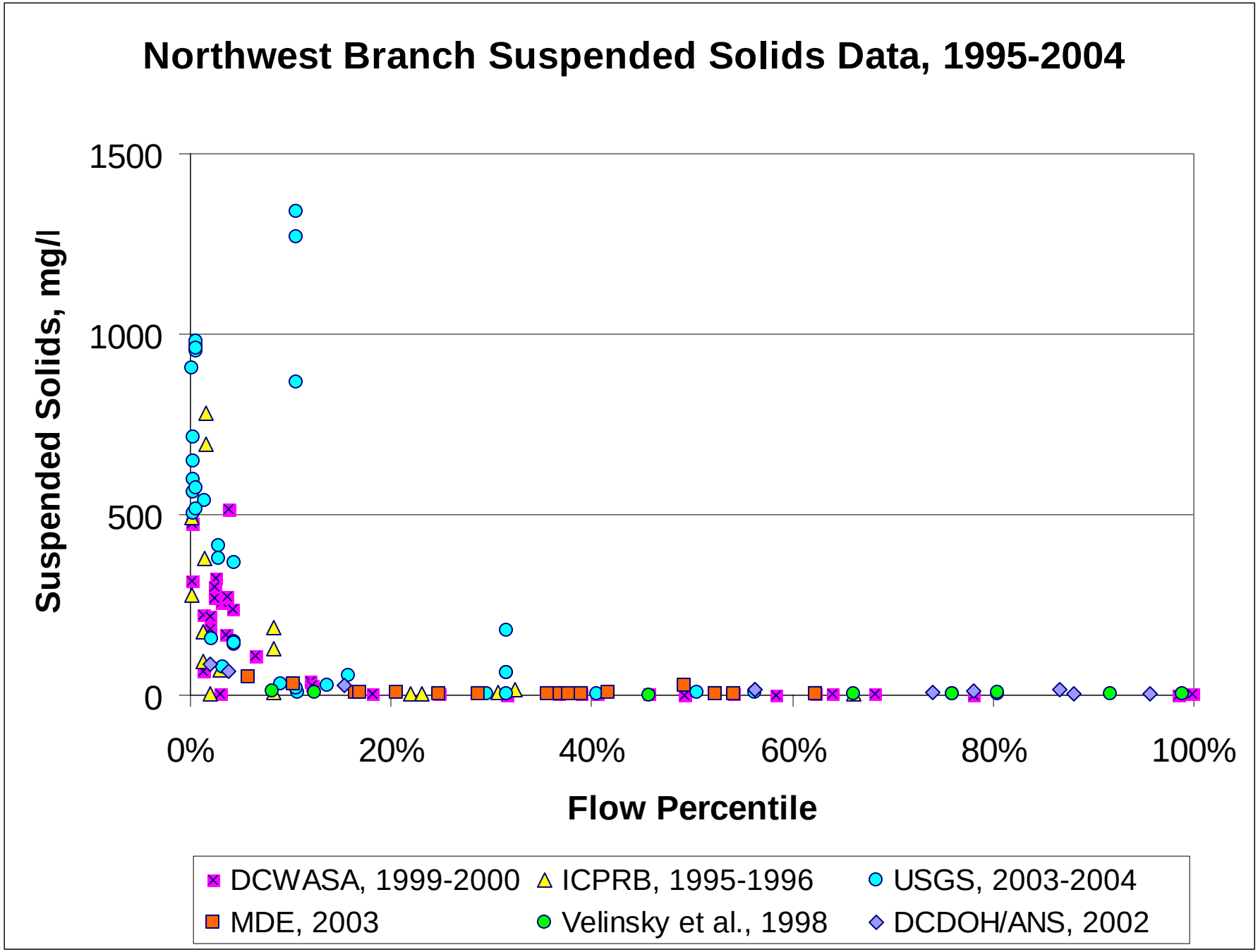

FDC Quantile Regression (QR) Results for Northeast Br
(USGS Station 01649500)
10000
1000
100
10
Flow (cfs)
0
20
40
60
80
100
Flow Percentile
High flows
Low flows
QR 2004 Flow
QR 1939 Flow

