

8 CAR Part 21 Stakeholder Workgroup

2026 Triennial Review



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ENERGY & ENVIRONMENT

Housekeeping

- Today's session is being recorded
- Silence cell phones
- When commenting or asking questions, state your name and speak into a microphone during designated Q&A time slots
- Only one conversation at a time
- Bathrooms are behind the elevators
- Coffee and water are in the back
- Emergency exit on the west opposite the door

Purpose of Workgroup

To assist DEQ by providing feedback on proposed revisions. We will do this by:

- Offering unique perspectives
- Facilitating discussion
- Providing reasonable and achievable recommendations for proposed 8 CAR Part 21 revisions



Participant Expectations

- Express opinions and ask questions in a professional manner
- Respect all participants and their right to express their views
- Stay on topic

8 CAR Part 21

“Rule 2” prior to March 2024

Arkansas Code Title 25. State Government § 25-15-218. Code of Arkansas Rules

The Bureau of Legislative Research

Completed January 2025

Code of Arkansas Rules: A codification of the general and permanent rules of agencies with a uniform style, format, and numbering system.

Rule 2 - 8 CAR Part 21

ARKANSAS POLLUTION CONTROL AND ECOLOGY COMMISSION

Regulation No. 2, As Amended

**Regulation Establishing
Water Quality Standards for Surface Waters
of the State of Arkansas**

CHAPTER 1: AUTHORITY, GENERAL PRINCIPLES, AND COVERAGE

Reg. 2.101 Authority

Pursuant to the Arkansas Water and Air Pollution Control Act, (Ark. Code Ann. § 8-4-101 *et seq.*), and in compliance with the requirements of the Federal Water Pollution Control Act, 33 U.S.C. § 1251 *et seq.*, (hereinafter “Clean Water Act”), the Arkansas Pollution Control and Ecology Commission (hereinafter “Commission”) hereby promulgates this regulation establishing water quality standards for all surface waters, interstate and intrastate, of the State of Arkansas.

Reg. 2.102 Purpose

The water quality standards herein set forth are based upon present, future and potential uses of the surface waters of the State and criteria developed from statistical evaluations of past water quality conditions and a comprehensive study of least-disturbed, ecoregion reference streams. The standards are designed to enhance the quality, value, and beneficial uses of the water resources of the State of Arkansas, to aid in the prevention, control and abatement of water pollution, to provide for the protection and propagation of fish and wildlife and to provide for recreation in and on the water. In establishing these standards, the Commission has taken into consideration the use and value of the streams for public water supplies, commercial, industrial and agricultural uses, aesthetics, recreational purposes, propagation of fish and wildlife, other beneficial uses, and views expressed at public hearings. The State of Arkansas has an exceptionally large volume of high quality water. With few exceptions the streams and lakes of Arkansas contain waters of a quality suitable for all legitimate uses without the necessity of unreasonable water treatment. Where man-made pollution exists, substantial progress has been

Title 8. Environmental Law

Chapter I. Arkansas Pollution Control and Ecology Commission, Department of Energy and Environment

Subchapter C. Water Quality

Part 21. Rule Establishing Water Quality Standards for Surface Waters of the State of Arkansas

