Ohio River Bacteria TMDL Update

June 2014

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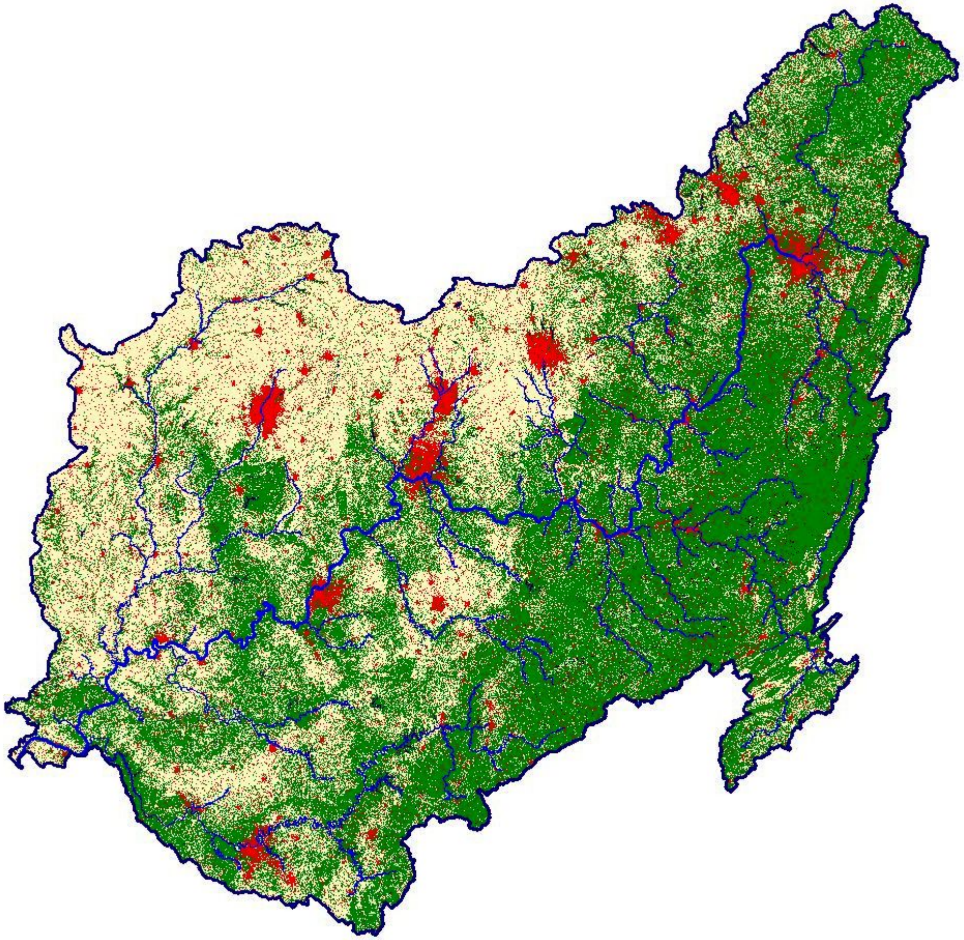
Discussion points

- Background
- General progress to date
- Data Analysis
- Sampling
- Modeling
- Next steps in July 2014
- Baseline for presentation of allocations

Ohio River



Basin

- 203,940 square miles
- Encompasses parts of 14 states

River

- 981 miles long
- Flows through 6 states
- Largest tributary of the Mississippi River in volume
- Supplies drinking water to 3.6M people

What is a TMDL?

- Total maximum daily load (TMDL)
- A tool for implementing state water quality standards
- It establishes the allowable loadings for specific pollutants that a waterbody can receive without exceeding water quality standards.

Clean Water Act

Integrated Report

- Section 305(b) and 303(d)
- Listing Categories
    1. Attaining WQS and no use is threatened
    2. Attaining some WQS, no use is threatened, and insufficient data to determine use attainment
    3. Insufficient data to determine use attainment
    4. Impaired or threatened for one or more designated uses but a TMDL is not required
    5. WQS is not attained and a TMDL is required

