Addressing Nutrients Using Narrative Water Quality Criteria

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National TMDL Meeting / NCTC
Water Quality Criteria

EPA WQS Handbook

Narrative criteria represent conditions sufficient to restore or maintain biological, chemical or physical integrity of water body and support attainment of uses.
Numeric Criteria

Acceptable Condition

Apply Criteria

Designated Uses

Monitoring & Assessment  Permits
TMDLs & Alternatives  Watershed Based Plans

Numeric Criteria

Biological Condition

Chemical Condition

Connecticut Department of Energy and Environmental Protection
Narrative Criteria

- Acceptable Condition
- Monitoring & Assessment
- Permits
- TMDLs & Alternatives
- Watershed Based Plans
- Interpretation of Narrative Criteria
  - Biological Condition
  - Chemical Condition

Apply Criteria → Designated Uses

Connecticut Department of Energy and Environmental Protection
Applying Narrative Criteria In CT

Long Island Sound TMDL (December 2000)
Basis: WQ Model linking DO to N

<table>
<thead>
<tr>
<th>Nitrogen</th>
<th>lbs/day</th>
</tr>
</thead>
<tbody>
<tr>
<td># Facilities</td>
<td>79</td>
</tr>
<tr>
<td>% WQB Permit</td>
<td>100%</td>
</tr>
<tr>
<td>Baseline</td>
<td>57,589</td>
</tr>
<tr>
<td>Goal</td>
<td>21,023</td>
</tr>
<tr>
<td>2016</td>
<td>17,488</td>
</tr>
<tr>
<td>2017</td>
<td>16,775</td>
</tr>
<tr>
<td>2018</td>
<td>22,246</td>
</tr>
<tr>
<td>% Reduction Achieved</td>
<td>67%</td>
</tr>
<tr>
<td>% Reduction Goal</td>
<td>63%</td>
</tr>
</tbody>
</table>

NPDES trading program implemented through a general permit & Nitrogen Credit Trading Board

Nitrogen Control Program for Long Island Sound
www.ct.gov/deep/nitrogencontrol
Phosphorus Reduction Strategy for Inland Non-Tidal Waters
(April 2014)
Basis: Relating periphyton community health to phosphorus loads

Will be developed into a TMDL Alternative

<table>
<thead>
<tr>
<th>Phosphorus</th>
<th>lbs/day</th>
</tr>
</thead>
<tbody>
<tr>
<td># Facilities</td>
<td>45</td>
</tr>
<tr>
<td>% WQB Permit</td>
<td>100%</td>
</tr>
<tr>
<td>Baseline</td>
<td>10,531</td>
</tr>
<tr>
<td>Goal</td>
<td>3,611</td>
</tr>
<tr>
<td>2018</td>
<td>9,233</td>
</tr>
<tr>
<td>% Reduction Achieved</td>
<td>12%</td>
</tr>
<tr>
<td>% Reduction Goal</td>
<td>66%</td>
</tr>
</tbody>
</table>

Enrichment Factor (EF) = \[
\frac{\text{Total NPDES Load (lbs/day)} + \text{Land Cover Load (lbs/day)}}{\text{Forested Condition Load (lbs/day)}}
\]

Phosphorus Reduction Strategy
www.ct.gov/deep/phosphorus
Applying Narrative Criteria in CT

2018 Assessment Methodology

Link phosphorus concentrations to periphyton community conditions

<table>
<thead>
<tr>
<th>Measure</th>
<th>IMPAIRED</th>
<th>IMPAIRED</th>
<th>SUPPORTING</th>
<th>IMPAIRED</th>
</tr>
</thead>
<tbody>
<tr>
<td>AQL assessment using bugs &amp;/or fish</td>
<td>++</td>
<td>++</td>
<td>+++</td>
<td>++</td>
</tr>
<tr>
<td>TP Concentration Threshold</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>Inferred Diatom TP Tolerance Classification</td>
<td>++</td>
<td>-</td>
<td>++</td>
<td>++</td>
</tr>
<tr>
<td>Combined Evidence</td>
<td>+++</td>
<td>---</td>
<td>+++</td>
<td>++++</td>
</tr>
</tbody>
</table>

**Management Outcome**
- +++: Convincingly supports or weakens
- ++: Strongly supports or weakens
- +: Somewhat supports or weakens
- 0: No effect (neutral or ambiguous)
- NE: No evidence

Figure 1: The grey shaded area contains sites likely to have altered conditions due to TP based on the CT diatom metrics (Becker et al 2018). These sites have >25% relative abundance of tolerant TP diatom species and <25% sensitive TP diatom species, as depicted by the lines. The lines are positioned at the optimal point of operation between sites with high TP concentrations (>0.045 mg/L) where most sensitive taxa are lost (Smuckler et al 2018) and low/mid TP concentrations (<0.045 mg/L).
Applying Narrative Criteria in CT

Coastal Embayments
- Develop a model set to relate nutrients to dissolved oxygen and water clarity
- Implement: TMDL or Alternative, Permits

Lakes
- Develop a model set to relate nutrients to trophic goals, dissolved oxygen and reduction of Harmful Algal Blooms
- Implement: New Statewide TMDL, Watershed Based Plans

In Development
Why Use Narrative Criteria for Nutrients?

**Numeric Criteria**
- Works well for chemicals that behave similarly in different water bodies
- Have well defined bioavailability
- Best for chemicals that don’t occur naturally or are present naturally in low levels
- Implementation is straightforward

**Narrative Criteria**
- Works well for chemicals or conditions that behave differently in different water bodies
- Complex bioavailability
- Can be used to address chemicals or conditions that also occur naturally
- Open to legal and political challenges

Both numeric and narrative criteria can be used successfully provided they are based on strong science, clear policies and have a strong connection to Water Quality Standards and Designated Uses
Open Discussion

- What experience have you had with narrative nutrient criteria?
- Challenges?
- Successes?
- What do you need to be successful?