Ecological Sustainability in Rapidly Urbanizing Watersheds: Evaluating Strategies Designed to Mitigate Impacts on Stream Ecosystems

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Collaborative Science and Technology Network
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Collaborators

- The Palmer Lab
- Montgomery County Department of Environmental Protection
- ESA, Inc.
- USGS-Water Resources Division
- EPA Environmental Photographic Interpretation Center

Project Goals

- Determine environmental responses as urbanization occurs
  - off channel (groundwater)
  - in-channel (surface water and streambed)
  - below channel (hyporheic)
- Evaluate long-term effectiveness of stormwater management technologies
  - in mitigating impacts from urbanization
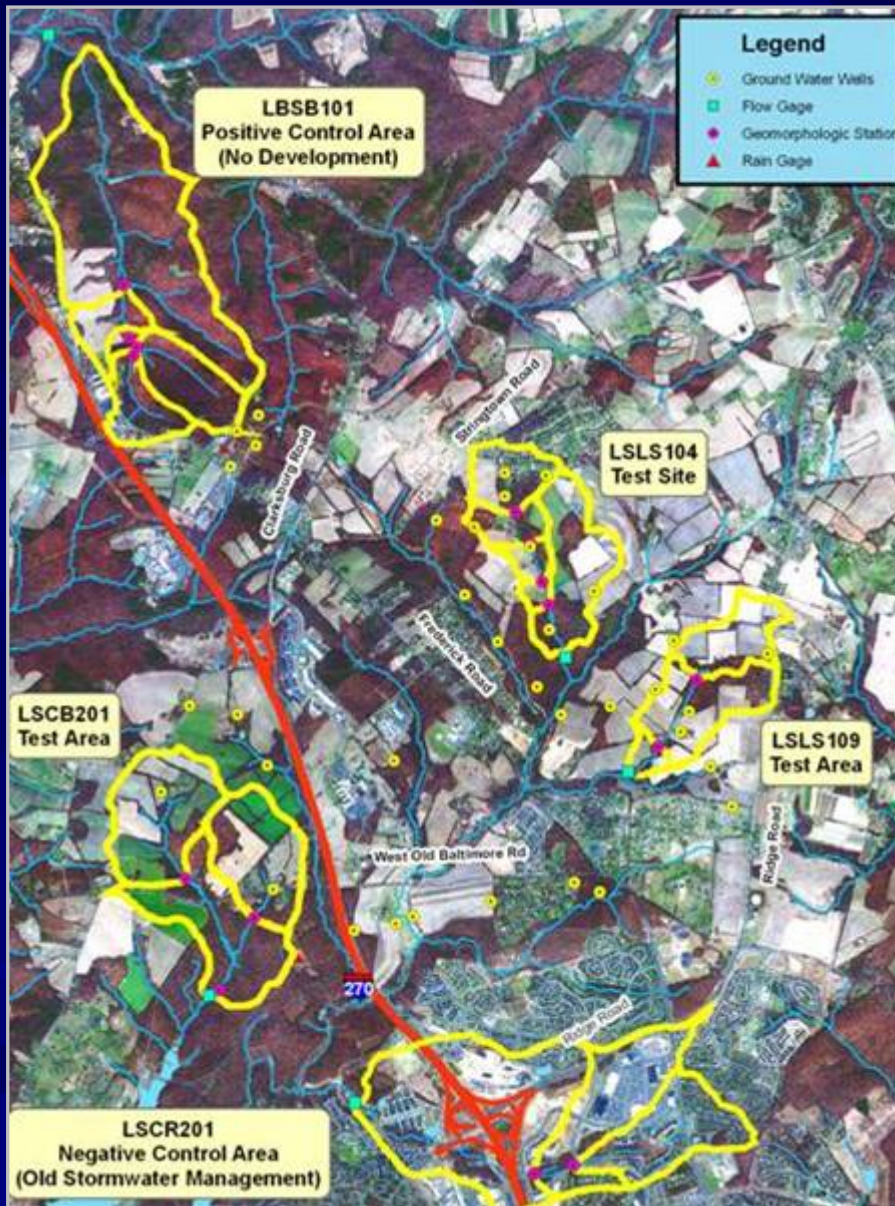 - sustaining structure and function of headwater streams