ORSANCO 305(b) Assessment 2012

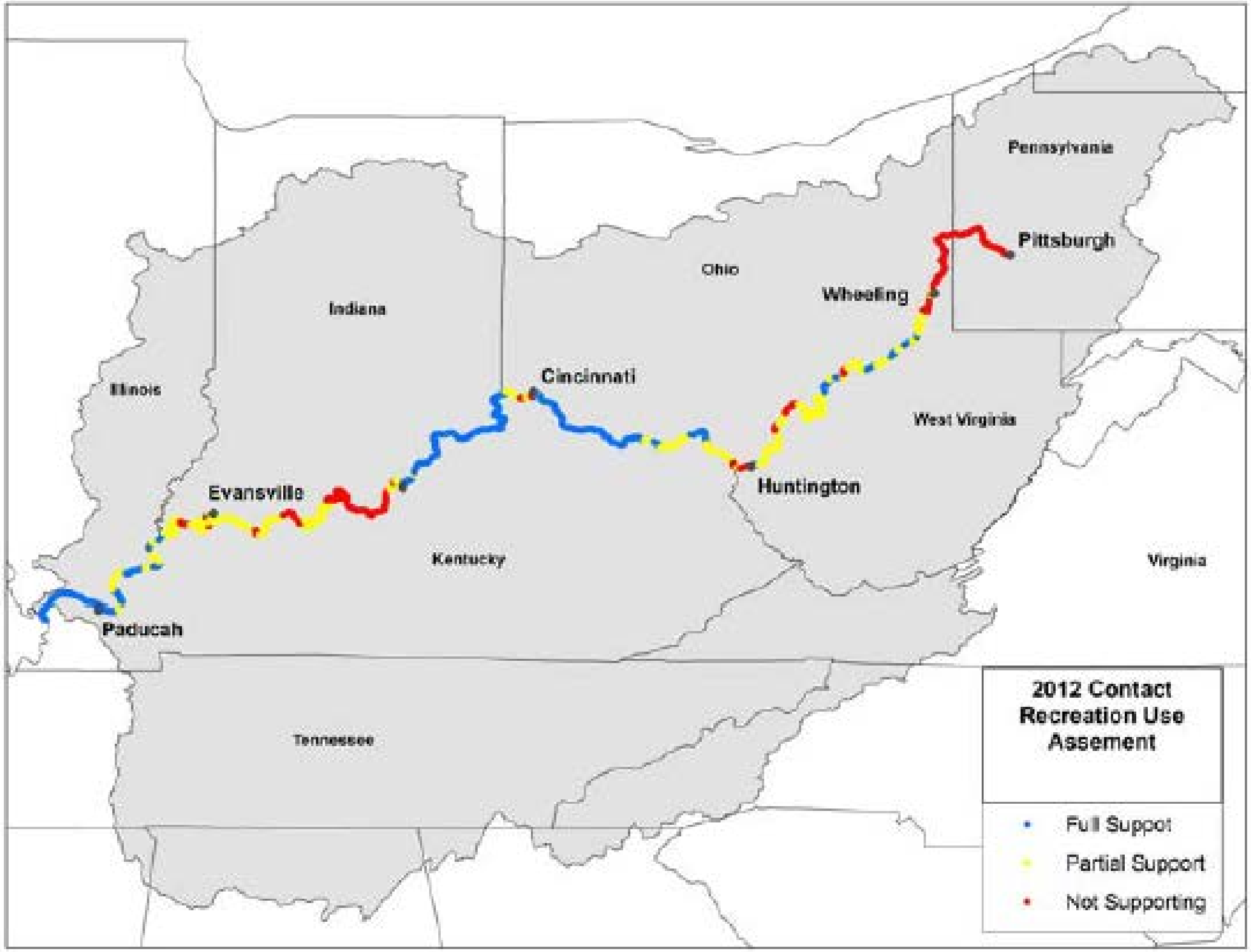


Figure 8. Ohio River miles impaired for the contact recreation use in the 2012 assessment.

Workgroup Members

- ORSANCO
- State representatives from IL, IN, KY, OH, PA, & WV
- US EPA Regions 3, 4, & 5
- Assistance from USACE, NOAA, USGS
- Contractor – TetraTech, Inc.

Past Workgroup Discussions

- Limitations of project (not upstream in tributaries)
- Needs of a multijurisdictional project (reconciling different standards)
- Methodologies – Load Duration Curves, models, statistics
- Data - states, permitees, ORSANCO, USGS, CSOs, SSOs, fecal coliform, *E. coli*, urban, longitudinal, tributary, historic modeling, other TMDLs
- Bacteria behavior - internal and other agencies' expertise re: *E. coli* behavior, modeling, Bacterial Source Tracking, controlled rivers, Long Term Control Plans (LTCP), data gaps

Bacteria TMDL Documentation

http://www.orsanco.org/bacteria-tmdl

- *Quality Assurance Project Plan*
- *Data Analysis and Conceptual Model*
- *Tributary Loading Estimations memo*
- *NPDES Point Sources memo*
- *Modeling memo*

Pittsburgh, PA

Quality Assurance Project Plan **and Changes**

- Characterize sources and develop conceptual model
  - **Summary memos by topic**
  - **Specialized tributary sampling**
  - **Review LTCPs**
  - **Review of outfall data**
- Set-up model **Change from CE-QUAL-W2 to HEC-RAS**
- Calibrate/validate model and prepare modeling report
  - **Determine segmentation**
- Run model and scenarios
- Develop draft TMDL report
- Public participation
- Develop final TMDL report

Preliminary data analysis methodologies

Data Analysis & Conceptual Model

Evaluation of datasets

- Longitudinal along the entire length of the Ohio River
- Long-term at six large cities on the Ohio River
- New sampling 2011-2012 at tributary mouths

Statistical Evaluation

- Load duration curves
- Contour plots
- Peak count analysis
- Regressions

Power Regressions

USGS fecal coliform

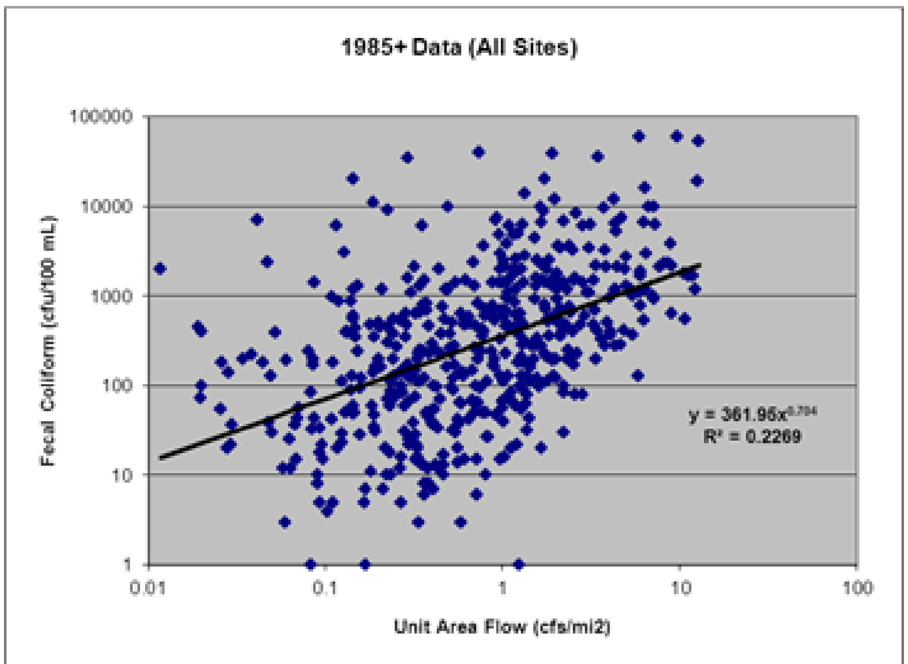
- Data exploration
  - Regression analysis
  - Independent/dependent variable representation
  - Outliers and extremes
  - Flow and seasonal influences
- Relationship between *unit area flow* and *bacteria (fecal coliform) concentration*

