

State Perspectives on NNC and Permitting

James Crawshaw & Ashley Keely
Missouri Department of Natural Resources



Presentation Overview

- Lake Nutrient Criteria
- Nutrient Implementation Plan
- Three-phase Nutrient Reduction Approach
- Modeling Case Study
- Questions

Criteria and Screening Values

Lake Ecoregion	Chl-a Criterion (µg/L)	Screening Values (µg/L)		
		Total Phosphorous (TP)	Total Nitrogen (TN)	Chl-a
Plains	30	49	843	18
Ozark Border	22	40	733	13
Ozark Highland	15	16	401	6

- Geometric mean of a minimum of four samples per year
- Samples collected from lake surface, near outflow
- Sampling period May 1 – September 30

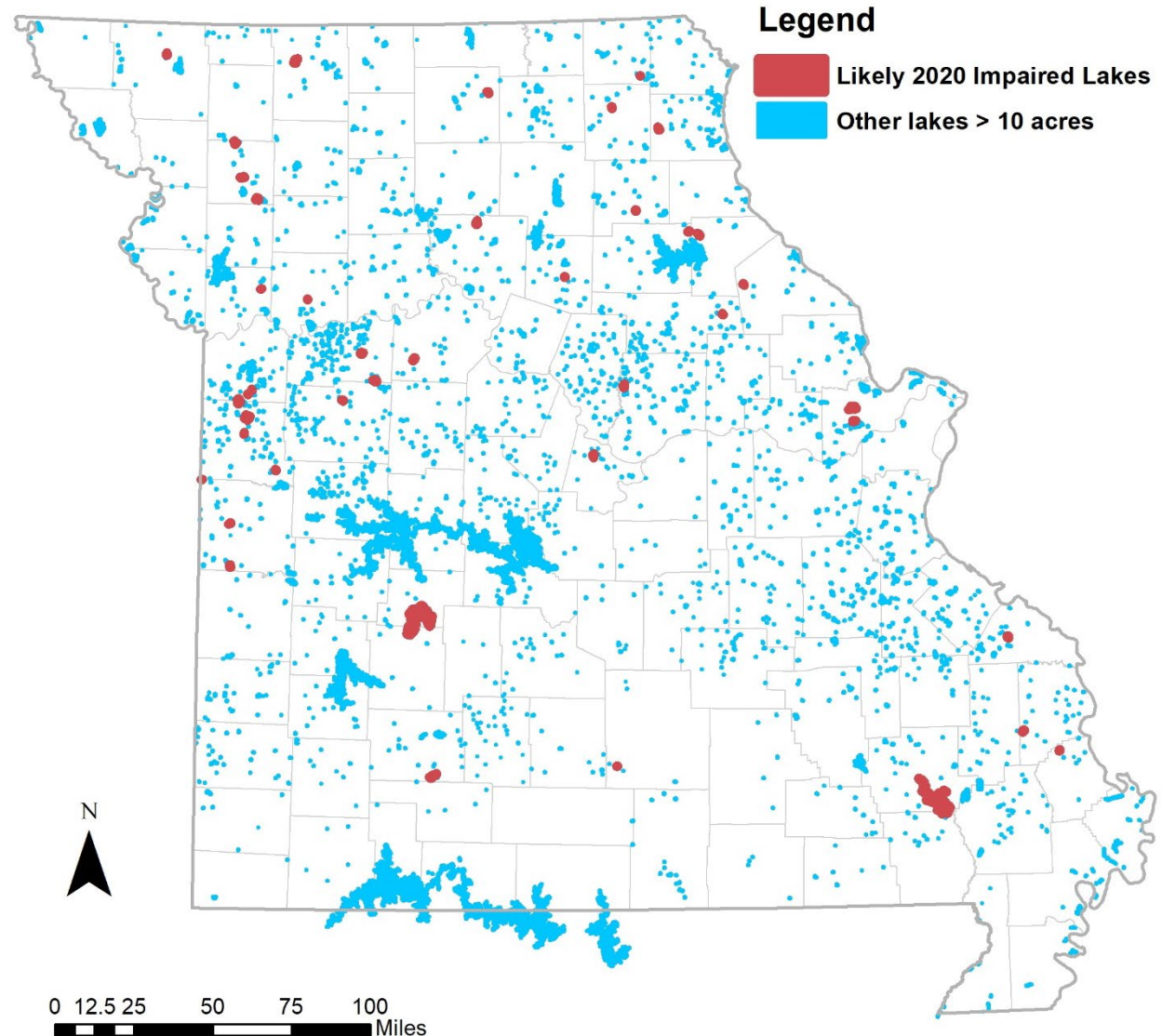
Eutrophication Factors

- Eutrophication related mortality
- Excursions of DO or pH criteria
- Cyanobacteria > 100,000 cells/mL
- Shift in aquatic diversity
- Excessive mineral turbidity