Subpart 1. Authority, General Principles, and Coverage

8 CAR § 21-101. Authority.

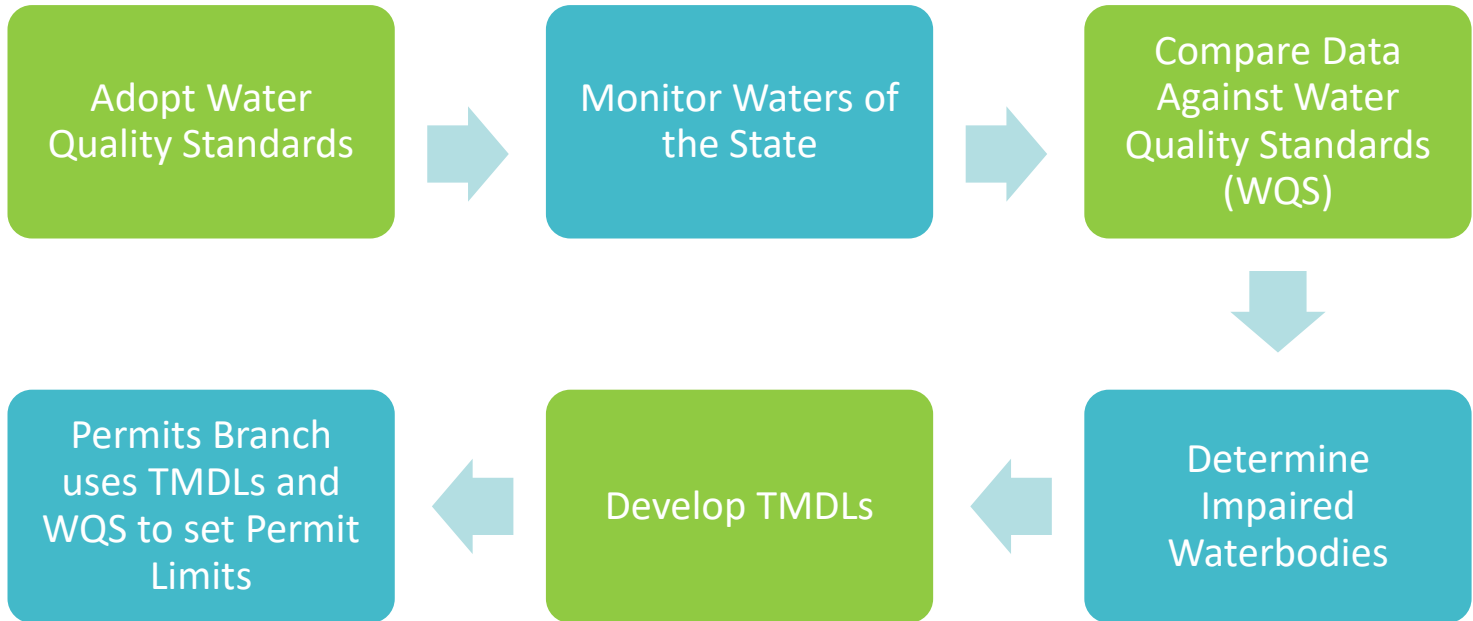
Pursuant to the Arkansas Water and Air Pollution Control Act, Arkansas Code § 8-4-101 *et seq.*, and in compliance with the requirements of the federal Water Pollution Control Act, 33 U.S.C. § 1251 *et seq.*, (hereinafter “Clean Water Act”), the Arkansas Pollution Control and Ecology Commission hereby promulgates this rule establishing water quality standards for all surface waters, interstate and intrastate, of the State of Arkansas.

8 CAR § 21-102. Purpose.

(a)(1) The water quality standards herein set forth are based upon present, future, and potential uses of the surface waters of the state and criteria developed from statistical evaluations of past water quality conditions and a comprehensive study of least-disturbed, ecoregion reference streams.

(2) The standards are designed to enhance the quality, value, and beneficial

Clean Water Act Requirements



What are Water Quality Standards?

Designated Use

Specified goals and expectations for how each waterbody is used

Criteria

Numeric or narrative values that protect designated uses

Antidegradation Policy

Requirements that provide a framework for maintaining and protecting water quality that has already been achieved



Designated Uses



**Primary Contact
Recreation**



Aquatic Life



**Domestic
Water Supply**



**Industrial Water
Supply**



**Secondary Contact
Recreation**

Water Quality Criteria

WQS include numeric and narrative criteria that protect Arkansas's waters

Numeric

- Bacteria (*E. coli*) – 410 colony forming units
- Temperature – 32 °C (89.6 °F)
- Dissolved Oxygen – 5 mg/L

Narrative

- Color – True color shall not be increased in any waters to the extent that it will interfere with present or projected future uses of these waters



Triennial Review Background

Clean Water Act (1972) requires states to establish WQS

- Must review WQS every 3 years
- Adopt new or revised WQS based on:
 - New or updated federal or state regulations
 - Legal decisions
 - New or updated scientific information
 - Public input
- Submit to EPA for review & approval



Previous (2023) Triennial Review

Task	Timeline
Stakeholder Workgroup	March – May 2022
Governor's Office	November 2024
Petition the APC&E Commission	December 2024
Public Notice	December 2024
Public Hearing	January & February 2025
45-day Comment Period	December 2024 – Feb. 2025
Responsive Summary	April 2025
Adoption by APC&E Commission	April 25, 2025
Legislative Review	June 2025
Submit to EPA	July 2025
EPA response	October 2025

DRAFT

Current (2026) Triennial Review

Task	Timeline
Informal Input Survey	July 15-August 14, 2025
Stakeholder Workgroup	Fall 2026
Governor's Office	Winter 2027
Petition the APC&E Commission	Spring 2027
Public Notice	Spring 2027
Public Hearing	Spring 2027
45-day Comment Period	Spring 2027
Responsive Summary	Summer 2027
Adoption by APC&E Commission	Summer 2027
Legislative Review	Fall 2027
Submit to EPA	Fall 2027

Informal Input Survey

Questions 1 – 10

- Prioritizing criteria revisions

1 = Short term goal

5 = Long term goal

Question 11

- Are there additional criteria you would like to see the Division investigate?