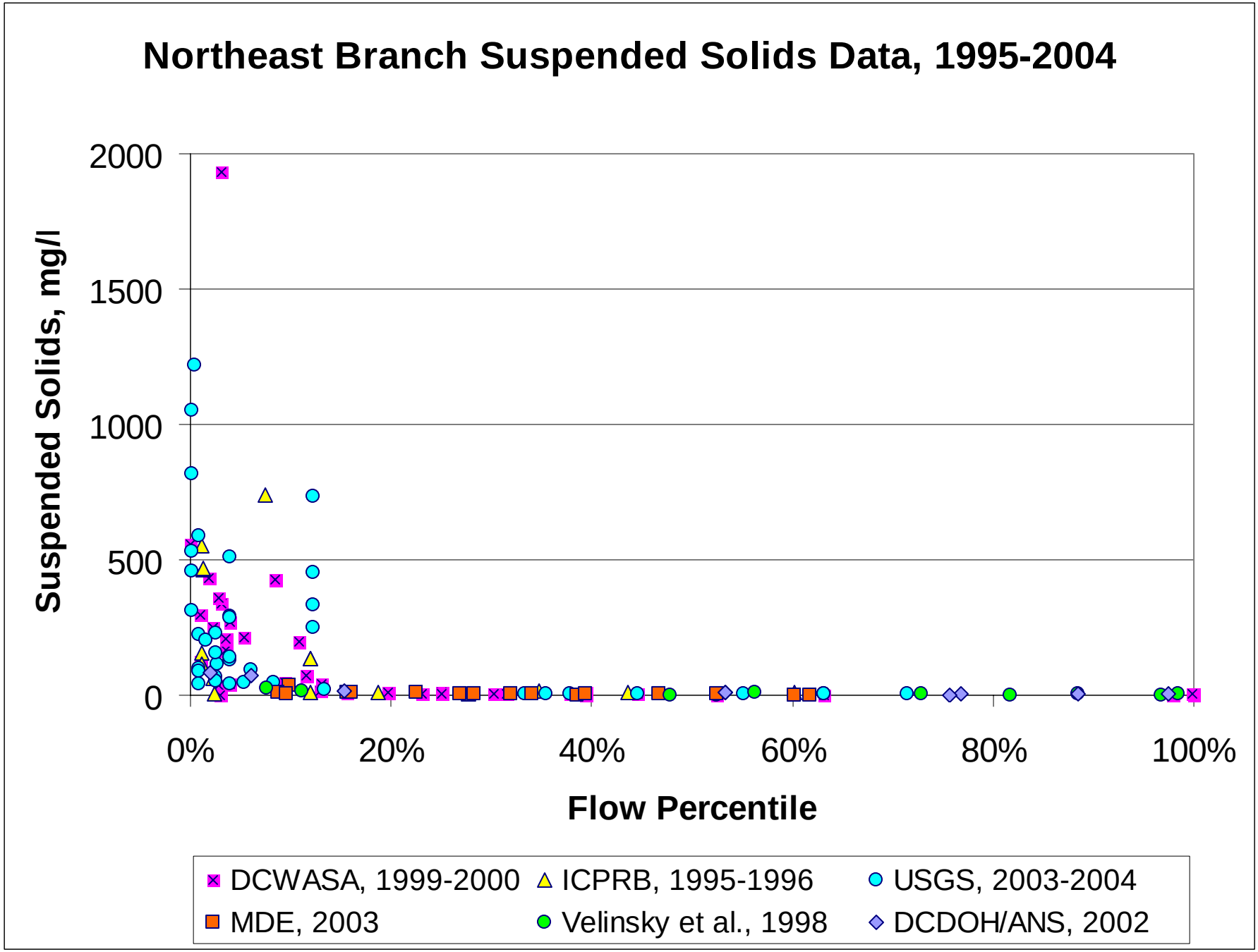
Non-tidal Streams - MBSS Results for Stream Bank Stability



Non-tidal Streams - MBSS Results for Stream Channel Embeddedness




Northwest Branch Suspended Solids Data, 1995-2004
Suspended Solids, mg/l
1500
1000
500
0
0%
20%
40%
60%
80%
100%
Flow Percentile
DCWASA, 1999-2000
ICPRB, 1995-1996
USGS, 2003-2004
MDE, 2003
Velinsky et al., 1998
DCDOH/ANS, 2002