- Assessment underway
- ~ 43 potential impaired lakes so far
- Trend analysis may add to this number

Numeric Nutrient Criteria Potential Impaired Lakes



Nutrient Criteria Implementation Plan

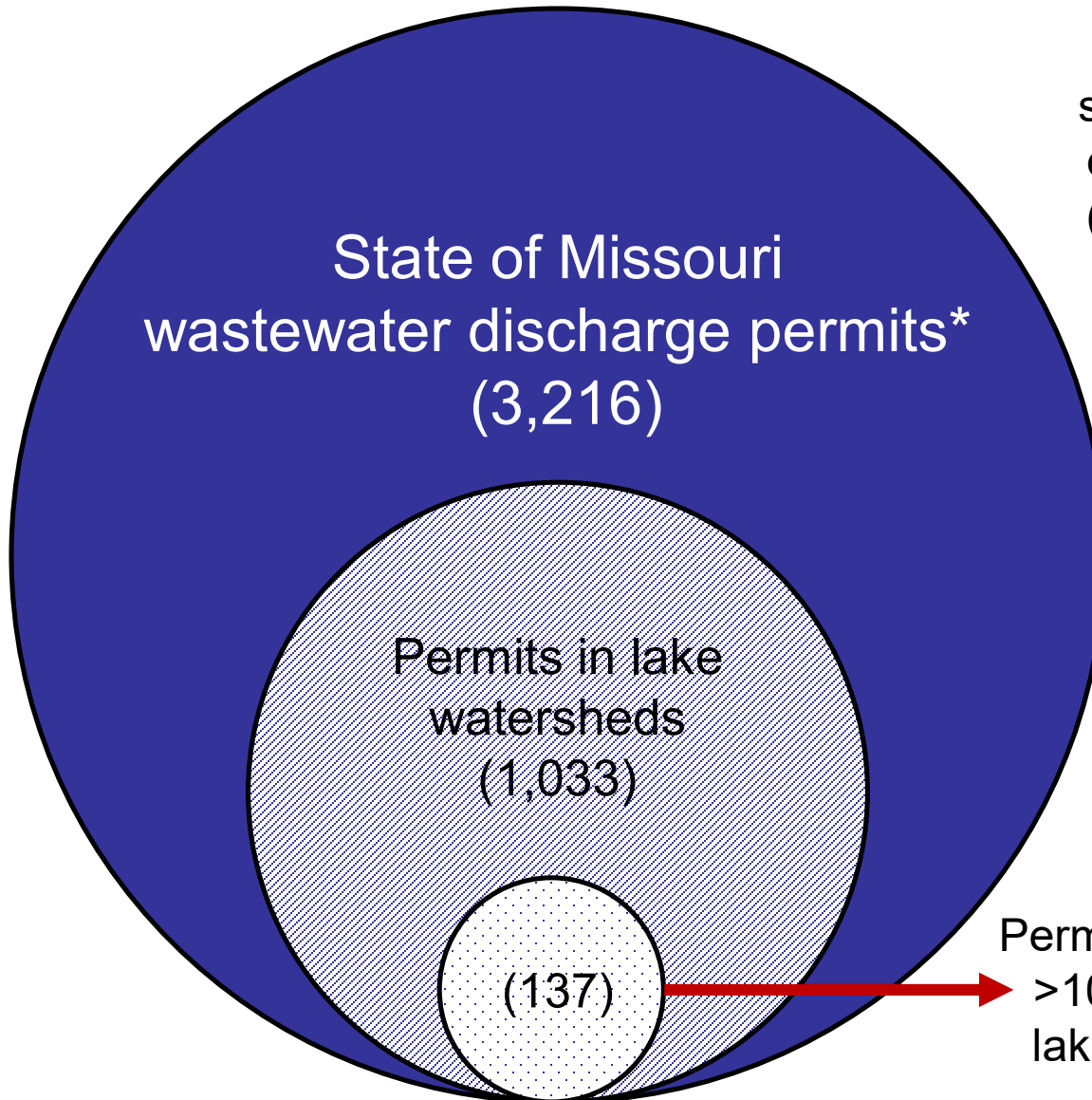
- Part I – Monitoring and Assessment
 - Lakes of Missouri Volunteer Program
 - Statewide Lake Assessment Program
- Part II – Permit Implementation
 - Three-phased approach for nutrient reduction

