Use of Science Tools in TMDL Design

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What are TMDLs?

- TMDL= total maximum daily load
- Clean Water Act planning program that:
  - identifies polluted waters and stressors
  - determines amount of pollutants that can be discharged and attain protection goals (aquatic life and human health protection)
  - allocates allowable pollutant loads among sources
- More than 20,000 polluted waters nationally, approximately 3,000 TMDLs completed to date
- Biggest problems are nutrients, pathogens, metals, and clean sediment

Science Challenges in TMDLs

- Goal: apply broad water quality standards (goals) to individual waters and fix problems
- Physical science challenges:
  - quantify narrative standards (e.g. nutrients)
  - estimate pollutant loads from diffuse sources
  - estimate behavior of nonconservative pollutants
  - consider dynamic hydrology, “critical conditions”
  - estimate ability to control nonpoint sources
- Social science challenges:
  - evaluate control costs and “equity” of burdens
  - consider public willingness to take voluntary action

Physical Science Tools (1)

- Interpret narrative standards
  - usually: literature values, reference values
  - rarely: site specific effects studies
- Estimate pollutant loads
  - frequently: simple analysis of limited data sets
  - often: dynamic watershed loading models (HSPF)
- Guess behavior of pollutants in water
  - usually: steady state models (QUAL2E)
- - increasingly: dynamic fate/transport models (WASP)

Physical Science Tools (2)

- Characterize hydrology and hydrodynamics
  - usually: critical “low flow” based on gauge data (7 Q 10)
- - increasingly: dynamic hydrology models (CE-QUAL)
- Estimate nonpoint source control effectiveness
  - usually: national literature values
  - rarely: local effectiveness monitoring

Social Science Tools

- Evaluate control costs and allocation equity
  - usually: rough State cost estimates, no benefits estimates, rough consideration of cost effectiveness (NOT required by CWA)
  - increasingly: use models to support public debate on allocation scenarios (WARMF)
  - rarely: rigorous analysis of relative cost-effectiveness or political/social acceptability (DOE-LLL project)

Needs for Better Tools

- Good existing physical models
- Most constrained by data limitations and shortage of qualified modelers!
- Need locally tailored standards for nutrients, sediments, some toxins
- Better information on effectiveness of nonpoint source management practices
- Not clear that models to assess control economics and allocation “equity” will help