

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

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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

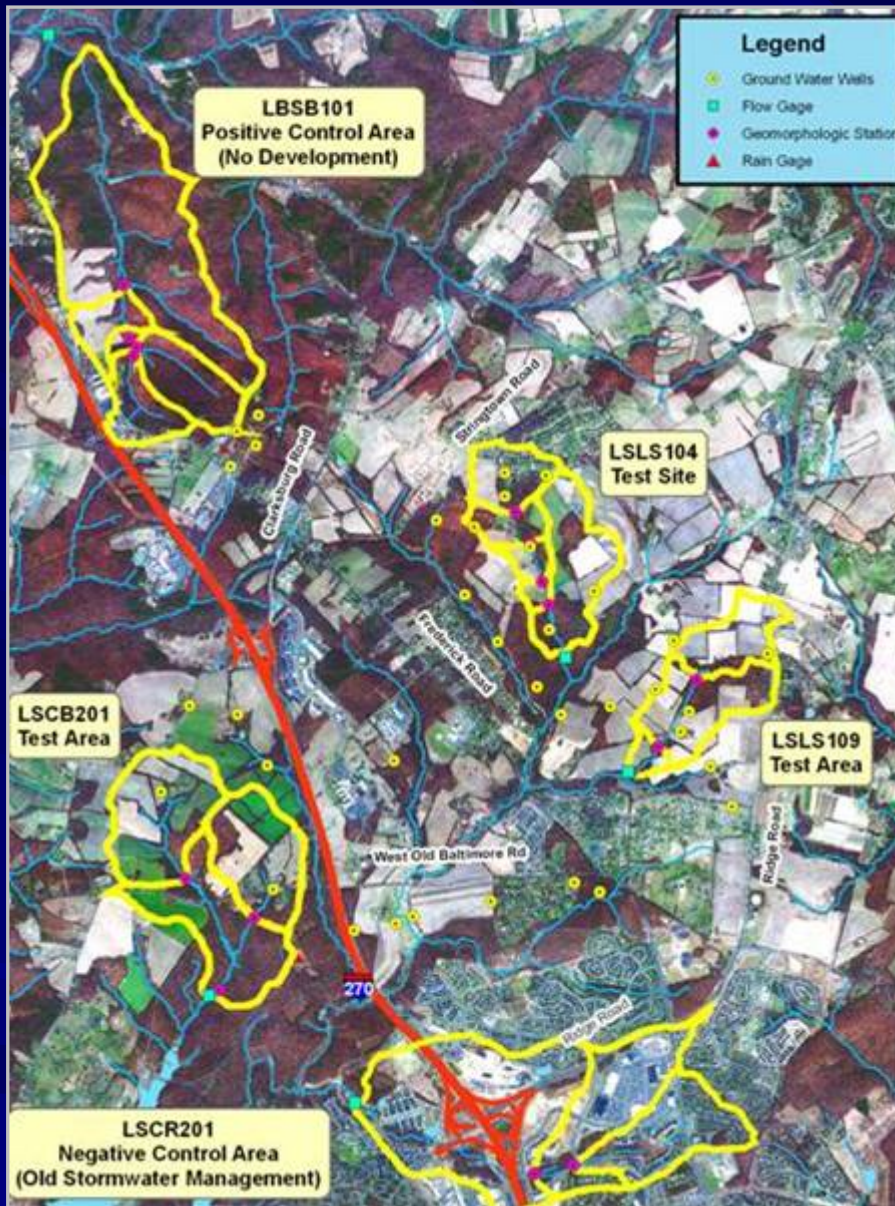
MD 2000 Stormwater Management Design Manual

