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The Wisconsin River TMDL from the Discharger’s Perspective

WWOA 48th Annual Conference

October 8, 2014
Outline of Presentation

• Wisconsin River TMDL Overview
• Wisconsin River Discharger Group (WRDG) Formation and Behind the Scenes
  • Who is WRDG?
  • WRDG’s Role
• Next Steps
Wisconsin River TMDL Overview

• The Wisconsin River has experienced a long history of impaired water quality conditions, including low dissolved oxygen and severe algal blooms

• Algae blooms caused by excessive phosphorus loading from point and nonpoint sources in the watershed

• TMDL Goals:
  • Identify sources
  • Develop improvement plan
Wisconsin River TMDL Overview

- Wisconsin River Basin (WRB) TMDL study area extends from basin’s headwaters in Vilas County to Lake Wisconsin (9,156 mi²)
- Utilizing a 4 year water quality monitoring effort throughout the WRB
- Modeling effort focused on two environments:
  - Upland loading, sediment transport, and nutrient loads
  - In-reservoir or in-lake processes
Overall Project Timeline

- Watershed & Reservoir Monitoring
- Conceptualization

2009 - 2013

2014

2015

2016

2017

Water Quality Data Assessment, Watershed & Reservoir Modeling

Draft TMDL

Allocation Development

Baseline

TMDL

WDNR Estimate as of April 2014
TMDL Monitoring Strategy

• Balance of needs and funding
• Mass balance principle: flow*concentration = load
  • Used existing flow network (WVIC and USGS data) and seven new USGS sites
  • Concentrations measured over a fixed, semi-monthly period from April 2009 to November 2013
• Additional sampling and available data
  • Streams/rivers – watershed rotation data, long term trend data, 303(d) evaluation
  • Lakes/reservoirs – sediment cores, past modeling efforts, WVIC data, DNR data, citizen data, etc.
TMDL Monitoring Sites

TMDL Monitoring Site
- River / Stream Water Quality
- Reservoir Water Quality
- Lake Water Quality
- Daily Discharge

City or Town
County Boundary
Hydrologic Network
Tributary Drainage
TMDL Modeling Strategy – Model Types

- Regression or Export Coefficient (PRESTO, SPARROW)
- Empirical (BATHTUB)
- Mechanistic (SWAT, HSPF)
- Mechanistic (CE-QUAL-W2, WASP)

- Increase in complexity
- Increase in data requirements
- Increase in $
TMDL Modeling Strategy – Model Domains

- Watershed Model (SWAT)
  - Entire basin
- Urban/Stormwater Model (WinSLAMM)
  - Urban areas (MS4, cities, and villages)
- Empirical Reservoir Response (BATHTUB)
  - Spirit River Flowage
  - Big Eau Pleine Reservoir
  - Lake DuBay
  - Dexter Lake
  - Tri Lakes
  - Lake Wisconsin
- Mechanistic Reservoir Response (*CE-QUAL-W2*)
  - Petenwell
  - Castle Rock

Figure 1 – Wisconsin River TMDL Water Quality Model Domains
Why is SWAT the best fit model?

- Public domain, open source code, user support
- GIS-based user interface
- Previously applied to TMDLs throughout Wisconsin and the United States
- Ability to incorporate heterogeneity of agricultural management
- Ability to simulate monthly nutrient loads
SWAT Model Details

- Simulates daily conditions based on climate data
- Input data, parameter intensive
- Outputs for each TMDL reach
- Outputs include crop yields, water balance, discharge, sediment, and water chemistry
SWAT Model Configuration

Segment 1: Headwaters

Segment 2: Upper

Segment 3: Central

Segment 4: Lower
WDNR Used Multi-Step Land Use Definition Process

Step 1:
Define annual crop change using satellite imagery

Step 2:
Categorize 5-year crop change into rotation types

Step 3:
Assemble local knowledge to further define rotations

Step 4:
Integrate local knowledge to land management layer

Step 5:
Confirm agricultural mgt. with available observed data
Urban Area Model Approach (WinSLAMM)

- WinSLAMM predicts stormwater flows and associated pollutant load generation and attenuation from urban areas.
- WinSLAMM output data will be incorporated into SWAT model as monthly point source loads.
- WinSLAMM model boundaries to be shared with MS4s.

