Planning for Future Change: Michigan’s Statewide E. coli TMDL

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Some Background

- Statewide E. coli TMDL was started in 2016 and approved by the USEPA in 2019
- We update it by adding newly discovered impaired waters “concurrent” with each Integrated Report.
Scope of the Problem

- About 76,000 miles of rivers, and we estimate that **half** are impaired by E. coli
- 29% of our river miles are assessed for Total Body Contact (TBC) designated use
- 27% of our total river miles are impaired by E. coli
Target

- Concentration Based with the target being equal to the WQS
  - Daily during summer 300 cfu/100 ml
  - Daily during winter 1000 cfu/100 ml
  - 30-day during summer 130 cfu/100 ml

Photo: E. coli monitoring in the Paw Paw Watershed.
Critical Conditions

- Critical Conditions (baseflow and heavy rain / high flow)
- WQS applies under all conditions

Photo: Flooding in metro Detroit.
Margin of Safety

- Margin of safety is implicit, due to uncertainty with growth and decay of bacteria
- This works to our benefit with Climate Change too (that wasn’t really planned)
“Planning for Future Change”

Not a required part of the TMDL, but in a ‘forever document’ it felt important

Climate drives changes in land use/cover, so it was more than just climate change
Politics are important in government
  • Michigan is a “Purple” state.
  • I did not know the personal beliefs of our leadership during the development of this TMDL.
  • Stick to the facts, avoid controversial discussion of what causes climate change.
Just the ‘Facts’ on Climate Change

• Great Lakes Integrated Science and Assessments (GLISA) – University of Michigan
  • 11% increase in precipitation between 1900 and 2012
  • 2°F increase in temperature (same years) and longer growing season
  • Increased intensity and magnitude of large rain events
• Office of the Great Lakes report: Water Strategy
  • Office was created by Governor Rick Snyder and the report was directed by him as well
  • Concluded that our infrastructure was not designed with large storms in mind
  • In fact our older cities were not planned with sewage disposal in mind at all (Combined storm and sewage systems)
Just the ‘Facts’ on E. coli in Michigan

• Because this was a statewide TMDL, we needed to discuss E. coli in general (site specific data is provided in the Appendices)
• Why not use our statewide probabilistic data set?
Just the ‘Facts’ on E. coli in Michigan

- 50 sites per year, total of 200 unique sites
- Each site monitored 4 times (May, July, September and November)
- Water temperature
- Did NOT have flow
- Delineated watershed and used GIS for
  - Watershed size,
  - Land cover,
  - 2010 census (housing units and population),
  - lost wetlands, and
  - Agricultural census (livestock populations)
What causes high *E. coli* in Michigan?

- Latitude had the strongest correlation with *E. coli*.
- But latitude is not a cause of *E. coli*.
What causes high E. coli in Michigan?

Temperature had a weak but statistically significant relationship with E. coli (r=0.3).
• Despite the overall weak relationship between water temperature and \textit{E. coli}, our July event clearly had the highest \textit{E. coli}.

• July has a few characteristics:
  • Hot and Dry
  • Water table is low (less dilution?)

• July-August are peak times for swimming in the Great Lakes
Normalized $E. \text{ coli}$ vs Agricultural Land Cover

$R=0.58$
Agriculture is expanding northward.
What impacts can we expect?

- E. coli is highest during July (hot and dry), that type of weather may last longer
- Agriculture will likely continue to move northward too

Photo: Algae in a stream with low water levels.
What impacts can we expect?

- Less forest and natural areas to ‘soak up’ and filter pollutants
- Loss of riparian buffers
- Manure land application in new areas
- Lower water table is possible – less **dilution of pollution** in the summer:
  - Water withdrawals for irrigation may increase,
  - Field tiles lower the water table

Photo: Sediment loss from a heavy rain on a freshly planted field.
TMDL Implementation

- NPDES permits
  - Requiring both setbacks and vegetated buffers for CAFO manure land-application fields. In TMDL watersheds they must be wider. But, this is being contested.
  - Municipal Separate Storm Sewer Systems (MS4s) with *E. coli* TMDLs must conduct wet weather first flush monitoring as well as dry weather outfall screening.

Photo: “Clean” storm water from a CAFO
TMDL Implementation

• Nonpoint Source Program Plan
  • BMP design criteria for storm events will be reevaluated periodically
  • Consideration of plant hardiness zone changes in BMP plantings

• Encourage conservation in undeveloped areas

Photo: Goose deterrent buffer at Chrysler Beach