Power Regressions
ORSANCO *E. coli* data

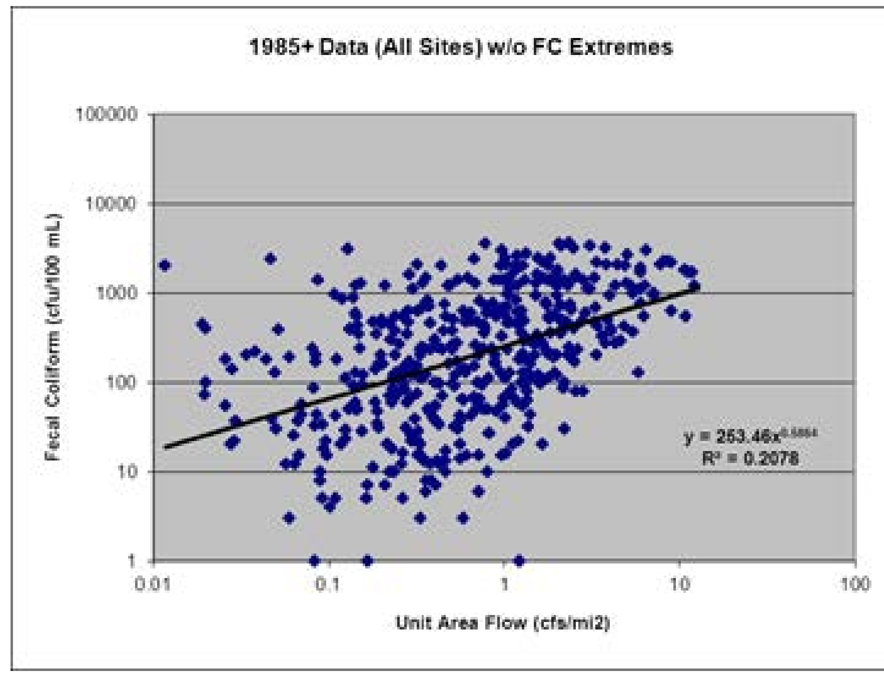
- Preliminary regressions with 2003-2009 data, updated with 2011-2012 data
- Purpose: to add information at the tributary mouths as “point” time-series inputs to model
  - Better model simulations not using a single static value
  - More representative, better characterization of natural flow
  - More confidence in simulation

