Establishing Nutrient Criteria to Protect Virginia Water Quality Under the Clean Water Act

23 October 2006
DEQ Stakeholders
DEQ Piedmont Region
Glen Allen, VA

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Academic Advisory Committee (AAC) to Va. Dept. of Environmental Quality (DEQ):

✓ Comprised of faculty from state Universities.
✓ DEQ requested assistance in developing freshwater nutrient criteria from the AAC.
Under CWA, Water Quality Standards: include

- A “designated use” for each water body
- Water quality *criteria*: describe quality of water that will support designated use: Narrative standards and/or numeric limits
- Antidegradation policy

EPA requires all states to develop *criteria* to protect waters from impairment by nutrients.*

Also see: [http://www.deq.state.va.us/wqs/rule.html](http://www.deq.state.va.us/wqs/rule.html) "Freshwater Nutrient Criteria"
US Streams and Rivers: % of impaired stream-miles affected by

- Siltation
- Pathogens
- Nutrients
- O2 depleting substances
- Metals
- Habitat Alterations
- Thermal
- Flow alterations

“Algae are either the direct or indirect cause of most problems related to nutrient enrichment” (EPA, 2000)

Environmental variables act as subsidies or stresses.

EPA Guidance Criteria for Virginia

EPA developed “Guidance Criteria” that EPA “may” implement in states that fail to develop their own nutrient criteria in a manner satisfactory to EPA.

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9 - Southeastern Temperate Forested Plains and Hills
11 – Central and Eastern Forested Uplands
14 – Eastern Coastal Plain
EPA developed “Guidance Criteria”

Developed by ecoregion based on observation that 75\textsuperscript{th} percentile of “reference” distribution tends to correspond with 25\textsuperscript{th} percentile of “all” streams/lakes distribution.

* Reference = “relatively undisturbed” or “least impacted.”
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http://www.epa.gov/waterscience/criteria/nutrient/
Factors affecting whether or not streams with high nutrient concentrations become nutrient-impaired by excessive algal growth.

Is stream shaded?
Does stream gradient allow re-aeration?
How long since bottom-scouring rain event?
Are conditions suitable for a robust population of grazer insects?

Periphytic algae grow on rocks and stream bottom.
Underlying assumption of AAC approach: Streams tend to become more sensitive to nutrients moving from headwaters towards the sea: Downstream areas are:

- Less shaded
- Lower gradient
AAC-recommended Approach - Rivers & Streams

To protect against localized impairment

Nutrient Criteria

And

Localized Component

Wadeable Streams

or

Non-Wadeable Streams

Downstream Loading Component (if applicable)

For a stream segment

To protect against impairment of downstream areas.

Different approaches due to dominant algae types
Localized Component for Wadeable Streams: AAC Recommendation = Staged Approach

- **Exceptional resources (e.g., nutrient-sensitive T&E species): Anti-degradation approach.**

- **Is TN/TP concentration > screening value?**
  - **Y:**
    - **Does Visual Assessment Indicate Excessive Algal Growth?**
      - **Y:**
        - **Is diurnal DO variation sufficient to indicate nutrient impairment?**
          - **N:** Not Impaired
          - **Y:**
            - **Does Macroinvertebrate Community Indicate Impairment?**
              - **N:** Not Impaired
              - **Y:** Impaired. Do TMDL

- **N:** Not Impaired
Biomonitoring data for Virginia streams from DEQ Probabilistic Monitoring Program.
0.05 mg/L = possible screening value level??

Stream Condition Index (SCI)

TP (mg/L)

Severe Stress
Moderate Stress
Fair
Good
Excellent
Localized Component for Non-Wadeable Streams

Greg Garman at VCU will be conducting a study of existing data, to determine correspondance of in-stream nutrient levels with fish community indices.
Downstream Loading Component:

80% of the state drains into nutrient-sensitive estuaries.

Virginia’s Major Drainages
C – Chesapeake Bay and Atlantic
A – Albemarle Sound (NC)
N – New River (WV)
U – Upper Tennessee (TN)
S – Big Sandy (KY)
Localized criteria are also in place downstream. The "Receiving Waters" Loading Component would limit nutrient delivery to receiving waters, so as to protect receiving waters’ capability to support designated use.
How Should Downstream Loading Component be Structured?

Narrative Criteria? “If a given stream segment contributes nutrients to receiving waters that are nutrient-impaired, that segment is subject to potential nutrient reductions imposed by water management program.” (TMDLs).

Difficulties with Numeric Criteria:

- DEQ monitors concentrations, not loadings
- Streamflows are not monitored as widely as concentrations.
- “Nutrient trading” may alter allowable contributions by individual tribss.
- Climatic variability causes concentration / loading variability.
Questions?