Nutrient TMDLs and Permitting for Small Towns

Are all facilities to be treated equally?

ACWA/EPA Nutrients Permitting Workshop
November 7, 2018
Agenda

- Background/Issues
- Ideas on TMDLs and Small Towns
- Practical Examples of TMDL Implementation
- Discussion

The views expressed in this presentation are those of the authors and do not necessarily reflect the views or policies of their respective employers.
Background/Issues

• Discussion raised in Boise last December
  • Increasing pressure to adopt Numeric Nutrient Criteria (NNC)
    • This may disproportionately affect POTWs, particularly small POTWs
  • The majority of POTWs serve a population (e.g. <3000) where construction and O&M of nutrient reduction technologies may be unaffordable
    • Large number of dischargers, small fraction of the permitted discharge flow
  • Nutrient reduction strategies remain a high priority for ACWA, states, EPA, environmental NGOs, and municipalities
  • Are variances for perhaps half or more of POTWs a reasonable solution?
  • How can the NPDES program best accommodate nutrient reduction?
• The small group that brought up issue in Boise has met informally
  • Debated the issue a little more/kicked around some ideas
  • Discussed at Columbus, OH Nutrient Permitting meeting June, 2018
• Are all facilities to be treated equally?
  • No!!
  • Nothing requires TMDLs to treat all facilities equally/proportionately
    • WLA can be sliced up in a variety of ways
      • Watershed permitting
      • Technology based WLAs
      • Load-based permits vs concentration-based permits
        • Declining population may equal declining load, but not declining concn.
    • Trading
    • Combinations of above
    • TBD

• But first a little context
Large and Small Communities

Percentage of US Cities by Population
- Pop >3000: 32%
- Pop <=3000: 68%

Percentage of US Population by City Size
- Pop >3000: 93%
- Pop <=3000: 7%

7% of US Population Lives in 2/3 of our Communities

Based on 2010 Census Data
Large and Small POTWs

45% <0.3 MGD

Based on ICIS Data
Large and Small Communities

2010 Census Results - United States and Puerto Rico
Population Density by County or County Equivalent
Large and Small POTWs

Based on ICIS Data

Percentage of POTWs by Region with Flows Above and Below 0.3 MGD

<table>
<thead>
<tr>
<th>Region</th>
<th>% &lt;=0.3 MGD</th>
<th>% &gt;0.3 MGD</th>
<th>National Avg</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>25</td>
<td>75</td>
<td>40</td>
</tr>
<tr>
<td>2</td>
<td>20</td>
<td>80</td>
<td>40</td>
</tr>
<tr>
<td>3</td>
<td>30</td>
<td>70</td>
<td>40</td>
</tr>
<tr>
<td>4</td>
<td>25</td>
<td>75</td>
<td>40</td>
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<td>5</td>
<td>30</td>
<td>70</td>
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<tr>
<td>6</td>
<td>20</td>
<td>80</td>
<td>40</td>
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<td>7</td>
<td>25</td>
<td>75</td>
<td>40</td>
</tr>
<tr>
<td>8</td>
<td>30</td>
<td>70</td>
<td>40</td>
</tr>
<tr>
<td>9</td>
<td>20</td>
<td>80</td>
<td>40</td>
</tr>
<tr>
<td>10</td>
<td>25</td>
<td>75</td>
<td>40</td>
</tr>
</tbody>
</table>
Large and Small POTWs

1.2% of Flow from <0.3 MGD

Based on ICIS Data
Income and Small Communities

Percentage of Cities in MHI Ranges
Above and Below 3000 Population Cities

Based on 2010 Census Data

2% MHI = $67-$75/mo
Costs and Small Communities

**Cost for Mechanical Treatment to Reduce \( \text{NH}_3/\text{NO}_3 \)**

<table>
<thead>
<tr>
<th>TP (mg/L)</th>
<th>Low</th>
<th>High</th>
<th>Avg</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>0</td>
<td>4.45</td>
<td>1.37</td>
</tr>
<tr>
<td>0.1</td>
<td>0</td>
<td>47.66</td>
<td>14.27</td>
</tr>
</tbody>
</table>

TN only. TP cost from UT Study:

- TetraTech/KDHE
Costs and Small Communities

Cost Per Household For Biological Nutrient Removal ($/month)

Assumes:
- 100 gal/person/day
- 2.5 persons/household
- TN - 6 mg/L
- TP - 2 mg/L
CBO Data – Capital vs O&M

Federal, state and local government spending on water and wastewater utilities, 1956 - 2014