Northeast Branch Suspended Solids Data, 1995-2004
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2000
1500
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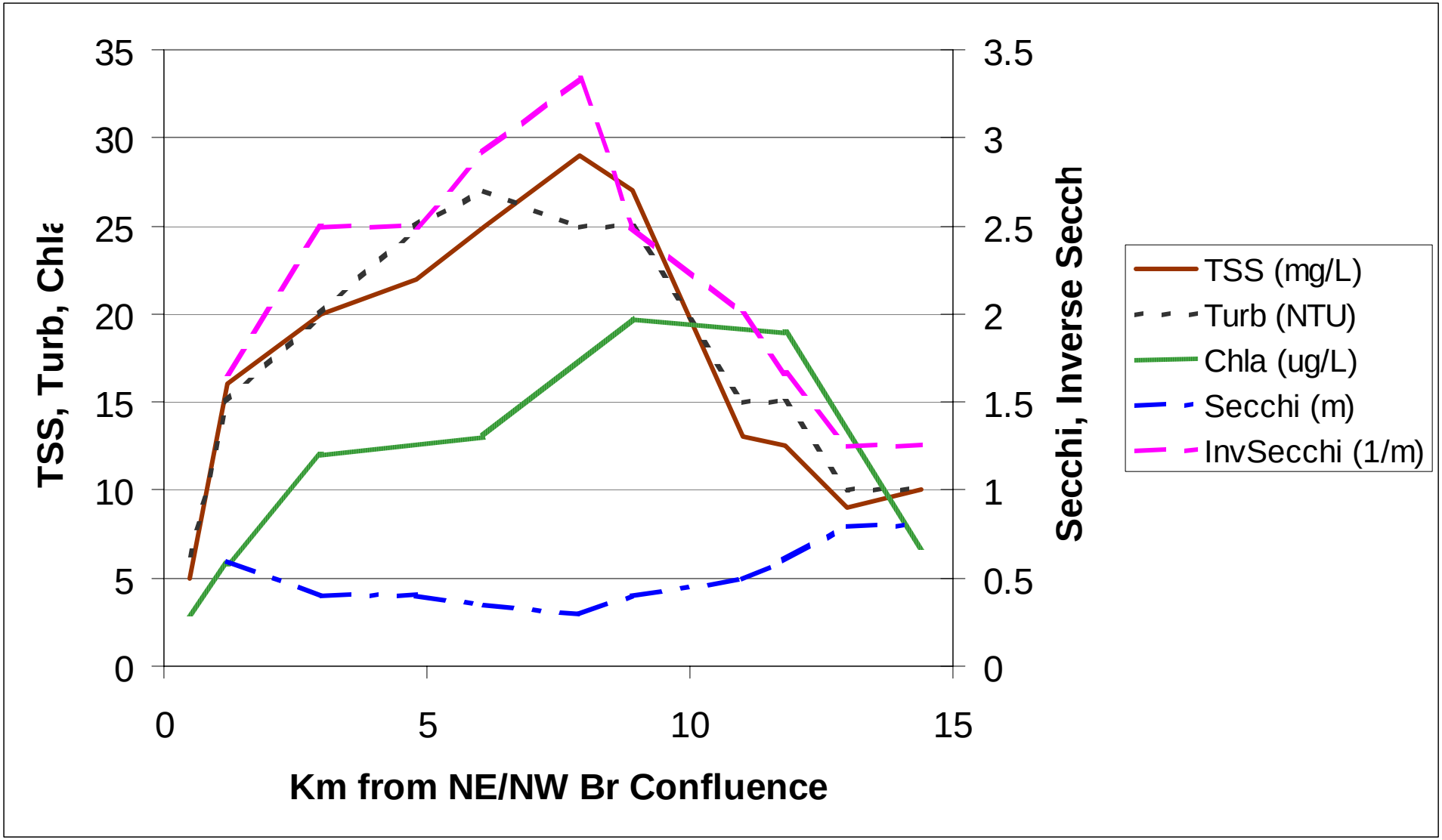
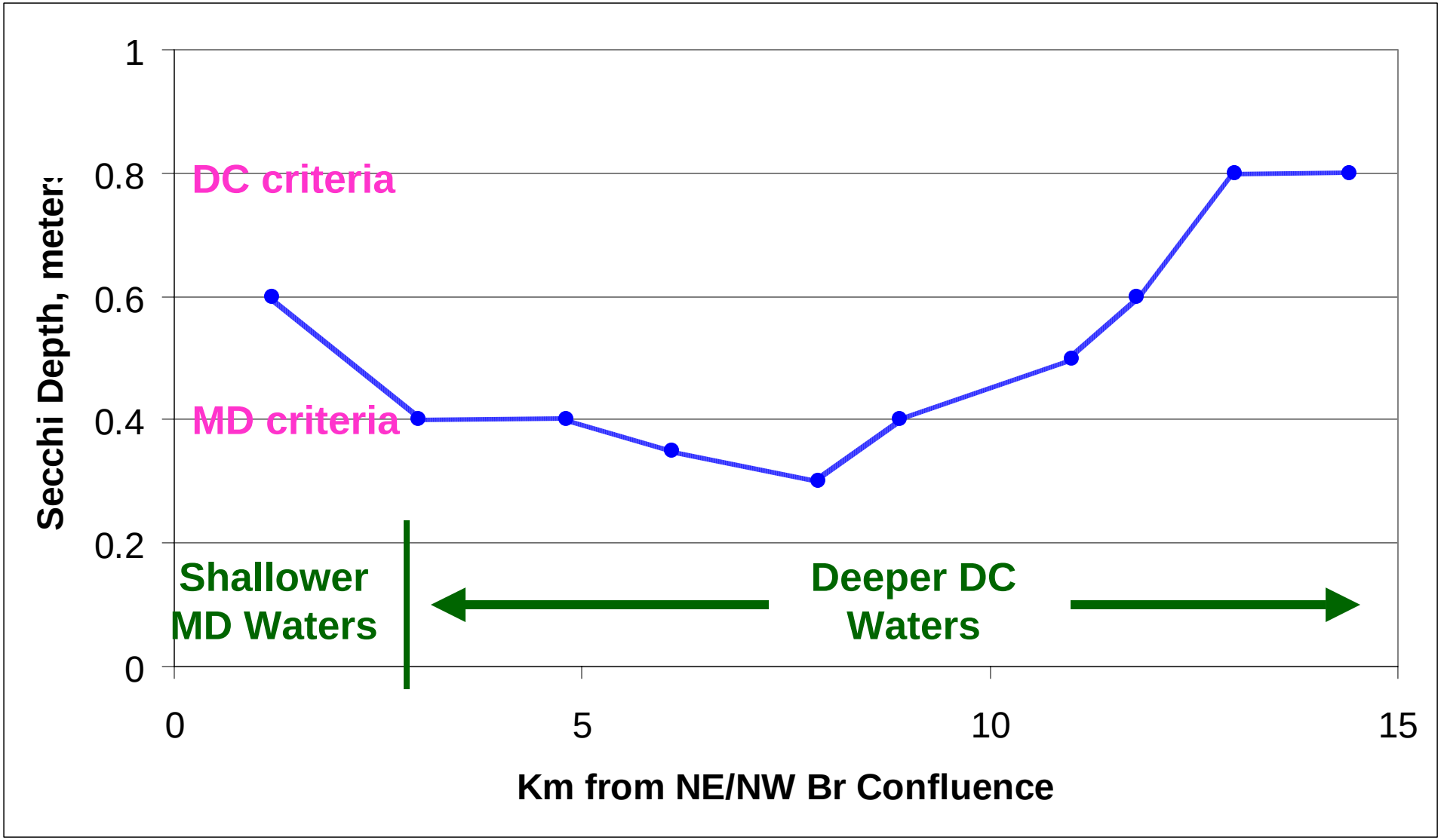
Long-Term Growing Season Medians of Water Quality Parameters