*Excluding significant areas of undeveloped and/or agricultural lands.*
Delineating Urban Model Areas

1. Permitted MS4?
   - No → City or Village?
     - No → WinSLAMM Model B
     - Yes → SWAT Model
   - Yes → City, Village, or UW-SP Campus?
2. City, Village, or UW-SP Campus?
   - No → Urbanized Area
     - No → WinSLAMM Model A
     - Yes → WinSLAMM Model A
Reservoir Modeling Overview

- Important components of reservoir modeling:
  - Physical characteristics
  - Chemical characteristics
  - Diagnostic goals
    - Water balance
    - Critical conditions
  - Predictive goals
    - Cause and effect
    - Assimilative capacity
BATHTUB Model Details

- Data collection and inputs
  - Vertical profile(s), horizontal patterns, constituents of interest (temperature, nutrients, chlorophyll, transparency)
- Calculates variance estimates and confidence limits for each output variable
- Determines sensitivity of predicted concentrations to deposition and dispersion coefficients
CE-QUAL-W2 Model Details

- Inputs – bathymetry, initial conditions, boundary conditions, calibration data, hydraulic parameters, kinetic parameters
- All water quality parameters are averaged laterally across a segment
  - Each layer within a segment acts as a fully mixed reactor for each time step
Model Integration Database

- Microsoft Access Database
- Platform for storing and organizing model inputs and outputs
- Record of complete multi-model architecture
- Will be used to calculate loading capacity, load allocations, and percent reductions

Rock River TMDL Database Schematic
Current WDNR Status

- Released an updated Wisconsin River Improvement Project website
- Website includes a spatial data viewer tool (like Surface Water Data Viewer)
- Recently released a land cover and agricultural management definition within the Upper Wisconsin River Basin Technical Memo
- WRDG provided comments
- Will be meeting with WDNR to discuss project schedule, staffing changes, and modeling changes next month.
A Pound’s A Pound, or Is It?

- Defined as closely aligning with each other.
- Approximately 330,000 pounds of phosphorus difference
- Industrial and municipal WWTPs discharged 256,000 pounds in 2011

**DATCP Cattle Inventory Manure vs. WDNR Approach**

- NASS Census (tons/year)
- WDNR Approach (tons/year)

- Marathon
- Juneau
- Lincoln
- Sauk
- Adams
- Wood
Wisconsin River Dischargers Group

- Rock River Group
- MEG
- Act Early

Wisconsin River Dischargers Group
WRDG Unites the Voice

The Wisconsin River Discharger Group (WRDG) is a group that unites the voice of various communities involved in the Wisconsin River Water Quality Improvement Project. This newsletter update highlights the following:

**Membership Update**

Welcome Charter Members:
- Athens
- Baraboo
- Bay
- Lakeland Sanitary District
- Marathon City
- Manawa
- Mauston
- Neenah
- New Lisbon
- Plover
- Port Edwards
- Portage
- Rhinelander
- Rib Mountain Metropolitan Sewerage District
- Stevens Point
- Tomah
- Tomahawk
- Wausau
- Writing
- Wisconsin Rapids

**WTDQ now consists of 21 communities, with a total population of 241,438.**

*Based on 2013 WDOA estimates.*

**Legislative Update**

Clean Waters, Healthy Economy Act (Act 283)

Several member community representatives were involved in the statewide effort to pass the Clean Waters, Healthy Economy Act. This act would provide additional variance alternatives for communities facing reduced phosphorus discharge limits. At the time of writing this bill passed both state houses and was awaiting the Governor’s signature. This bill is supported by many statewide organizations including the Municipal Environmental Group (MEG).

If signed, several steps will be necessary for utilities to be able to take advantage of this new compliance alternative. The Wisconsin Department of Administration (DOA) will need to prove that compliance will cause widespread economic hardship, and the USEPA will need to approve the proposed variance.

**Lagoon Variance**

Several communities and WDRG representatives gathered in Vesper in April to discuss alternatives for lagoon facilities. If the community has a lagoon based system, even if they have additional treatment such as an RBC for ammonia removal, they may qualify for the phosphorus lagoon variance after evaluating all options available to them and system optimization. A lower value effluent must be achieved which may become the new limit. If financial hardship is proven (full exceeds 2% MHB), they have met the qualifications for a 3-year variance. In the next permit cycle and technologies need to be rechecked. If that is not, they will get another 5-year permit, with no sunset clause in the program. Therefore, the new lower limits for phosphorus would not apply to them, nor would the TMDL limits.

**Did You Know?**

WDRG is working on a Site Specific Criterion (SSC) guidance document. SSCs can be used to create different compliance alternatives.
The Fine Print

• Tax exempt status, 503 regs
• Needed to get a bank account and letterhead developed
• 20 current member communities, population ~200,000
• Can be challenging to get members to sign on the dotted line

Baraboo  Necedah  Rib Mountain MSD
Elroy    Nekoosa  Stevens Point
Lakeland Sanitary District  New Lisbon  Tomahawk
Marathon City  Plover  Wausau
Marshfield  Port Edwards  Whiting
Mauston  Portage  Rhinelander
WRDG Next Steps

• Encourage WDNR to keep efforts moving forward

• Monitor activities in watershed
  • Other user groups
  • Agricultural impacts

• Communicate with members
Questions and Answers

Thank you!

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Thank you to WDNR for many graphics!