Informal Input Survey Results

- Survey Reach
 - E-mailed to ~500 people
 - Noted in Mitchell Williams Law Blog
 - Distributed to AEF and AWWMA members
- Response
 - 12 individuals
 - Primarily neutral

Proposal:

**Grammar, Formatting, &
Consistency**



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Minor Proposals

- Footnotes moved into text
- 21-106 – “trout waters” instead of “trout fishery”
- 21-302 – “designated use” instead of “beneficial use”
- 21-512 – correct typo in acute table and add “mg/L”
- Appendix A – correct typos in site specific criteria tables

Grammar, Formatting, & Consistency Discussion



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Background Information – Watershed Size Specific Uses

- Recreation
 - $> 10 \text{ mi}^2$ – primary contact
 - April 1 – October 31
 - $< 10 \text{ mi}^2$ – secondary contact
- Aquatic life
 - $> 10 \text{ mi}^2$ – year-round
 - $< 10 \text{ mi}^2$ – non-critical season only
 - Water temp. $< 22^\circ\text{C}$

Proposal:

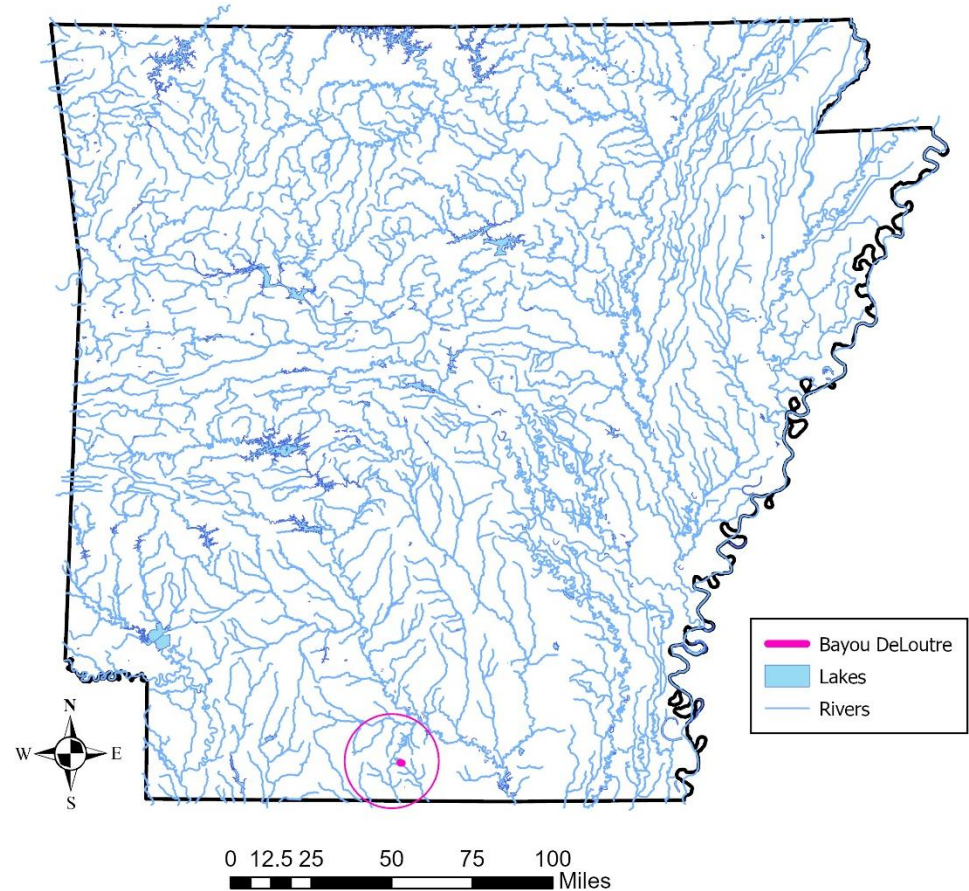
Site Specific Criteria Removals



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Site Specific Temperature Criteria Removal