Water Quality Standards in the Anacostia Related to Sediment

	Designated Use	Streams	Water Quality Standards
MD tidal	Use II: Support of estuarine and marine aquatic life and shellfish harvesting – seasonal shallow water SAV subcategory	MD portion of tidal Anacostia	Secchi depth criteria = 0.4 meters
MD non-tidal	Use I: Protection of nontidal warmwater aquatic life	All non-tidal MD streams except those designated Use III and IV	Biological criteria - based on biological assessment data
	Use III: Nontidal cold water (supporting self-sustaining trout populations)	Paint Br above Beltway	Biological criteria - based on biological assessment data
	Use IV: Recreational trout waters	Northwest Br above Hiway 410	Biological criteria - based on biological assessment data
DC tidal	Class 3: Protection & propagation of fish, shellfish and wildlife	DC portion of tidal Anacostia	Secchi depth criteria = 0.8 meters
DC non-tidal	Class 3: Protection & propagation of fish, shellfish and wildlife	All non-tidal DC streams	Narrative criteria: protection of aquatic life

Long-Term Growing Season Median Secchi Depths



MD Anacostia Sediment TMDL Strategy - Challenges

- **Need to meet a variety of water quality criteria in two separate jurisdictions**
  - Solution: calculate required load reductions for each criteria – final TMDL allocations will meet most stringent load reduction requirement
- **Need to quantify relationships between conditions in watershed, solids loads, and water quality conditions**
  - Focus on problems (and solutions) for modern urban watershed

Non-tidal TMDLs – Two-Component Approach

- **ICPRB HSPF model used to compute solids loads from major sub-watersheds:**
  - Model used to estimate current loads from all modeled sub-watersheds
  - “Reference” sub-watershed loads used as TMDL “targets” to determine required load reductions
- **Flow duration curve/quantile regression analysis used to help determine portion of loads due to altered hydrology:**
  - Use QR-estimated 2004 FDC and current sediment rating curve to estimate current loads
  - Use QR-estimated 1939 FDC and current sediment rating curve to estimate portion of current load resulting from altered hydrology

ICPRB's Anacostia HSPF Model – "Phase 3"

- Calibration data from 1995 – 2004, includes new Northeast/Northwest Branch suspended solids data from USGS storm water monitoring study funded by MDE/PG County
- Calibration to monthly loads estimated with USGS's ESTIMATOR model
- Land use areas from Maryland Department of Planning layer; impervious surface estimates from county's layers of buildings, roads, etc.
- EOS estimates from means of Maryland state-wide MS4 monitoring program

Reference Watershed: Upper Paint Br (7.5 mi^2 above Fairland Rd)