Reported in billions of 2014 dollars

Total public spending

Spending on operations and maintenance

Spending on capital

Graphed by the Environmental Finance Center at the University of North Carolina, Chapel Hill.
Source: Congressional Budget Office supplemental data for the Public Spending on Transportation and Water Infrastructure, 1956 to 2014 report (March 2015). Displays public spending on supply systems for distributing potable water as well as wastewater and sewage treatment systems and plants. Real spending is shown after adjusting nominal spending to their 2014 dollar equivalent using infrastructure-specific price indexes.
Rural/Metro Demographics

Non-Metro Population Change 2010 - 2016

2/3 experiencing population loss

Source: USDA, Economic Research Service using data from the U.S. Census Bureau.
## EFC Forecast Tool - Input

<table>
<thead>
<tr>
<th>Model Inputs</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Community</td>
<td></td>
<td></td>
<td>aaa</td>
</tr>
<tr>
<td>Current Average Household Monthly Drinking Water Bill ($)</td>
<td>65.90</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current Annual Growth Rate in Drinking Water Bills*</td>
<td>2%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current Average Household Monthly Wastewater Bill ($)</td>
<td>61.53</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current Annual Growth Rate in Wastewater Bills*</td>
<td>2%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Planned Expenditure on Drinking Water Infrastructure</td>
<td>$0.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of Years that the Infrastructure Will be Financed</td>
<td>20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Planned Expenditure on Wastewater Infrastructure</td>
<td>$0.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of Years that the Infrastructure Will be Financed</td>
<td>20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Annual Interest Rate</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use Default Rate?</td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>If not, Enter Annual Interest Rate for Financing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Run Model</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* - Note: The current annual growth rate in bills should incorporate all projected cost increases EXCEPT for those associated with the debt payments on infrastructure.
# EFC Tool - Output

## Model Outputs - Wastewater

<table>
<thead>
<tr>
<th>Model</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Community Population (2016)</td>
<td>2,887</td>
</tr>
<tr>
<td>Increase in Average Monthly Wastewater Bill</td>
<td>$0.00</td>
</tr>
<tr>
<td>Probability that Monthly Wastewater Bill Exceeds 2.0% of Median Household Income</td>
<td>0.8366</td>
</tr>
<tr>
<td>Sustainability Risk</td>
<td>High</td>
</tr>
</tbody>
</table>

## Drinking Water Outputs

<table>
<thead>
<tr>
<th>Variable</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current MHI</td>
<td>$48,206</td>
</tr>
<tr>
<td>Current Wastewater Bill</td>
<td>$61.53</td>
</tr>
<tr>
<td>Projected Average Wastewater Bill</td>
<td>$61.53</td>
</tr>
</tbody>
</table>

## Note:
The graph shows the typical sustainable threshold for the community (blue line), forecast into the future, along with a range of estimates developed in a statistical model. It also shows the projected wastewater bills using the inputs you provided.

## Projections

<table>
<thead>
<tr>
<th>Year</th>
<th>Median Household Income</th>
<th>Monthly Wastewater Bill</th>
</tr>
</thead>
<tbody>
<tr>
<td>2018</td>
<td>49,206</td>
<td></td>
</tr>
<tr>
<td>2019</td>
<td>49,301</td>
<td></td>
</tr>
<tr>
<td>2020</td>
<td>49,303</td>
<td></td>
</tr>
<tr>
<td>2021</td>
<td>49,205</td>
<td></td>
</tr>
<tr>
<td>2022</td>
<td>49,140</td>
<td></td>
</tr>
<tr>
<td>2023</td>
<td>49,072</td>
<td></td>
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<tr>
<td>2024</td>
<td>49,004</td>
<td></td>
</tr>
<tr>
<td>2025</td>
<td>48,936</td>
<td></td>
</tr>
<tr>
<td>2026</td>
<td>48,868</td>
<td></td>
</tr>
<tr>
<td>2027</td>
<td>48,802</td>
<td></td>
</tr>
<tr>
<td>2028</td>
<td>48,802</td>
<td></td>
</tr>
<tr>
<td>2029</td>
<td>48,788</td>
<td></td>
</tr>
</tbody>
</table>

## Percentage Change in MHI

<table>
<thead>
<tr>
<th>Year</th>
<th>Percentage Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>2018</td>
<td>15%</td>
</tr>
<tr>
<td>2019</td>
<td>15%</td>
</tr>
<tr>
<td>2020</td>
<td>16%</td>
</tr>
<tr>
<td>2021</td>
<td>16%</td>
</tr>
<tr>
<td>2022</td>
<td>17%</td>
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<td>2023</td>
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<td>2024</td>
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<td>2027</td>
<td>18%</td>
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<tr>
<td>2028</td>
<td>18%</td>
</tr>
<tr>
<td>2029</td>
<td>19%</td>
</tr>
<tr>
<td>2030</td>
<td>19%</td>
</tr>
</tbody>
</table>
Some Comments From C-Bus

• Idea of *de minis* dischargers
  • For instance, OH does not address nutrients for dischargers with <100,000 gpd design