- Bayou De Loutre from Lanxess Outfall 001 to Loutre Creek



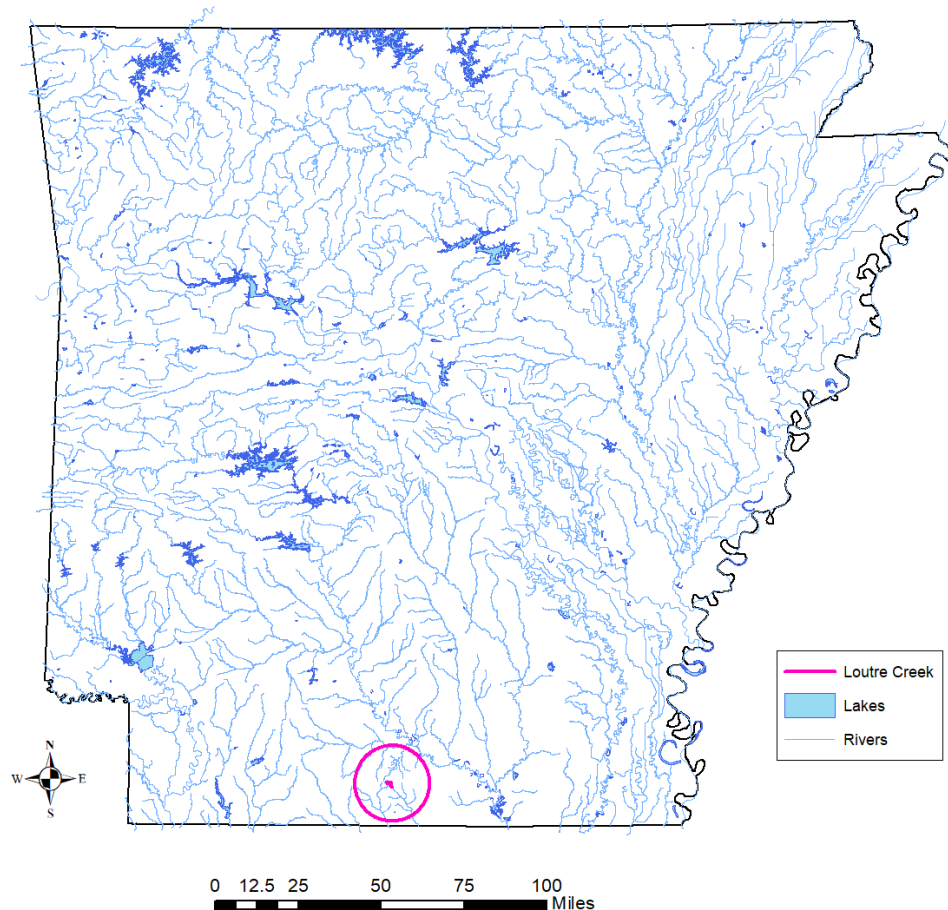
Site Specific Temperature Criteria Removal

Current Criteria	Proposed Revision – Apply Ecoregion Criteria
35.6°C/96°F	30°C/86°F

- Bayou De Loutre from Lanxess Outfall 001 to Loutre Creek – 2002
- Lanxess permit limit - 96°F
 - 8/2019 – 6/2024 - Did not discharge
 - 12/11/2019 - Permittee requested that Outfall 001 be removed
 - 7/1/2024 - Permit renewal did not include Outfall 001

Site Specific Dissolved Oxygen Criteria Removal

- Loutre Creek from headwaters to railroad bridge
- Loutre Creek from railroad bridge to mouth



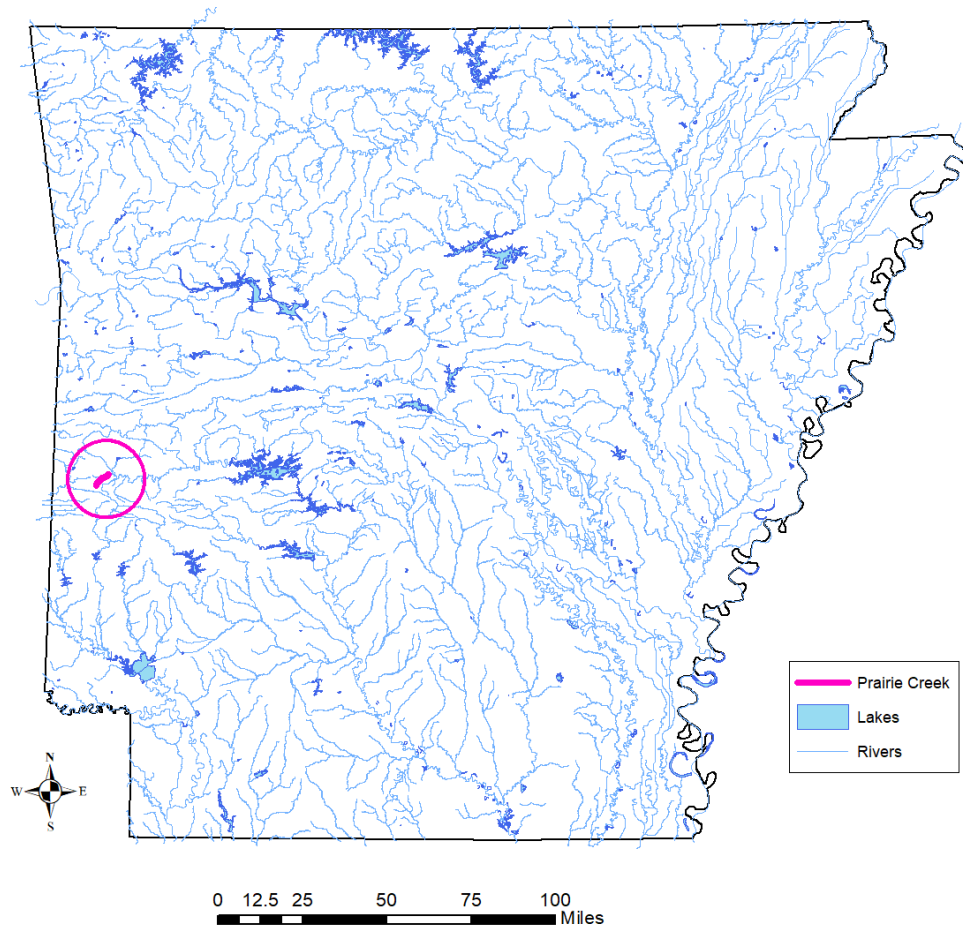
Site Specific Dissolved Oxygen Criteria Removal