USGS Fecal coliform data regression analysis – extreme values

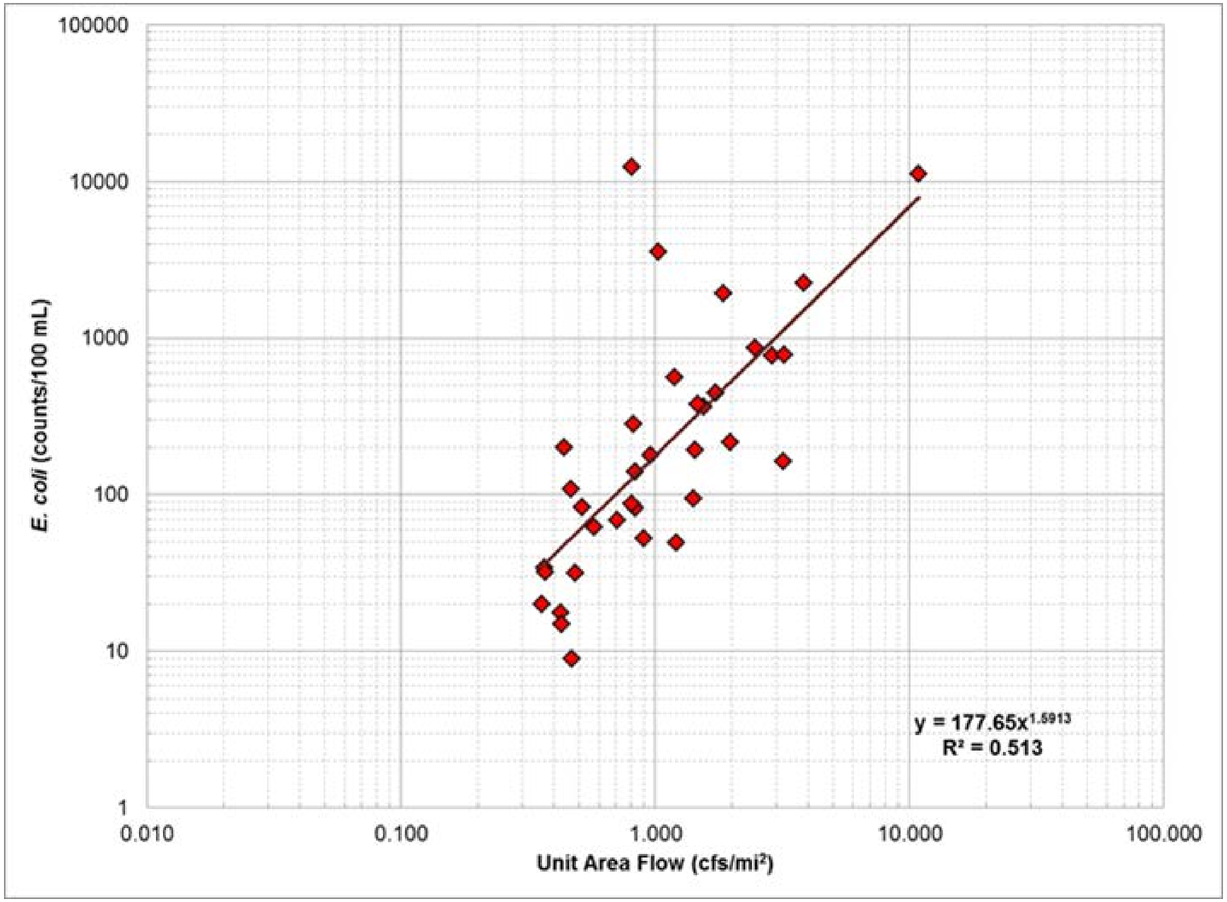
All sites all data R^2 = 0.2269



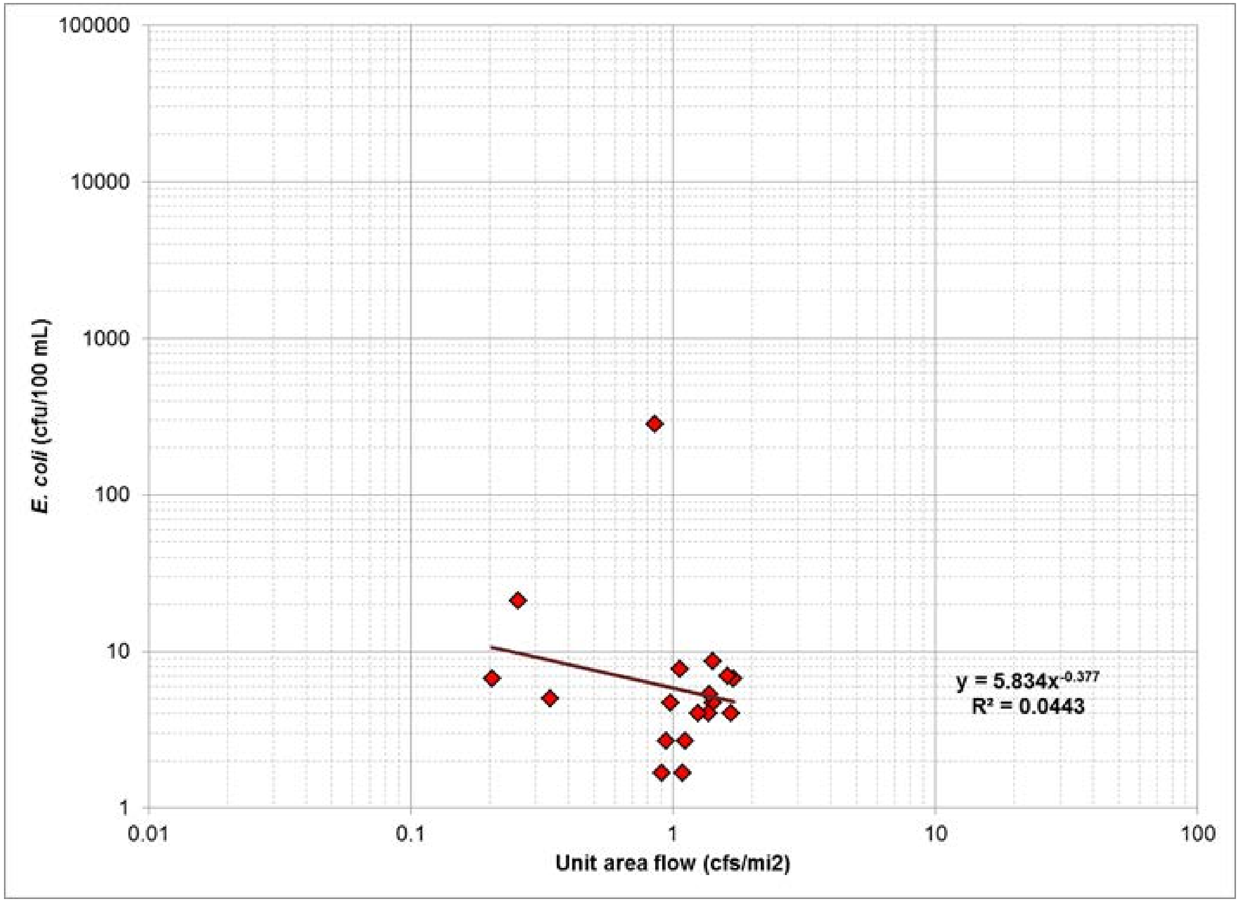
All sites omit extremes R^2 = 0.2078



ORSANCO *E. coli* data Regression analysis Hocking River

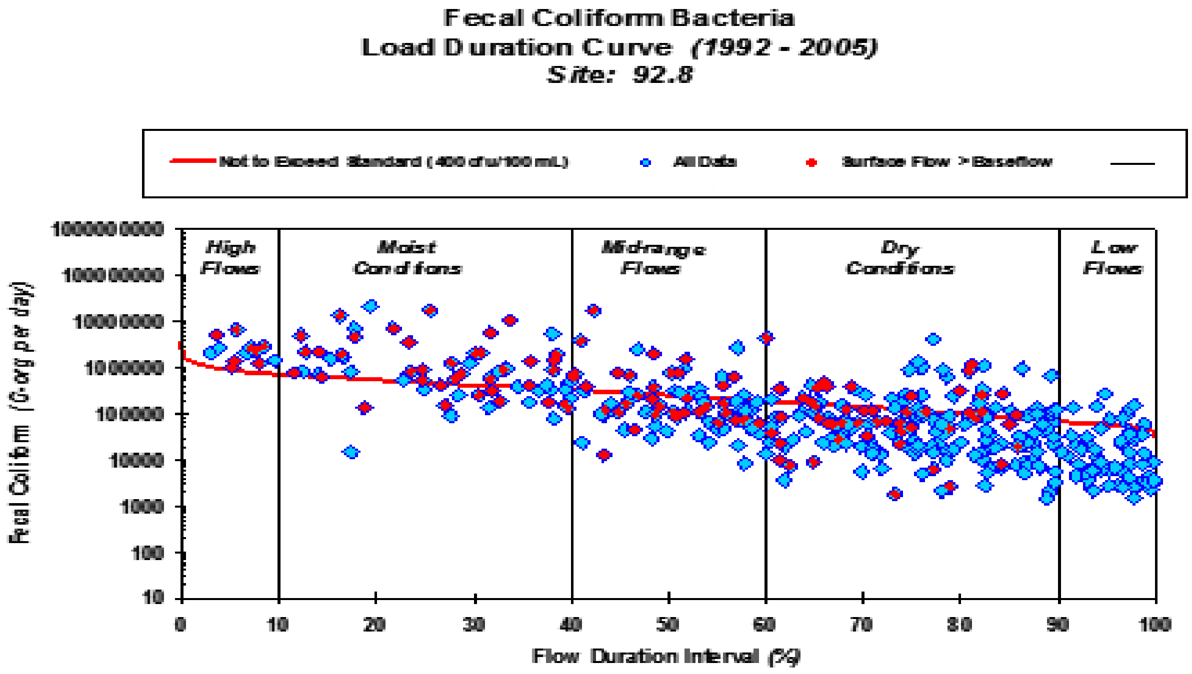


Regression of tributary with man-made flow control structures Cumberland River