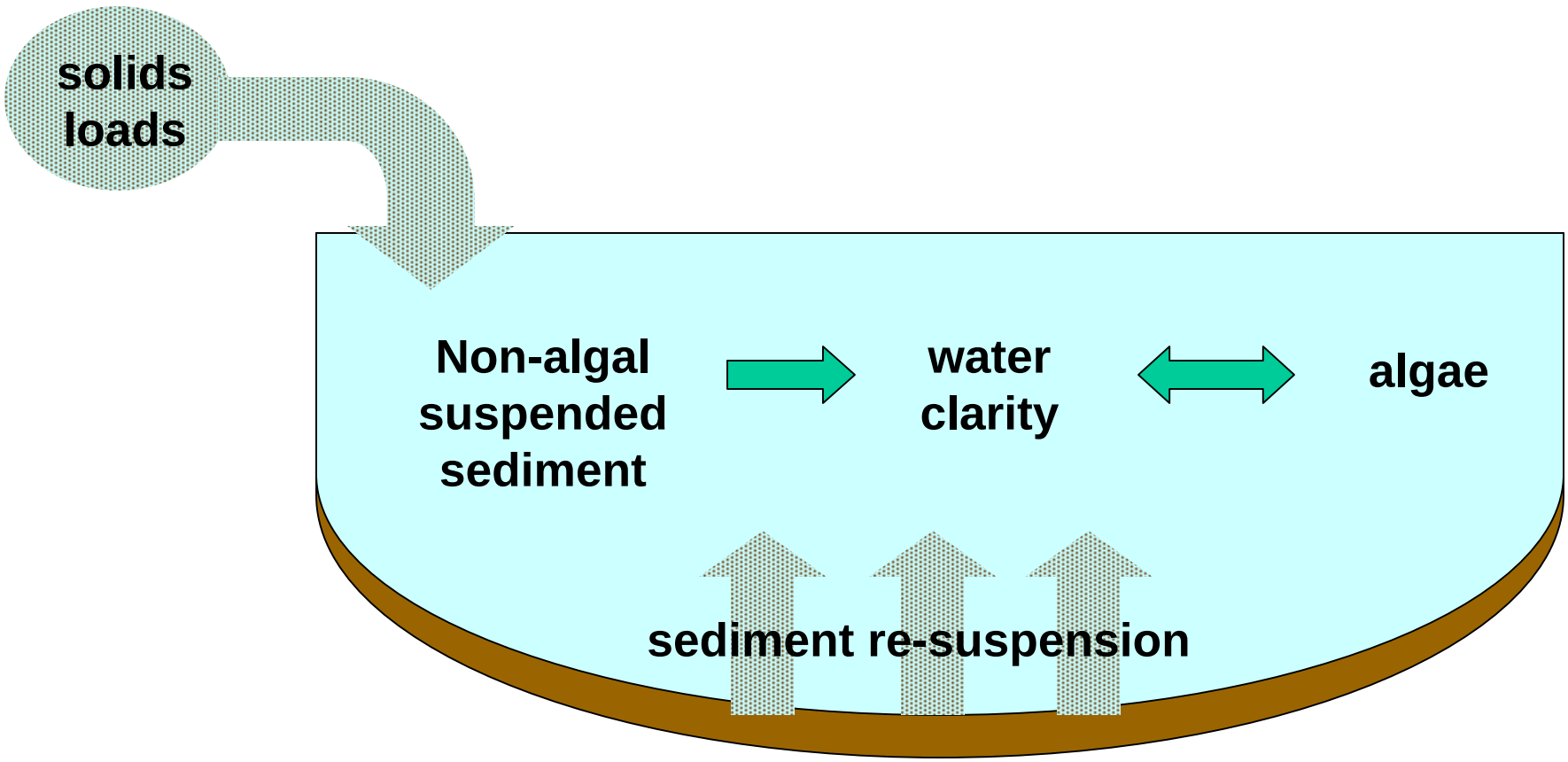
- Located in Piedmont physiographic province
- Low and medium density residential land use with large areas of forested parkland
- Spawning and nursery area for trout
- Designated by Mo. Co. as Special Protection Area (SPA) in 1995 – impervious cap of 10%
- Some degradation due to lack of SW controls in older developed areas
- Stormwater retrofits and stream restoration projects underway
- WRAS under development by Mont. Co.

<u>Reference Watershed</u>: Upper Beaverdam Cr (13.9 mi^2)

- Predominantly forest and agricultural; institutional (BARC); only 4.4% impervious in ICPRB Phase 2
- Highest percentage forest cover in the Anacostia watershed
- 475 acres designated "Wetland of Special Concern"
- More than 50% designated "Ecologically Significant Area"
- MDE streambank erosion study by COG concluded "the Upper Beaverdam Creek mainstem represents an excellent mainstem reference stream area for the Anacostia watershed"
- Large uncontrolled impervious surface areas exist at BARC, Goddard, BW Parkway and HEW

Tidal TMDL Approach

Use coupled sediment transport/eutrophication water quality models to simulate water clarity:



Tidal TMDL Approach - Details

- Using available data from 1995 through 2004
- Using TAM/WASP 1-dimensional modeling framework
- Northeast/Northwest Branch load estimates obtained from ESTIMATOR model concentration/flow regression results
- New information on sediment re-suspension processes from recent DCDOH/VIMS study will be incorporated
- New regression equation developed relating non-algal suspended solids concentrations and chlorophyll *a* concentrations to light attenuation coefficient

Conclusion

- The Anacostia River and tributaries constitute a valuable resource for residents of both Maryland and the District of Columbia
- Problems due to sediment, now largely a result of urbanization, will require concerted effort by all jurisdictions and stakeholders
- Maryland's Anacostia sediment TMDL will meet water quality standards of both Maryland and the District of Columbia