• Issues vary across states and Regions
  • Need to make geographic/geopolitical allowances

• Quite a bit of support for a combo of Options 4 and 5
  • Technology-based approach for major POTWs; or
  • Tiered-technology for small POTWs with TBELs or WQBELs for majors
  • Longterm Nutrient Reduction Plans (LNRPs)

• Like the idea of tiered tech levels

• Concern about making any system spend money on meeting a tech-based limit if NNC were coming in the future
Some Comments From C-Bus

- Concern that NNC were not in the foreseeable future, so need to do something else to spur reduction
- As much as it may present bad “optics” – variance may be needed
- Do not like narrative translators
- Not all small POTWs need relief
  - If they do not, should not be let off the hook
- Need to allow for site-specific implementation in sensitive watersheds
- Is there a possibility for a nationwide variance, or at least a framework?
- Probably need more discussion on when it is best or most appropriate to use UAA vs Site Specific Criteria vs Variance.
- Bottom line – small communities are an important issue. Keep working!
Modern Era Non-Point Nutrient Pollution

"It's positively disgraceful. Just look at the way he's fertilizing. Has he no respect for tradition?!"
Kansas Wastewater Demographics

- 85% of Kansas Towns have population under 3000
- Most of those Towns rely on gravity-fed facultative lagoons for wastewater treatment
- Between 2010 – 2016, only 37 towns with populations between 300 and 3000 saw growth
- Nutrient Impairments (TP, NH3, NO3) closely associated with mechanical plants
- Nitrogen handled as concentrations (numeric criteria)
- Phosphorus handled as mass (narrative criteria)
- 130 mechanical plants in Kansas average 3 MGD; focus of nutrient TMDLs
- 322 lagoon systems with average design flow of 0.12 MGD; what to do?
Phosphorus is handled through TMDLs

- Typical Small Town Handles Wastewater with Lagoons
  - 120 to 150 days of retention time
  - 3, 4 or 5 cells
  - Default is 2 mg/l TP (tech-based), but Mass is the limit
  - Population Determines Wastewater Volume (Little to No Industry)
  - Wasteload Allocation based on Design Flow X Default [TP]
  - Design Flows typically >> Actual discharge
    - Declining population
    - High ET, Low Precipitation during Summer Baseflow
    - Reuse gaining Momentum

- Thus, Town remains within its WLA, without Capital Outlay for additional Treatment
Ammonia is handled through MDVs

- Most Small Towns with Lagoons can Comply with NH3 Limits Based on 2013 Criteria
  - 120 to 150 days of retention time allows for adequate biological uptake of NH3 and NO3
  - Winters often problematic with compliance for some towns
  - Population declines also erode revenue stream
  - Little Financial Capability to invest or maintain BNR (Nitrify – Denitrify)
  - Multi – Discharger Variance in place for towns with population below 3000
  - Highest Attainable Criteria = Most likely cap on ammonia output = historic 99th percentile
  - Pollution Minimization Plans holds the line on rises in ammonia output
    - Musts – Restrictions: Cert. Op, Adequate Maintenance, No Industrial Wastewater
    - Consider Operational Conditions: Irrigation, Controlled Discharges, Routine Desludging
    - Encouraged Construction Improvements: Improved Piping, Additional Cells
Thank you/Questions

Tom Stiles
Assistant Director, BOW
Tom.Stiles@ks.gov
We’ve Shown Our Ideas – Yours?

1. Are states using TMDLs in other ways to deal with nutrient permitting?
   • If so, differentiating between “Small” and “Large” POTWs?
2. What about industry?
   • How is industry nutrient permitting handled?
3. What about TMDLs with WLAs more stringent than treatment technology can achieve?
   • Particularly for small facilities?
Lagoon Study Data - KDHE

**KDHE Lagoon Study**

**TP vs Month**

- **Total Phosphorus (mg/L)**
  - Feb: 0.0
  - Apr: 0.5
  - Jun: 1.0
  - Aug: 1.5
  - Oct: 2.0
  - Dec: 2.5

**KDHE Lagoon Study**

**TN vs Month**

- **Total Nitrogen (mg/L)**
  - Feb: 3.0
  - Apr: 4.0
  - Jun: 6.0
  - Aug: 8.0
  - Oct: 10.0
  - Dec: 12.0
Lagoon Study Data - KDHE

- **Ammonia (mg/L)**
  - Feb: 0.0
  - Apr: 0.5
  - Jun: 1.0
  - Aug: 1.5
  - Oct: 2.0
  - Dec: 2.5

- **Nitrate (mg/L)**
  - Feb: 0.0
  - Apr: 0.5
  - Jun: 1.0
  - Aug: 1.5
  - Oct: 2.0
  - Dec: 2.5