Waterbody	Current Site Specific Criteria	Proposed Revision – Apply Ecoregion Criteria
Loutre Creek from headwaters to railroad bridge	Non-critical season DO 5 mg/L	Non-critical season DO 5 mg/L
Loutre Creek from railroad bridge to mouth	Critical season DO 2 mg/L	Critical season DO 2 mg/L

- Site specific criteria same as ecoregion criteria
- No permittee affected
- Notation in Appendix A not needed

Site Specific Dissolved Oxygen Criteria Removal

- Prairie Creek: from headwaters to confluence with Briar Creek



Site Specific Dissolved Oxygen Criteria Removal

Waterbody	Current Site Specific Criteria	Proposed Revision – Apply Ecoregion Criteria
Prairie Creek from headwaters to confluence with Briar Creek	Critical season DO 4 mg/L	Critical season DO 6 mg/L

- Prairie Creek watershed size 17.3 sq mi
- City of Mena discharge data
97% meet ecoregion DO criteria
- Monitoring site OUA0040 data
88% over 16 years meet ecoregion DO criteria

Site Specific Criteria Removals Summary

- One temperature proposal
 - Bayou De Loutre – outfall removed from permit
- Two dissolved oxygen proposals
 - Loutre Creek – redundant, same as ecoregion criteria
 - Prairie Creek – permittee & waterbody can uphold ecoregion criteria

Site Specific Criteria Removal Discussion



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Proposal:

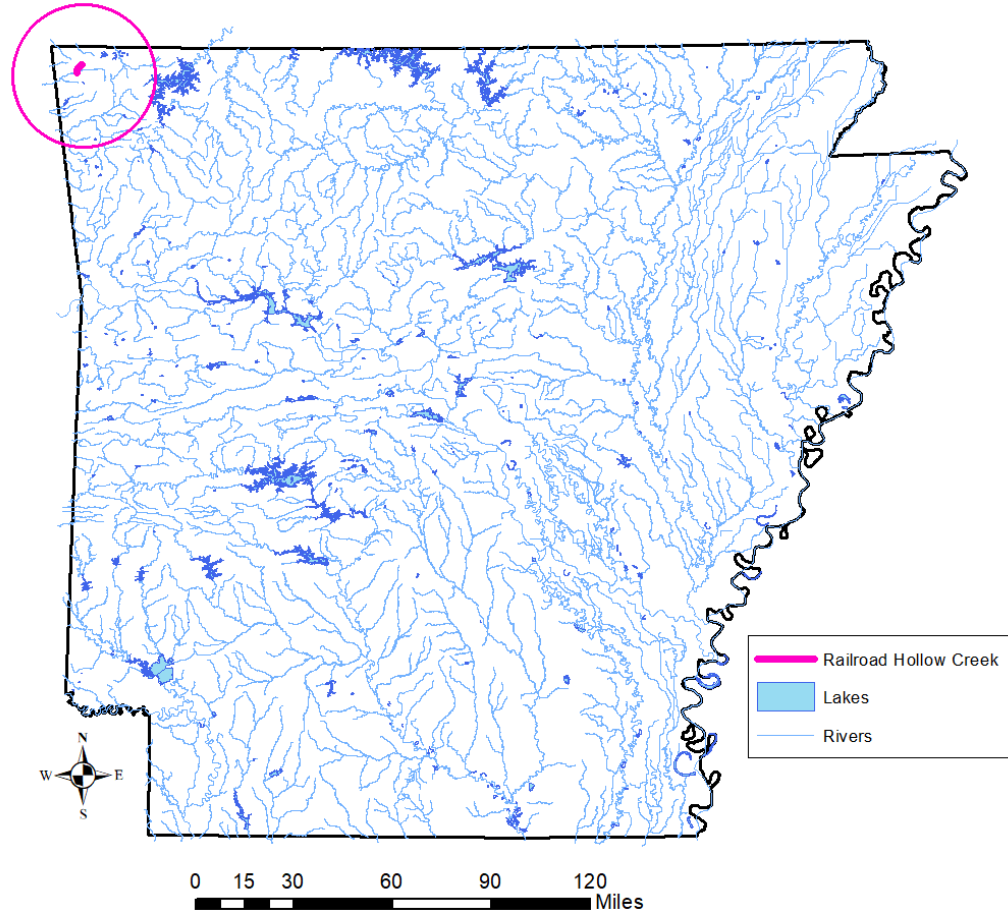
Designated Use Exception Removal



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Reinstating Fishable/Swimmable Uses

- Railroad Hollow Creek
 - No fishable/swimmable uses
- Railroad Hollow Creek from headwaters to Spavinaw Creek
 - Year-round DO 2 mg/L