- 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

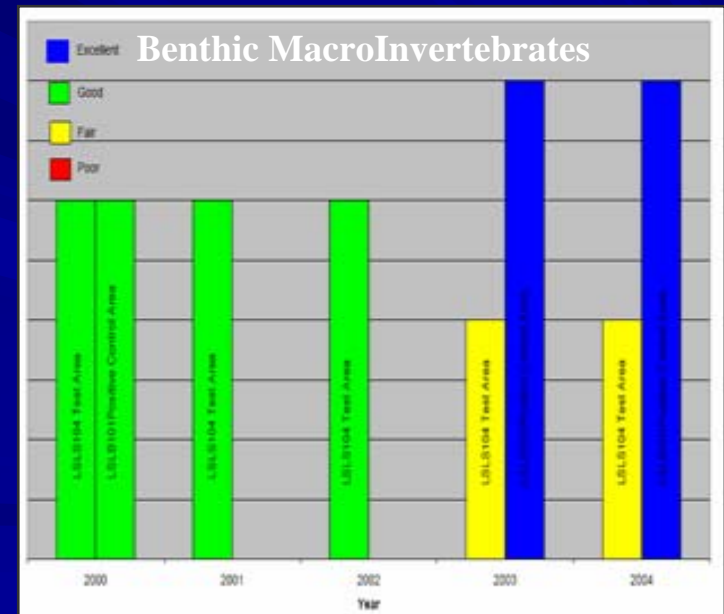


MD Stormwater Design Manual Monitoring

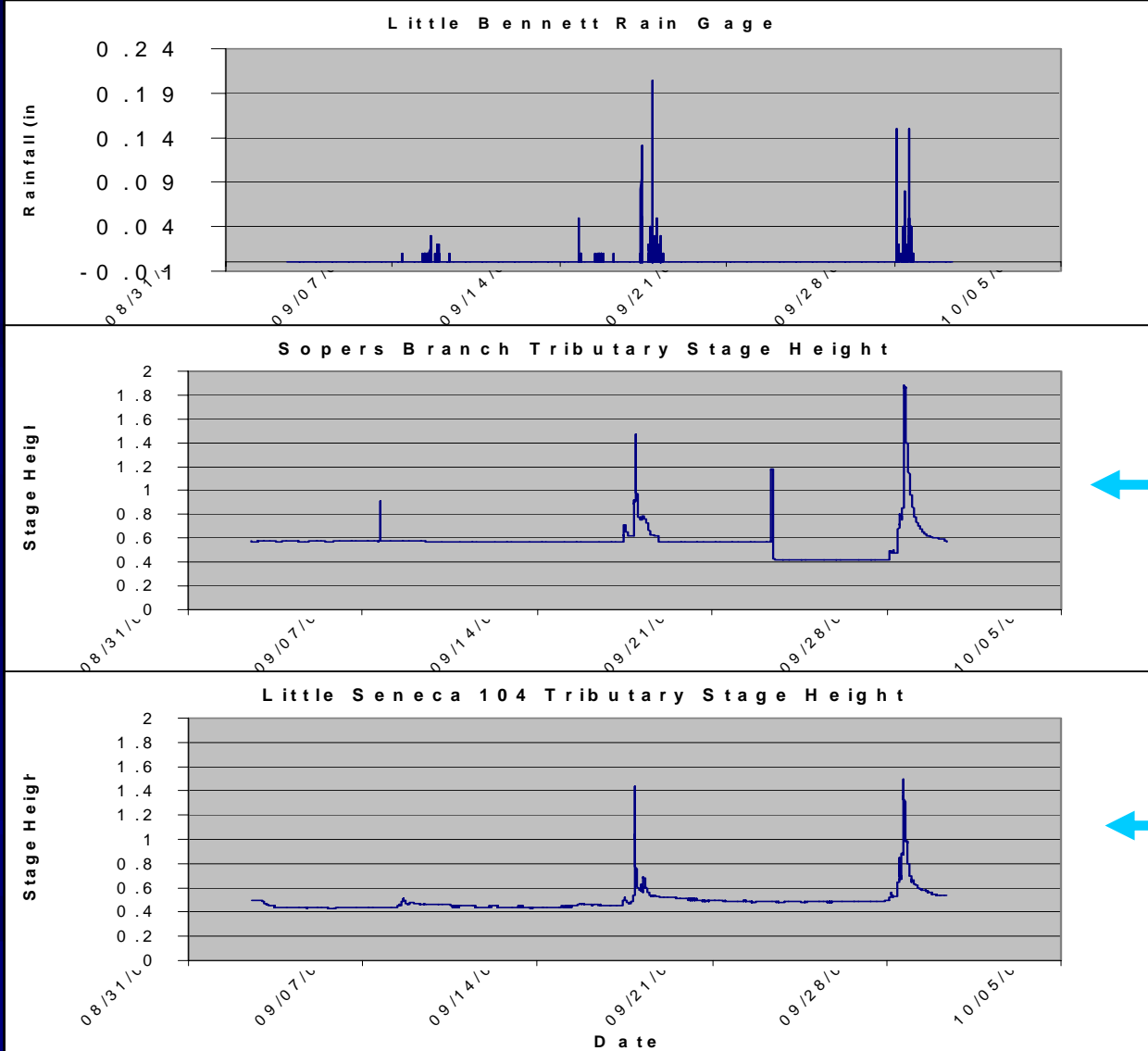
Large Jurisdictions * Required in Permit	Anne Arundel	Baltimore City	Baltimore County	Montgomery County	Prince George's County
Stream Cross-Sections*	✓	✓	✓	✓	✓
Stream Profiles*	✓	✓	✓	✓	✓
Bank Erodibility Hazard Index		✓	✓	✓	✓
Pebble Counts	✓	✓	✓	✓	
Water Chemistry Suite		✓ Bank and channel sediment	✓		✓
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*



← *positive control*

← *test area*



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?

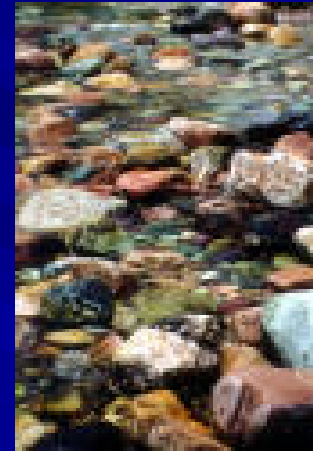


Measure nutrient uptake using short-term solute injections

Measure GPP, CR and NDM using whole-stream methods

Stream ecosystem structure

- How does water quality differ across watersheds?
- How does the availability of organic matter differ across watersheds?
- How do substrate 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?*