Nutrient Criteria Implementation Plan

- Missouri's nutrient criteria is applicable to facilities with discharges to a lake watershed where:
 - Lake area is ≥ 10 acres
 - Lake is not in the Big River Floodplain
 - Facility has a design flow $> 100,000$ gpd
 - Facility typically discharges nutrients



MISSOURI
DEPARTMENT OF
NATURAL RESOURCES



*Excludes stormwater and no discharge permits (such as CAFOs).

Permits for facilities
>100,000 gpd in
lake watersheds



MISSOURI
DEPARTMENT OF
NATURAL RESOURCES

Implementing a Three-Phase Nutrient Reduction Approach

Phase 1

Data
Collection
and Analysis

Phase 2

Voluntary
Optimization
and Source
Control

Phase 3

Final
Effluent
Limitations

Phase 1 – Data Collection and Analysis

Design Flow (gpd)	Sampling Frequency
> 100,000 to < 1,000,000	Quarterly
$\geq 1,000,000$	Monthly

Influent and Effluent Monitoring Requirements	
Total Phosphorus	Total Nitrogen (Nitrite + Nitrate, Total Kjeldahl Nitrogen, and Ammonia as N)

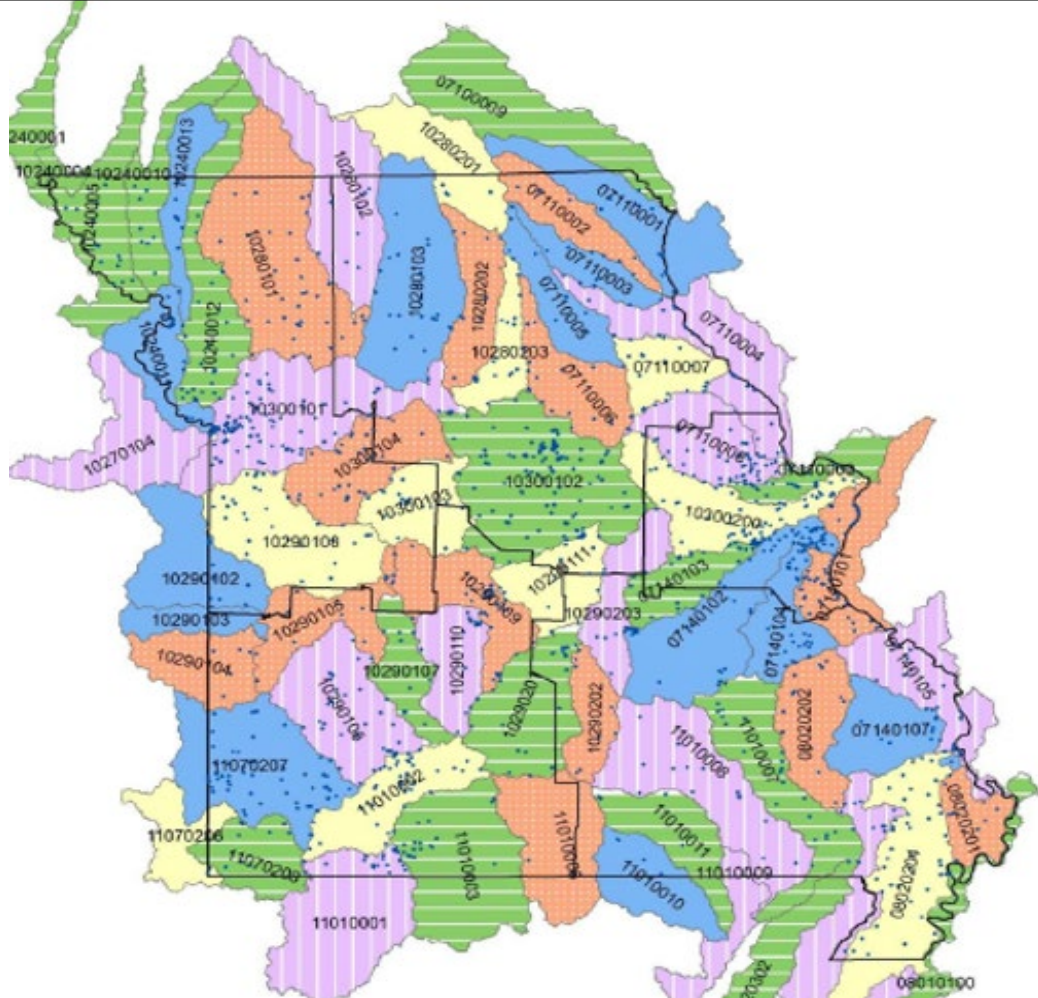
Phase 2 – Voluntary Plant Optimization and Source Control