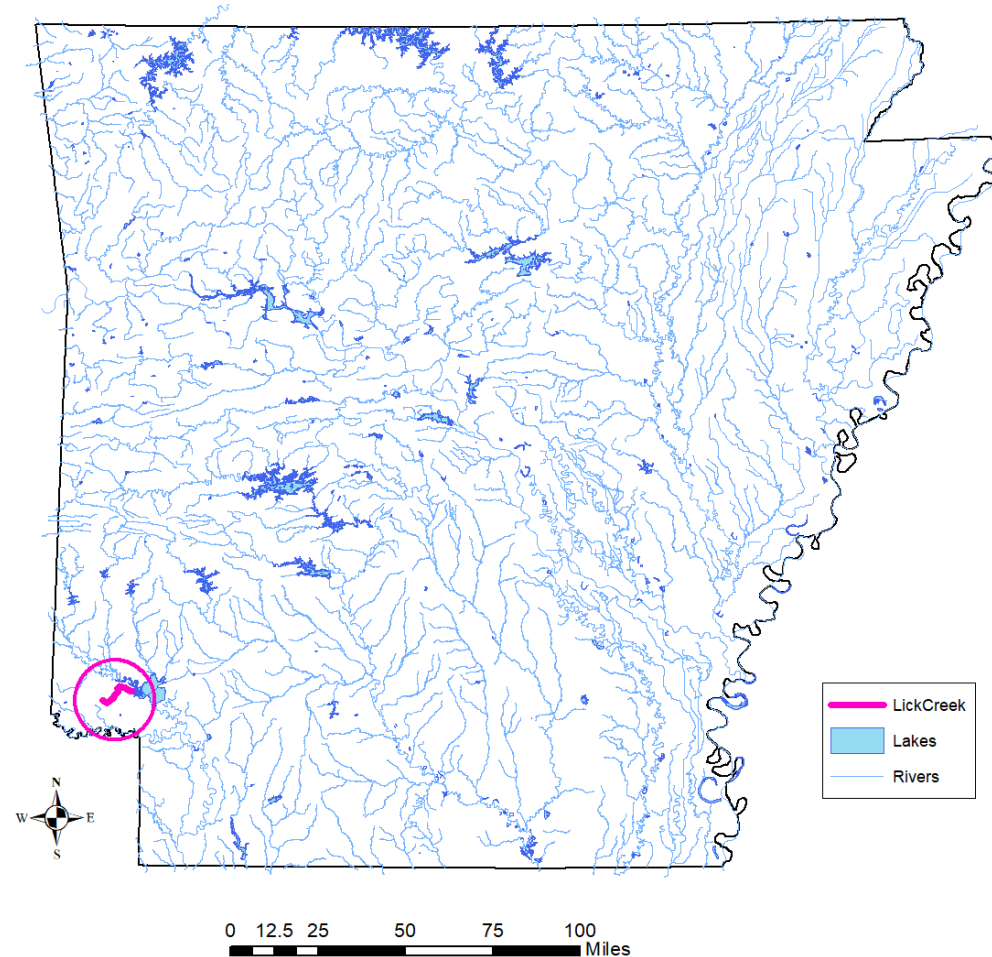
Fishable/Swimmable Use Summary

Current Site Specific Criteria	Proposed Revision – Apply Ecoregion Criteria
Year-round 2 mg/L	Noncritical season 6 mg/L Critical season 2 mg/L

- Railroad Hollow Creek Study, February 1981
 - Biological community absence not verified in noncritical season
- Watershed size: 2.127 mi²
- 1 permittee – City of Gravette
- City of Gravette permit discharge data
 - 90% meet ecoregion DO noncritical criteria
- Proposed revisions:
 - Add seasonal aquatic life and secondary contact recreation
 - Remove site specific criteria “Year-round DO 2 mg/L”