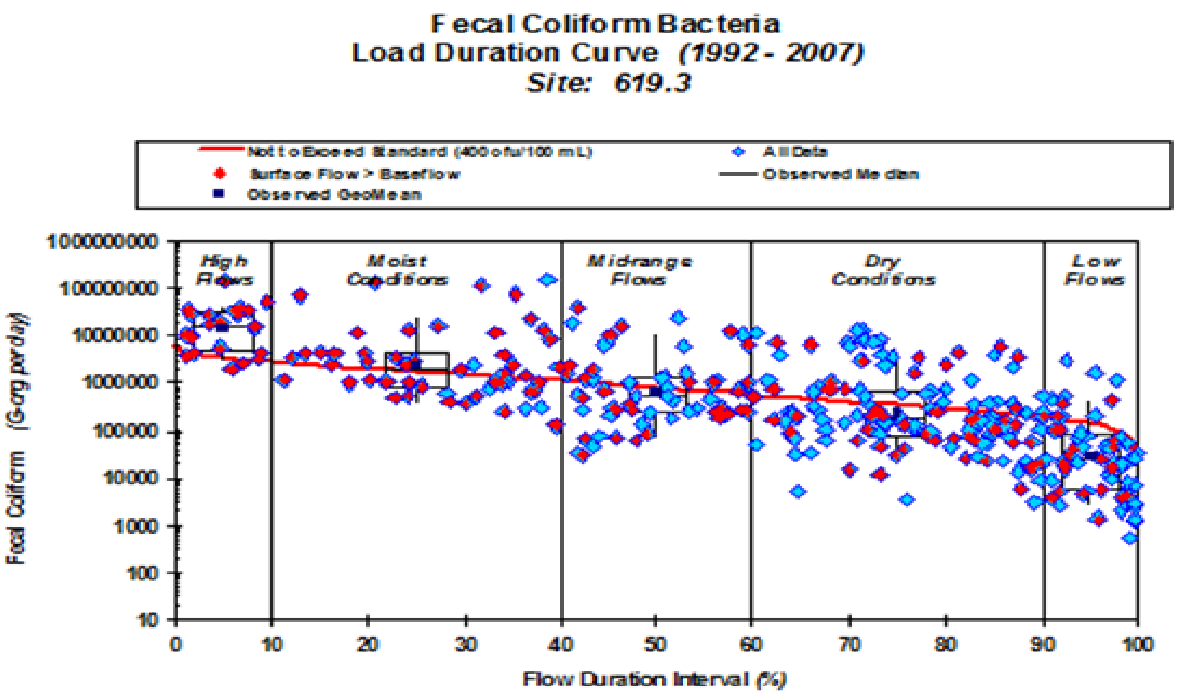
Load Duration Curve: Pike Island-Hannibal Pool

- High flows on left portion of figure, exceedances from both baseflow and runoff, moist conditions exceedances from both baseflow and runoff
- Low flow concentrations on right portion of figure, all part of baseflow
- Low flow standard exceedances only from baseflow conditions