MD 2000 Stormwater Management Design Manual

- **Unified Sizing Criteria**
  - Water Quality Volume
  - Recharge Volume
  - Channel Protection Volume
  - Overbank Flood Protection
  - Extreme Flood Protection
- **Include credits for innovative site planning**
  - non-structural practices
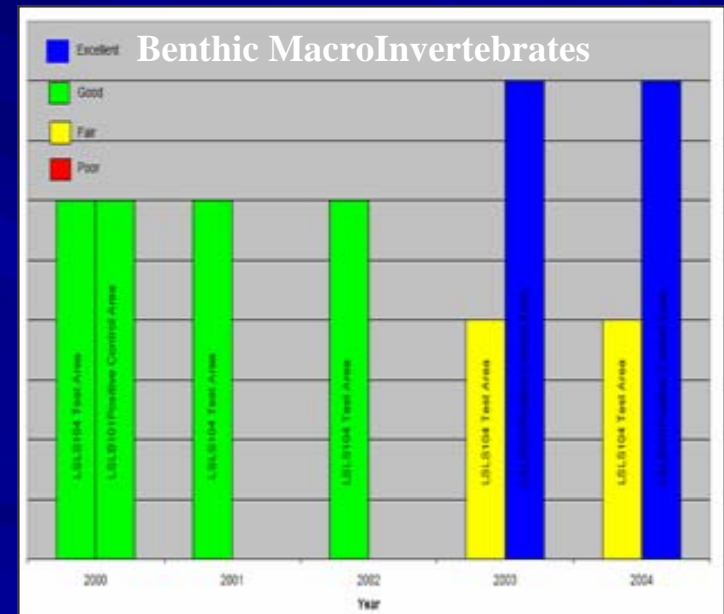 - site design techniques