Reinstating Fishable/Swimmable Uses

- Lick Creek
 - No primary contact recreation
 - Seasonal aquatic life



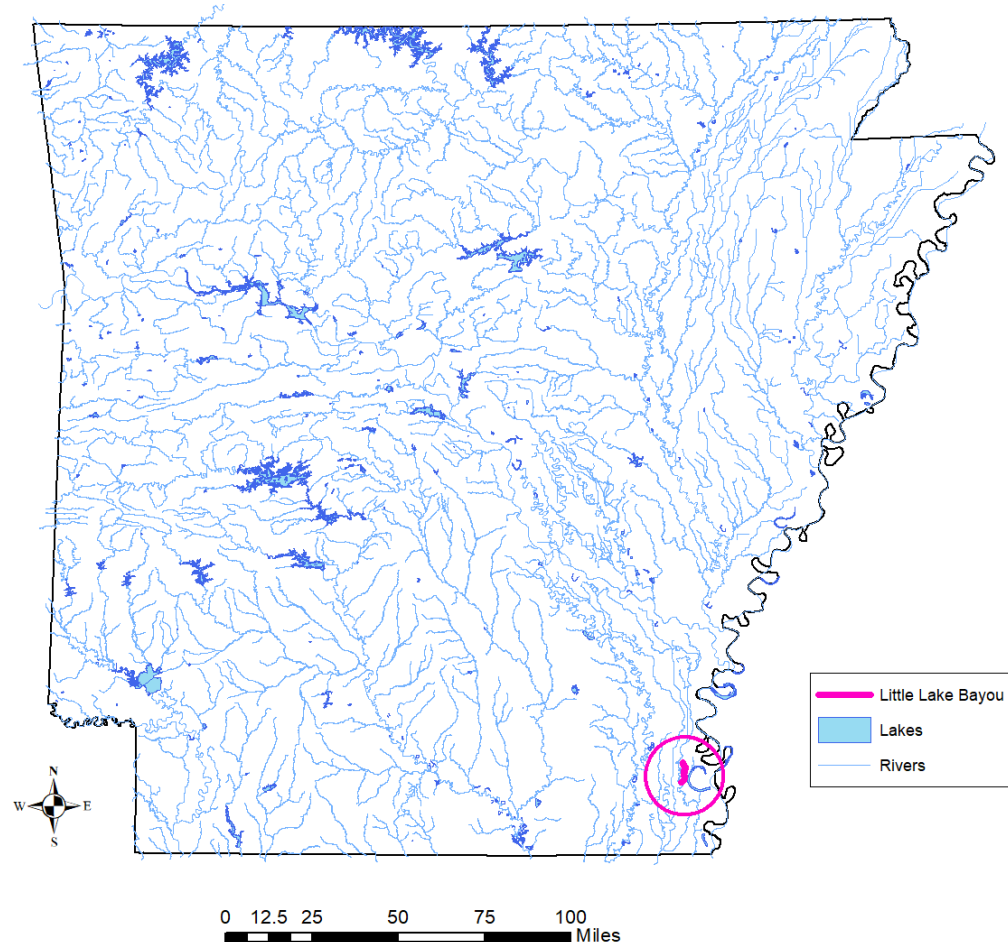
Reinstating Fishable/Swimmable Uses

Waterbody	Current Use Removal/Site Specific Criteria	Proposed Revision – Apply Designated Uses and Ecoregion Criteria
Lick Creek from headwaters to Millwood Reservoir	No primary contact	Primary contact
	Seasonal aquatic life use	Year-round aquatic life use

- Lick Creek watershed size 16.7 sq mi
- Fish collected and presence verified in summer 2021
- Town of Wilton discharge data
 - 90% meet primary contact individual sample *E. coli* criteria

Reinstating Fishable/Swimmable Uses

- Little Lake Bayou
 - No primary contact recreation
 - Seasonal aquatic life
 - Year-round DO 2 mg/L



Reinstating Fishable/Swimmable Uses

Waterbody	Current Use Removal/Site Specific Criteria	Proposed Revision – Apply Designated Uses and Ecoregion Criteria
Little Lake Bayou	No primary contact	No primary contact
	Seasonal aquatic life use	Seasonal aquatic life use
	Critical season DO 2 mg/L	Critical season DO 2 mg/L

- Little Lake Bayou watershed size 9.74 mi²
- < 10 mi² uses and criteria apply
- **Site specific criteria same as ecoregion criteria**
- No permittee affected

Designated Use Exception Removals Summary

- Railroad Hollow – size supports seasonal ecoregion uses
- Lick Creek – permittee & stream can meet ecoregion uses & criteria
- Little Lake Bayou – redundant, same as ecoregion uses

Designated Use Exception Removal Discussion



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Proposal:

8 CAR § 21-508

Human Health Criteria



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EPA UPDATE: HUMAN HEALTH CRITERIA

- Section 304(a) of the CWA requires EPA to develop, publish, and revise recommended criteria for the protection of water quality that reflect the latest scientific knowledge.
- 2015 update includes new health exposure values that more accurately represent the current population.
 - Body weight: 70 kg → 80 kg
 - Drinking water intake: 2.0 L/day → 2.4 L/day
 - Fish consumption: 17.5 g/day → 22 g/day
- EPA updated criteria for 94 pollutants as a result.