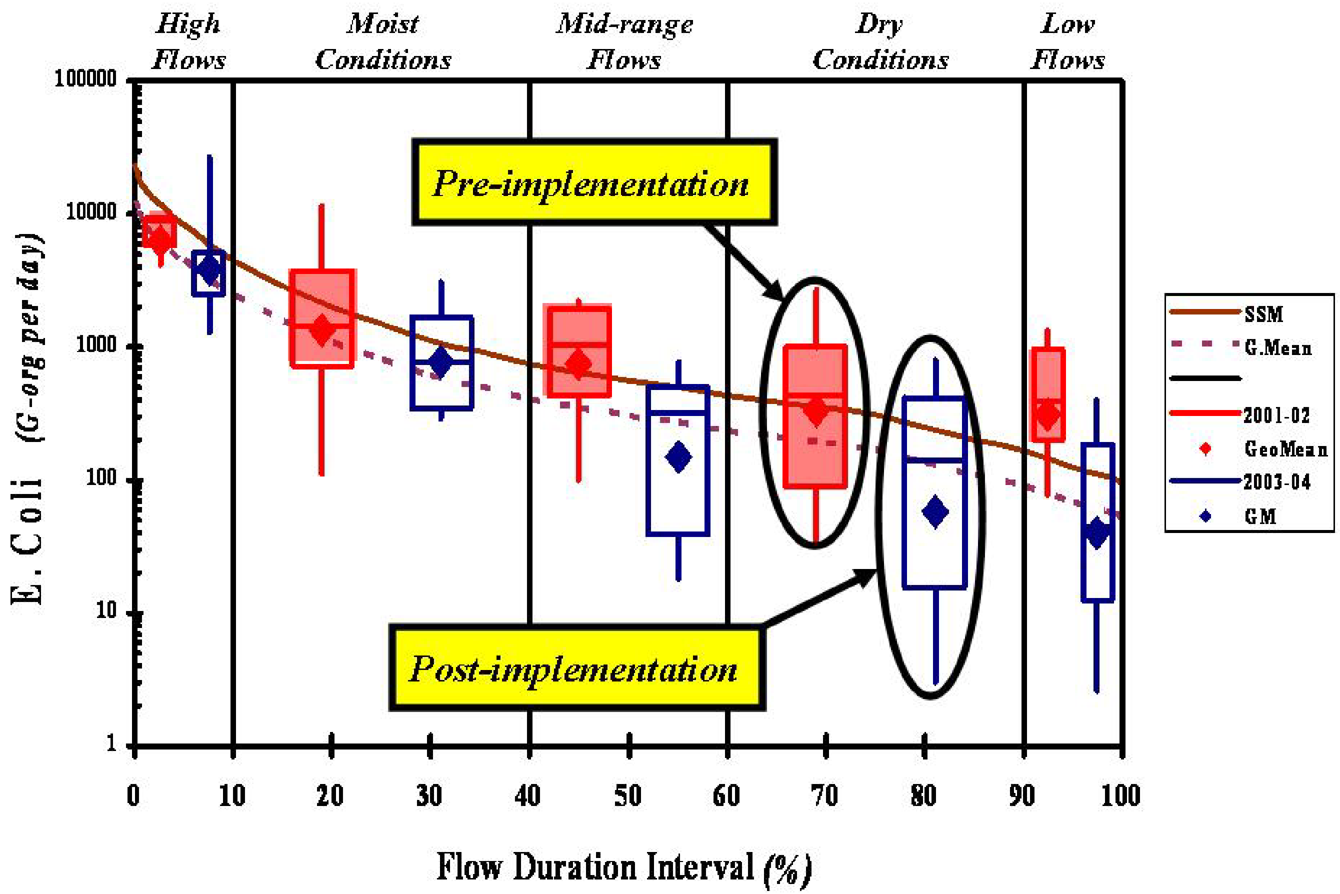
Load Duration Curve: McAlpine-Cannelton Pool

- High flows on left portion of figure, exceedances all from runoff, moist conditions exceedances mostly from runoff
- Low flow concentrations on right portion of figure, baseflow plus runoff
- Low flow standard exceedances both from baseflow and runoff



What "before and after" the TMDL implementation should look like -

Reductions in all flow regimes to meet standards



Bottom line of analyses

- Characterize different portions of the river
- More data to confirm original data and have more robust statistical analysis
- Data collection based on QA/QC recommendations from internal EPA review
- Can help focus on or identify possible difficult analysis in the modeling effort