- **Opt out:** Move to Phase 3. Modeling group will use data from Phase 1 to determine reasonable potential (RP).
- **Opt in:** Permittee has up to 5 years to determine cost-effective strategies for nutrient reduction by:
 - Making operational adjustments
 - Reducing the amount of phosphorus entering the facility
- Resources will be made available to permittees (trainings, fact sheets, publications, etc.)



Phase 3 – Final Effluent Limits

-



Existing Dischargers to Impaired Lakes

Does the facility's discharge cause or contribute to the impairment?

No

- Limits will not be established, but monitoring may still be required for future determinations

Yes

- Effluent limits that are protective of water quality will be established

- If an existing discharge goes to an unimpaired lake, modeling will determine if facility has reasonable potential to *cause* a nutrient impairment.



New or Expanding Dischargers to Impaired Lakes

Will the facility's discharge cause or contribute to the impairment?

No

- Permit writer will establish TP limits based on best available technology

Yes

- Need more advanced treatment or alternative method of wastewater disposal

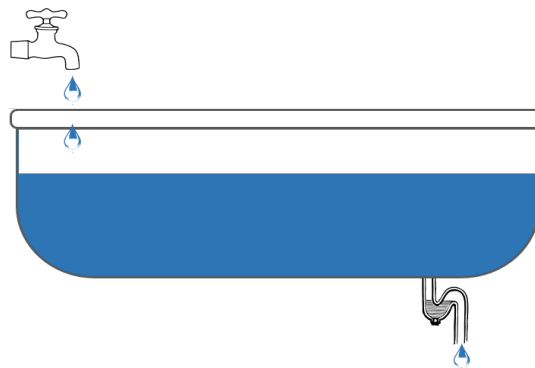
➤ If an new or expanding discharge goes to an unimpaired lake, limits will be based upon a Tier II Antidegradation Review.

Flexibilities for Permittees

- Tools for permit compliance
 - Schedules of Compliance
 - WQS Variances
 - Watershed-Based Permits
 - Water Quality Trading
 - Integrated Management Plans

Modeling Approach

- Determine if facilities have reasonable potential to cause or contribute to impairment
- BATHTUB model for lake water quality
- Watershed model to predict NPS loading
- Attenuation model for fate and transport
- Use observed data whenever available





Case Study – Table Rock Lake

Bathtub Version 6.1

Case Edit Run List Plot Options Help
Quit

Status: Ready

Standard Mode Run

File: demo_tablerock.btb
Title: TableRock
Segments: 7 Tributaries: 37
Predicted Area-Weighted Means:
---Total P (ppb) = 21
---Total N (ppb) = 482
---Chl-a (ppb) = 8
---Secchi (m) = 3.1