sand filter

bioretention

MD Stormwater Design Manual Monitoring

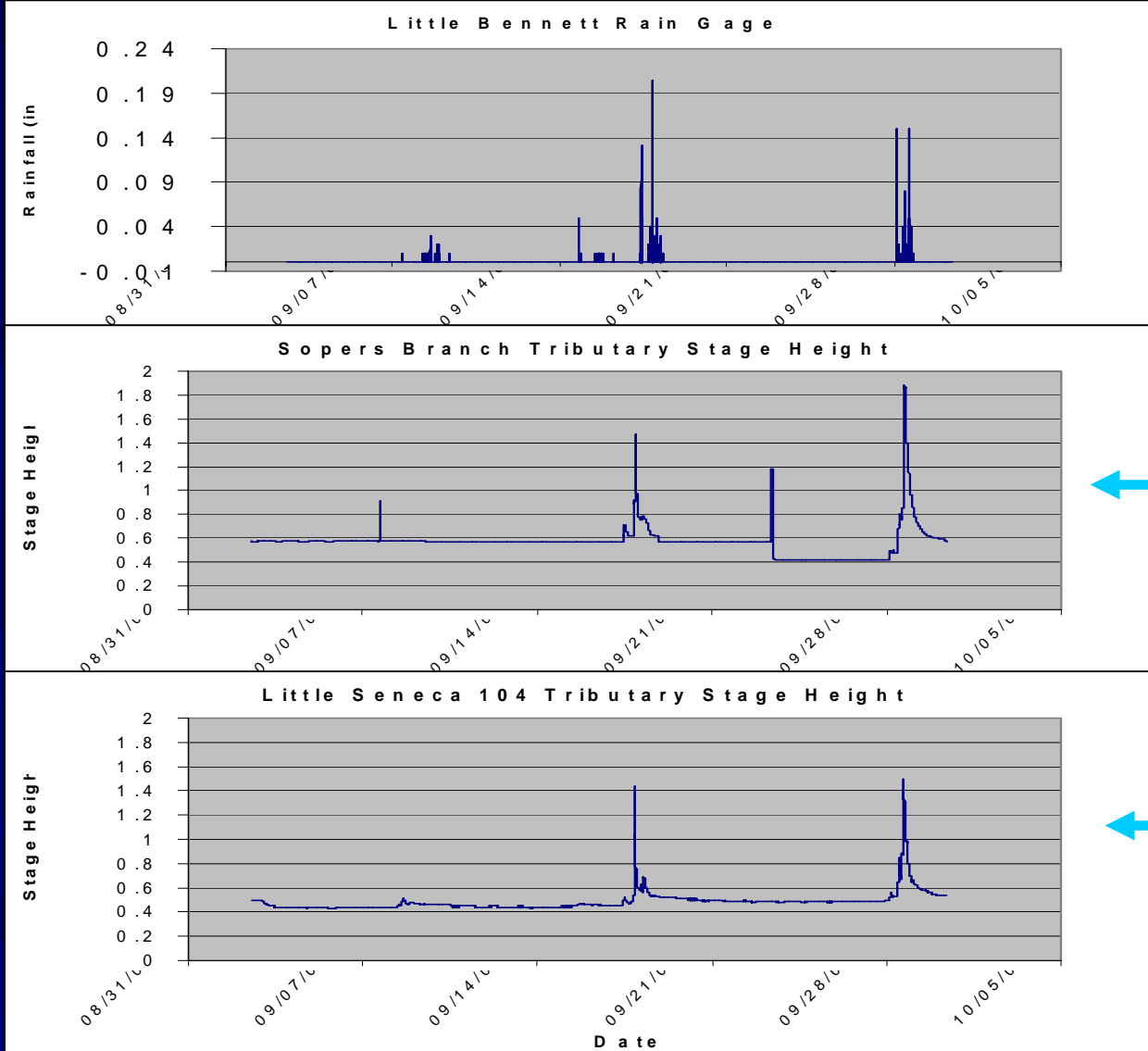| Large Jurisdictions * Required in Permit	Anne Arundel	Baltimore City	Baltimore County	Montgomery County	Prince George's County
Stream Cross-Sections*	✓	✓	✓	✓	✓
Stream Profiles*	✓	✓	✓	✓	✓
Bank Erodibility Hazard Index		✓	✓	✓	✓
Pebble Counts	✓	✓	✓	✓	
Water Chemistry Suite		✓ Bank and channel sediment	✓		✓
Water Quality Parameters	✓	✓	✓	✓	✓
Biological	✓	✓	✓	✓	✓
Habitat	✓	✓	✓	✓	✓
Discharge	✓	✓	✓	✓	✓
Groundwater Recharge				✓	
Continuous Temperature				✓	
Control Site		✓	✓	✓	✓

- Positive Control-no development
- 3 Test Areas-MD 2000 SWM Manual
- Negative Control-prior SWM Manual

Preliminary Results--*comparing rainfall to runoff*

Little Bennett Rain Gage

Sopers Branch Tributary Stage Height

← *positive control*

Little Seneca 104 Tributary Stage Height

← *test area*

2003   2004

Positive Control Area 2 (Soper's Branch)
Cross Section 1 - Facing Upstream in Years 2003 and 2004

Stream ecosystem function

- *How does **nutrient processing** differ across watersheds?*

- *How does **metabolism** (GPP, CR & NDM) differ across watersheds?*

Measure nutrient uptake using short-term solute injections

Measure GPP, CR and NDM using whole-stream methods

Stream ecosystem structure

- *How does **<u>water quality</u>** differ across watersheds?*
- *How does the **<u>availability of organic matter</u>** differ across watersheds?*
- *How do **<u>substrate</u>** characteristics differ across watersheds?*
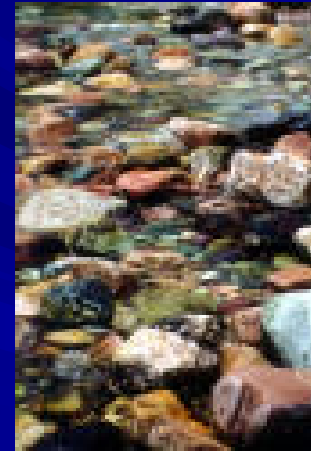
Survey of structural metrics

Identifying mechanisms that contribute to differences in structure and function

- *How does **GW-SW exchange** differ across watersheds?*
- *How does **groundwater quality** differ across watersheds?*

Measure GW-SW exchange

Measure streamside and hyporheic water quality

How do streams draining watersheds being developed with new SWM strategies __change__ over time?