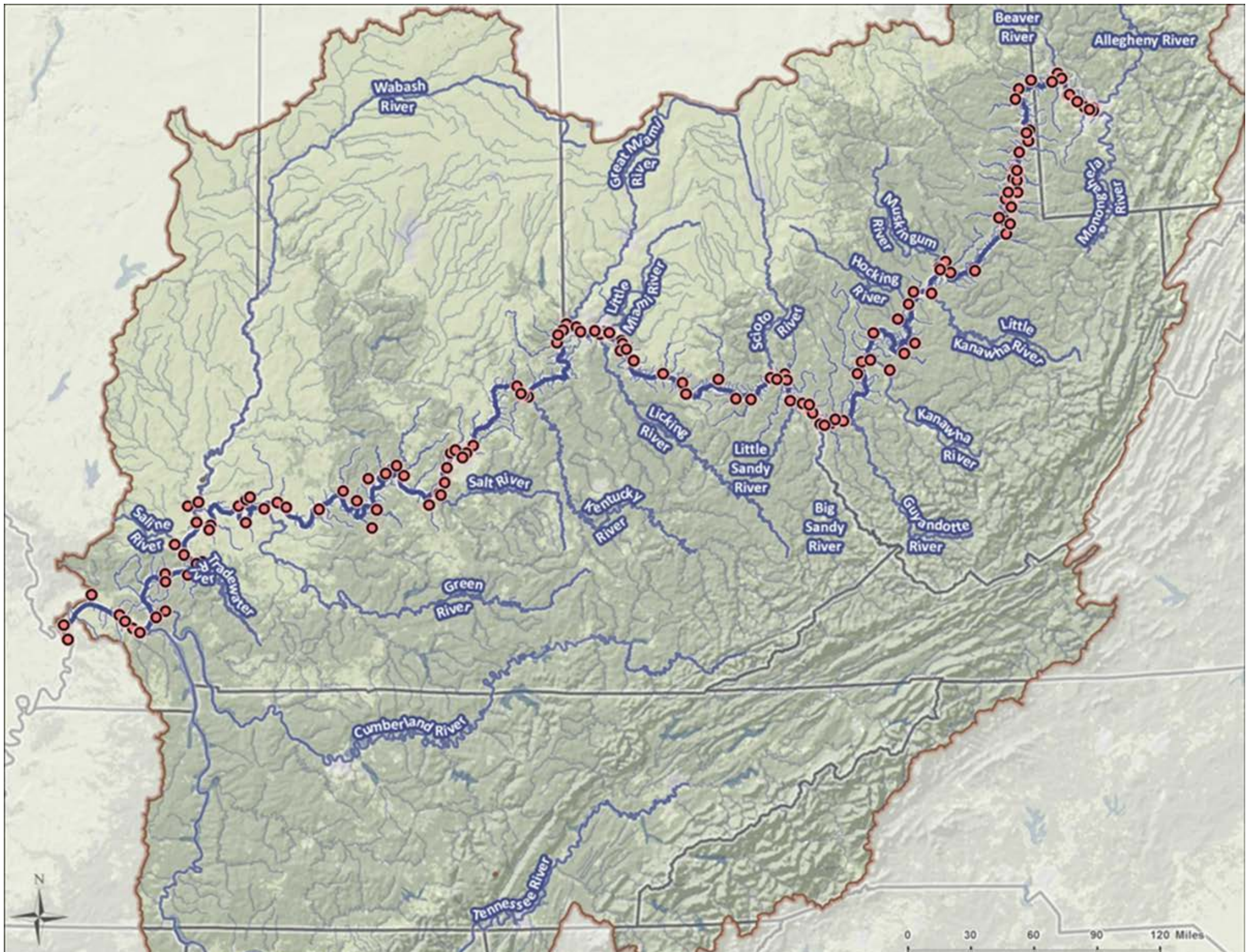
Flow analysis

- Tributaries provide critical input of both water quantity and quality to the mainstem
- Decision to use major tributaries and some minor tributaries as “point” inputs to the model
- Needed more data for these points to use as boundary conditions input to the model
- New sampling plan to strengthen tributary data inputs to the model

ORSANCO collected additional tributary samples

- Occurred in 2011 & 2012
- Address data gaps and need for better characterization
- Workgroup identified 37 tributaries for further sampling
- The primary contact recreational season is May through October - but extra months were added to better understand and assist the modeling effort
- 15 rounds sampled November 2011 and March/April 2012
- 555 total samples of *E. coli* collected and processed