Output Destination: EXCEL WORKSHEET

Output Workbook: bathtub_output.xls

Clear Output Save Output

Edit Tributary Data

List Add Insert Delete Clear Undo Help Cancel OK

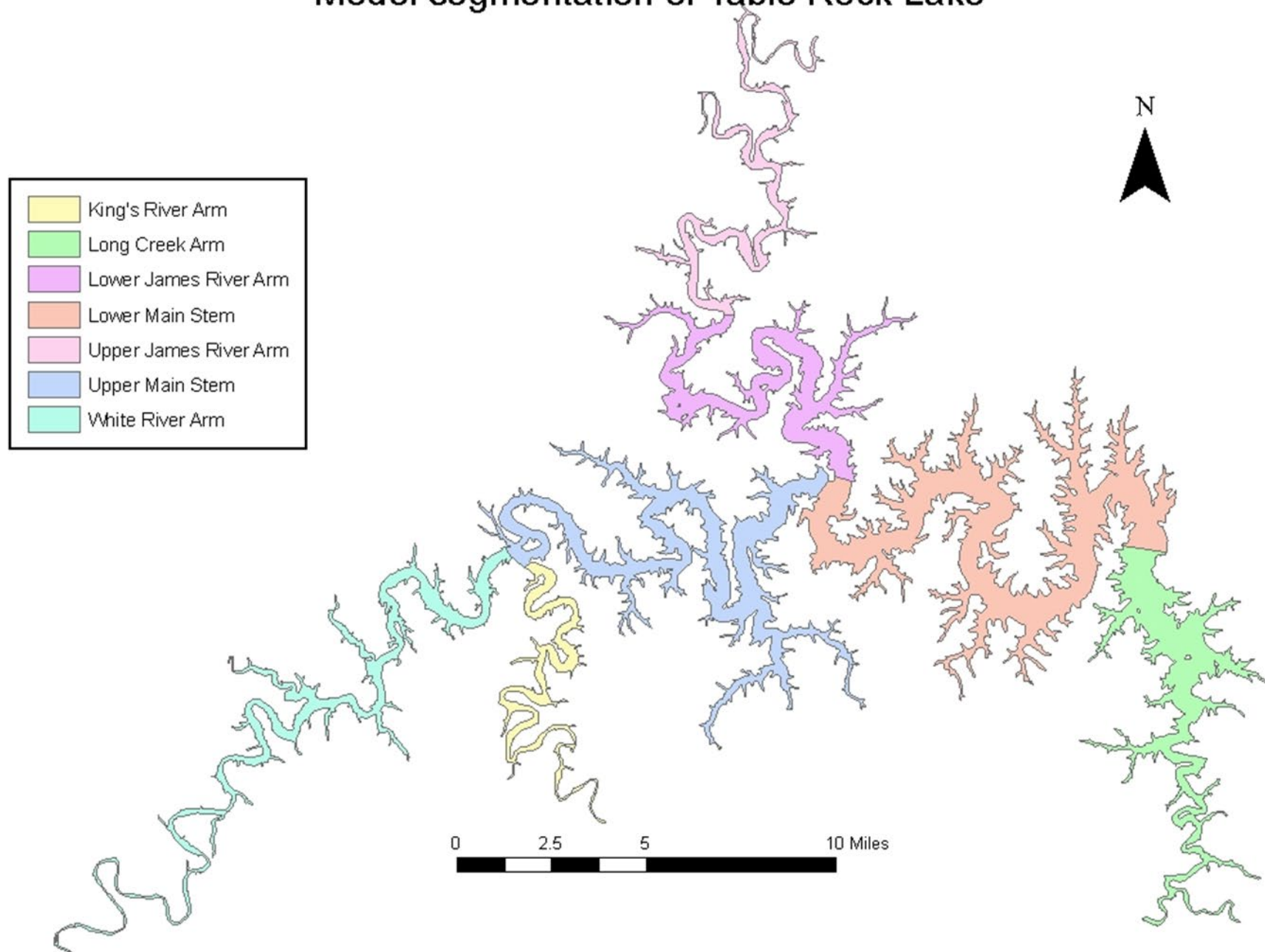
01 James River Number of Tributaries = 37

Monitored Inputs Land Uses

Tributary Name: James River
Segment: 07 Upper James River Arm
Tributary Type: 01 Monitored Inflow

	Mean	CV
Total Watershed Area (km2):	2669.6	
Flow Rate (hm3/yr):	766.27	0.28
Total P Conc (ppb):	164	1.38
Ortho P Conc (ppb):	115	1.27
Total N Conc (ppb):	2515	0.55
Inorganic N Conc (ppb):	2137	0.325
Conservative Subst. Conc (ppb):	0	0