ORSANCO Tributary Sampling Sites

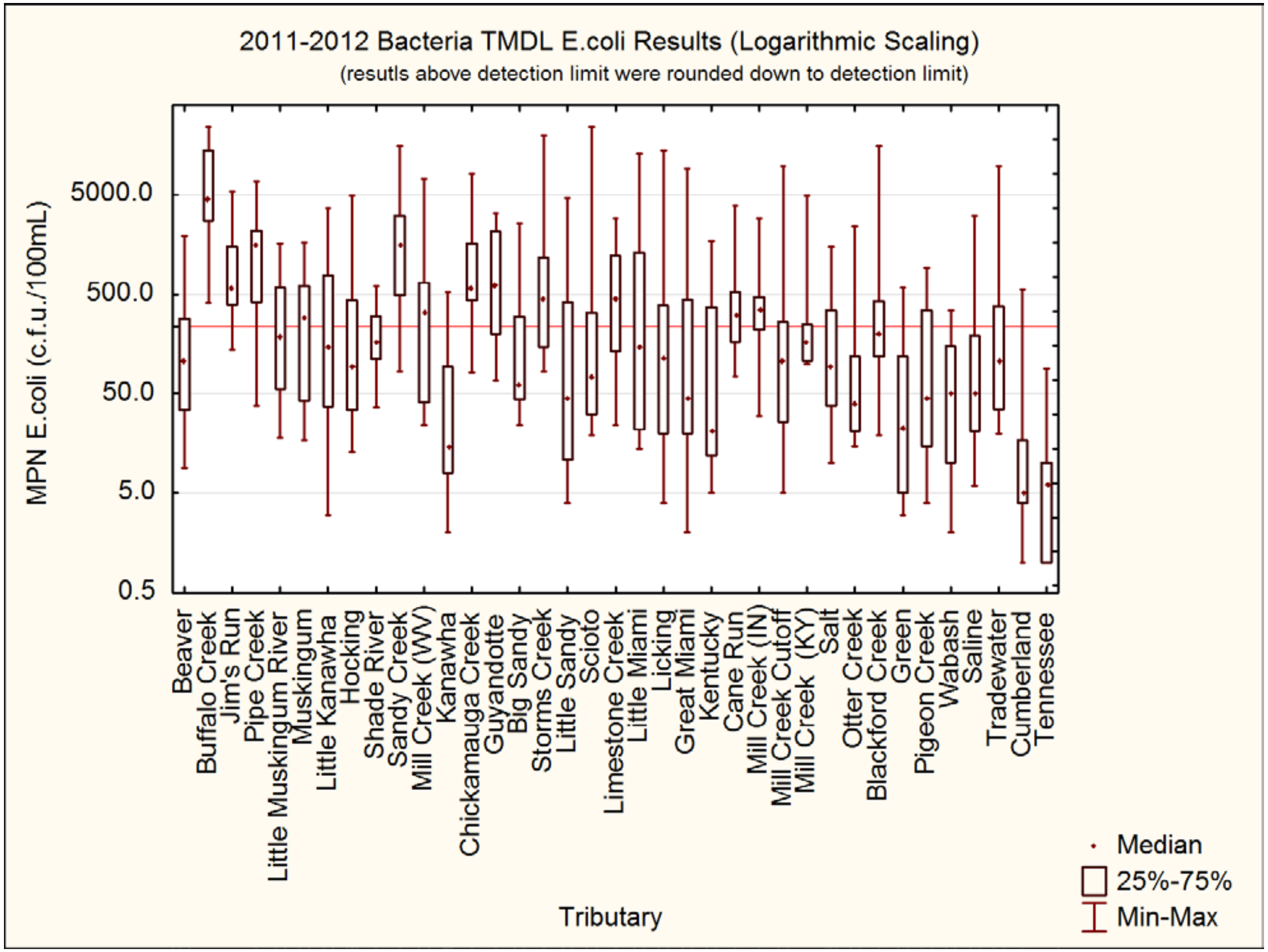


Sunny days

Calm days

Wet days

ORSANCO Tributary Sampling



Status of the Ohio River HEC-RAS Bacteria Model

Tetra Tech

Model Status

- Changed from initial model to Corps' HEC-RAS (Hydrologic Engineering Centers – River Analysis System)
- Better continuity with same framework for the hydrologic portion of the model
- Used daily for H&H on the river by the Corps
- Can adapt modules for water quality
- Calibration is currently occurring
- Next steps will be verification

Modeling

- Only the *major* tributaries are present in the existing model; we are adding *E. coli* loads for both *major* and *minor* tributaries
- Previous approach with power regressions of fecal coliform counts versus unit area flow
  - Individual regressions for *major* and *minor* tributaries with 25+ samples and *urban minor* tributaries
  - Generic regression for *major* and *minor* tributaries with fewer samples or with very poor individual regressions
  - No regressions for subbasins assumed to be ephemeral (i.e., less than 3 square miles)
- Will model both fecal coliform and *E. coli*

Modeling NPDES Inputs

Allocations

Ohio River

- WLA will be calculated for regulated sources directly discharging to the Ohio River
- LA will be calculated for non-regulated sources that discharge directly to the Ohio River

Tributaries

- Explicitly modeled tributaries will receive WLA as an aggregate value at the confluence with the mainstem
- Explicitly modeled tributaries will receive LA as qualitative values regarding likely sources
- Tributaries will not receive reductions if they do not directly discharge to the Ohio River
- Ephemeral tributaries will not receive reductions (i.e., draining less than 3 square miles)

Wasteload Allocations

NPDES facilities on the mainstem will receive WLAs

- WLA will be based upon permit limits, LTCPs, modeled loading capacities

NPDES facilities in tributary watersheds will not receive allocations

- With the previously discussed exception of NPDES facilities that discharge at or near the mouth of a tributary of the Ohio River

Combined Sewer Overflows (CSOs) & Sanitary Sewer Overflows (SSOs)

Combined Sewer Systems (CSS) considered:

- Discharge directly to or within 1 mile of the Ohio River

Available data vary by CSS

- Outfall locations (*most* CSS)
- Number of CSOs/SSOs, duration, volume, and precipitation (*some* CSS)
- Concentrations, pipe dimensions, volume of rain to cause CSO, and CSO modeling data (*very few* CSS)

Municipal & Industrial Facilities

- Facilities considered:
  - Permitted to discharge bacteria
  - Discharge directly to or within 1 mile of the Ohio River
- Daily Monitoring Reports (DMR) data to construct a time-series
  - Final effluent flow volume
  - Final effluent bacteria concentration
- In the absence of bacteria data, concentrations will be estimated on the basis of facility type
- DMR data focus on date, duration, and volume of overflow
- Not in model yet
- Not likely to have a big impact

Regulated MS4s

- Only regulated MS4s are considered
  - Discharge directly to the Ohio River
- Available data are limited
  - Population (U.S. Census)
  - System information (varies by state)
    - Total area (IN, PA)
    - Number of outfalls (IN)
    - Total length of conveyance structures (IN)
- Loads will be estimated based upon system area, population, and land use
- Any additional information can still be accepted and utilized in the modeling effort

Outline of Draft TMDL Report

Likely Minimum Segmentation Upstream and Downstream of major inputs

- Urban locations - sampled annually (6)
- CSO communities (49)
- Major tributaries (37)
- State boundaries (5)
- Locks and dams locations (20)
- Spatial relationship to sampling sites
- Other - to be decided by state workgroup representatives

Outline of TMDL Report

1. Purpose and Background
   - Project Organization
   - Approach
2. Water Quality Standards and Impairments
   - ORSANCO
   - States
   - TMDL Targets
3. Setting
4. Summary of Water Quality Data

Outline of TMDL Report

5. Source Assessment
   - Point Sources
   - Nonpoint Sources
   - Tributaries
   - High Priority Sources for Model Development
6. Modeling and Loading Capacity
   - Model Development
   - Model Results
   - Loading Capacity
7. Allocations (WLA + LA)
   - Existing/Baseline Conditions
   - Baseline Scenario – final stage with all LTCPs implemented, all regulated sources set to permit limits, and completed tributary TMDLs accounted for
   - Reduction Scenario – further reduction of the tributaries and other sources to meet all applicable WQS

Outline of TMDL Report

8. Margin of Safety
9. Critical Conditions and Seasonal Variation
10. Reasonable Assurances
11. Implementation
12. Public Participation
13. References

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Thank You