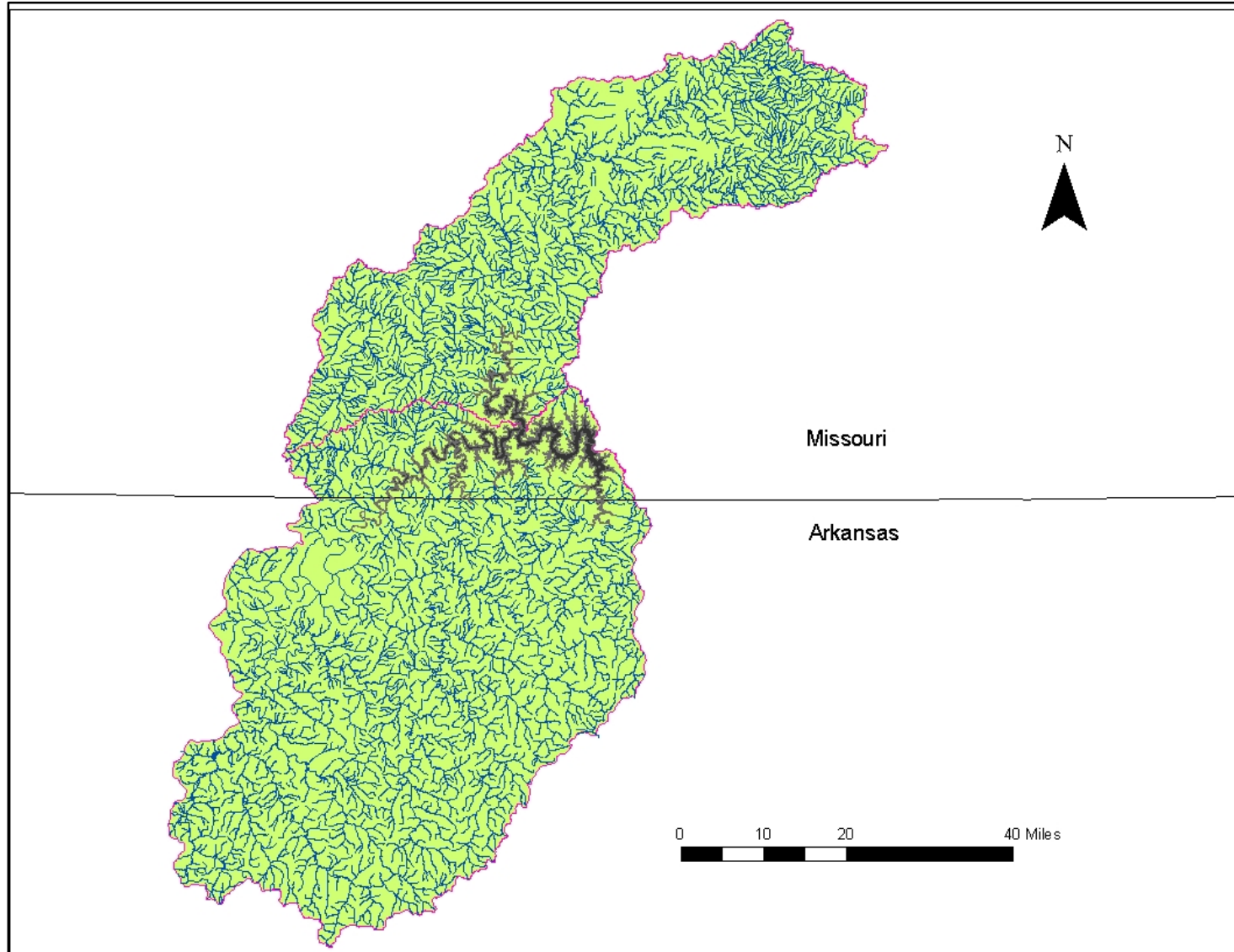
Model segmentation of Table Rock Lake





MISSOURI
DEPARTMENT OF
NATURAL RESOURCES

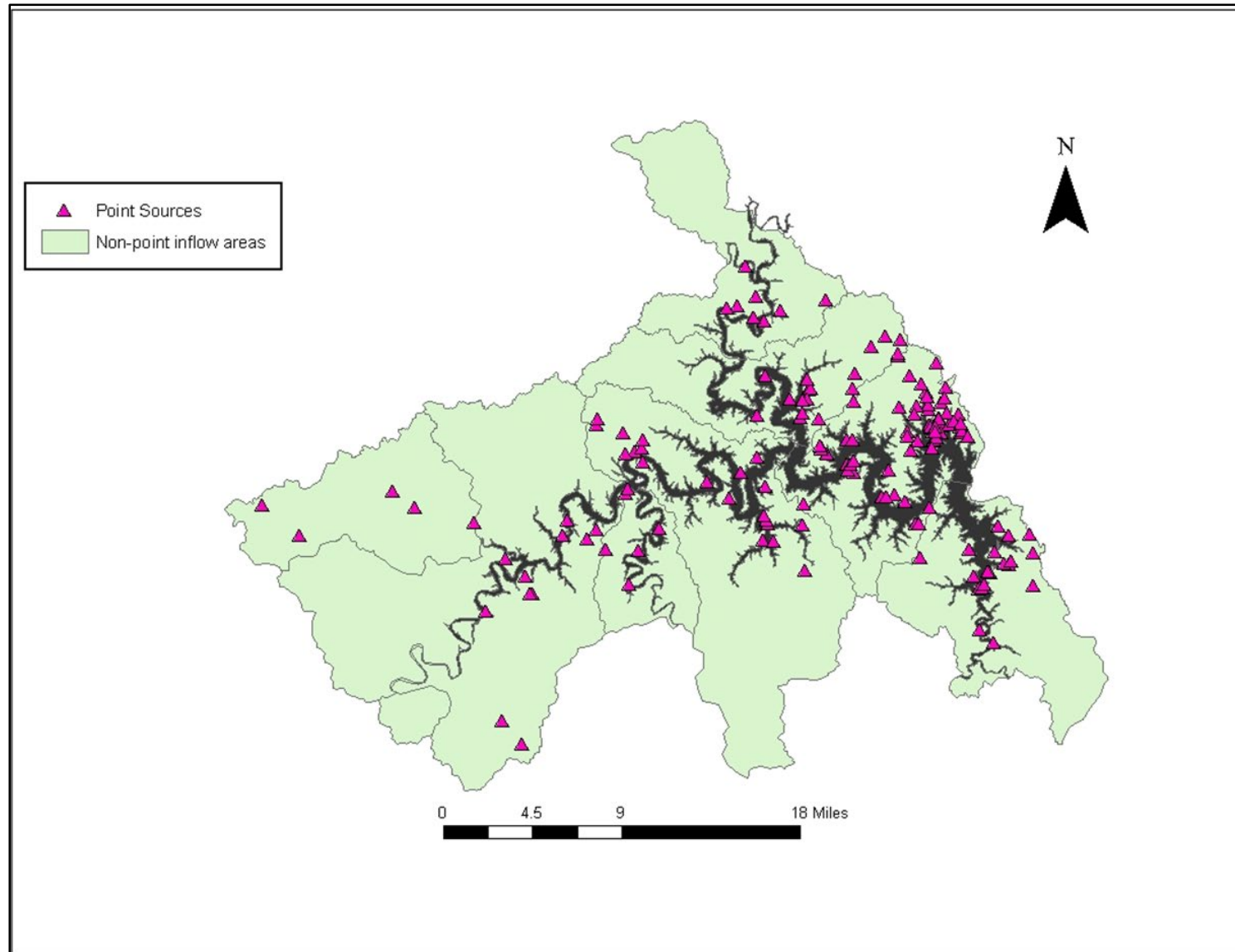
Watershed Area of Table Rock Lake





MISSOURI
DEPARTMENT OF
NATURAL RESOURCES

Point sources with potential direct impact on lake



Thank you!

James Crawshaw
Environmental Specialist
Missouri Department of Natural Resources
Watershed Protection Section
573-751-2034
james.crawshaw@dnr.mo.gov

Ashley Keely
Environmental Specialist
Missouri Department of Natural Resources
Operating Permits Section
573-751-7326
ashley.keely@dnr.mo.gov