EPA 2015

Update

Body Weight:
70kg → 80 kg

Fish Consumption:
17 g/day → 22
g/day

Drinking Water:
2 L/day → 2.4
L/day

UPDATES TO HUMAN HEALTH CRITERIA IN 8 CAR PART 21

Pollutant	Previous Criteria (ug/L)	Revised Criteria (ug/L)
alpha- Hexachlorobenzene	0.0373	0.0036
Chlordane	0.005	0.0031
Dieldrin	0.0012	0.000012
Dioxin (2,3,7,8 TCDD)	0.000001	0.00000005
PCBs (polychlorinated biphenyls)	0.0004	0.00064
Toxaphene	0.0063	0.007

GENERAL PROCESS

2023 & 2024 Toxics Release Inventory



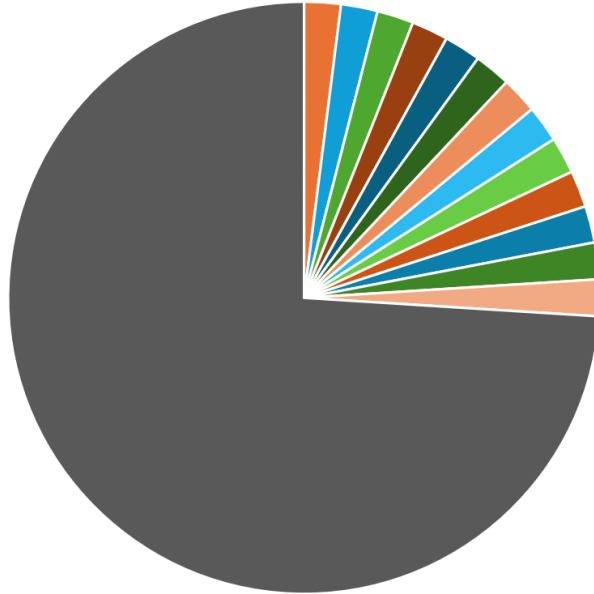
2023 & 2024 DMR data



EPA's Integrated Risk Information
System (IRIS) Confidence Level

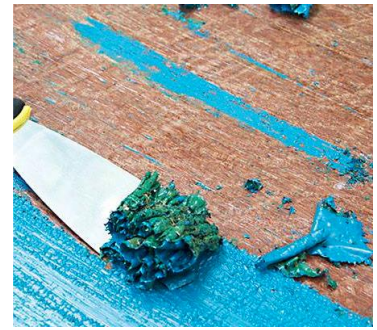
GENERAL PROCESS

- 14 out of the 94 pollutants were determined to be discharged into Arkansas waters and had a medium or high IRIS confidence



NEW HUMAN HEALTH CRITERIA

Pollutant	Carcinogen Status	IRIS Confidence	Health Concern	Criteria Value (ug/L)
Chlorobenzene	No	Medium	Liver, kidney	1000
Tetrachloroethylene (PCE)	Yes	Medium	Liver, kidney, neurological	100
Trichloroethylene (TCE)	Yes	High	Liver	6
1,2,4-Trichlorobenzene	No	Medium	Kidney	70
Nitrobenzene	Yes	Medium	Neurological	100
Dichloromethane (methylene chloride)	Yes	High	Neurological	200
1,1,2- Trichloroethane	No	Medium	Liver, immune system	5.5



NEW HUMAN HEALTH CRITERIA

Pollutant	Carcinogen Status	IRIS Confidence	Health Concern	Criteria Value (ug/L)
1,1-Dichloroethylene	Possible	Medium	Kidney, liver	3000
Carbon Tetrachloride	Possible	Medium	Kidney, liver, neurological	4
Pentachlorophenol	No	Medium	Neurological	0.3
Benzo(a)pyrene	Yes	Medium	Immune system, developmental	0.2
Hexachlorobenzene	No	Medium	Liver, neurological	1
Vinyl Chloride	Yes	Medium	Liver, neurological	2
2,4-Dinitrotoluene	Yes	High	Kidney, liver	0.46



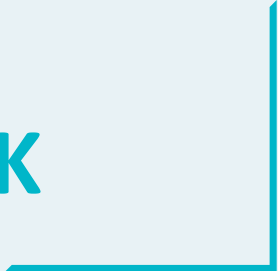
Human Health Criteria Proposals Discussion



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15 – MINUTE BREAK

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Proposal:

8 CAR § 21-503

Turbidity



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Turbidity - Base Flows vs Storm Flows

EPA Took No Action – Parts Not Approved for CWA Purposes

“Storm flows” considers all flows and data collected throughout the year, including elevated flows due to rainfall events;

“Base Flows” means that portion of the stream discharge that is derived from natural storage, or sources other than recent rainfall that creates surface runoff. Also called sustaining, normal, dry weather, ordinary or groundwater flow

Continual pressure from EPA regarding how the base flow and storm flow criteria were developed.

Turbidity – Original Criteria Development

Base flows criteria -1988

4 to 6 stations per ecoregion

2-year period – one sample per year

Calculation unknown

DEQ unable to determine original justification for derivation of criteria

DEQ unable to determine original justification for the “in no case” exceedance rate

Storm flow criteria - 2004

70 stations

10 year period

90th percentile of ecoregion data

To recognize naturally occurring increase in turbidity after a storm event

NOT paired with storm events, flow, or precipitation data

DEQ unable to determine original justification for 20% exceedance rate

Turbidity – Criteria Language

EPA Took No Action – Not Approved for CWA Purposes

Base

Base Flows
exceedance amount
is 20%

Storm

Storm Flows
exceedance amount
is 25%

Current Criteria

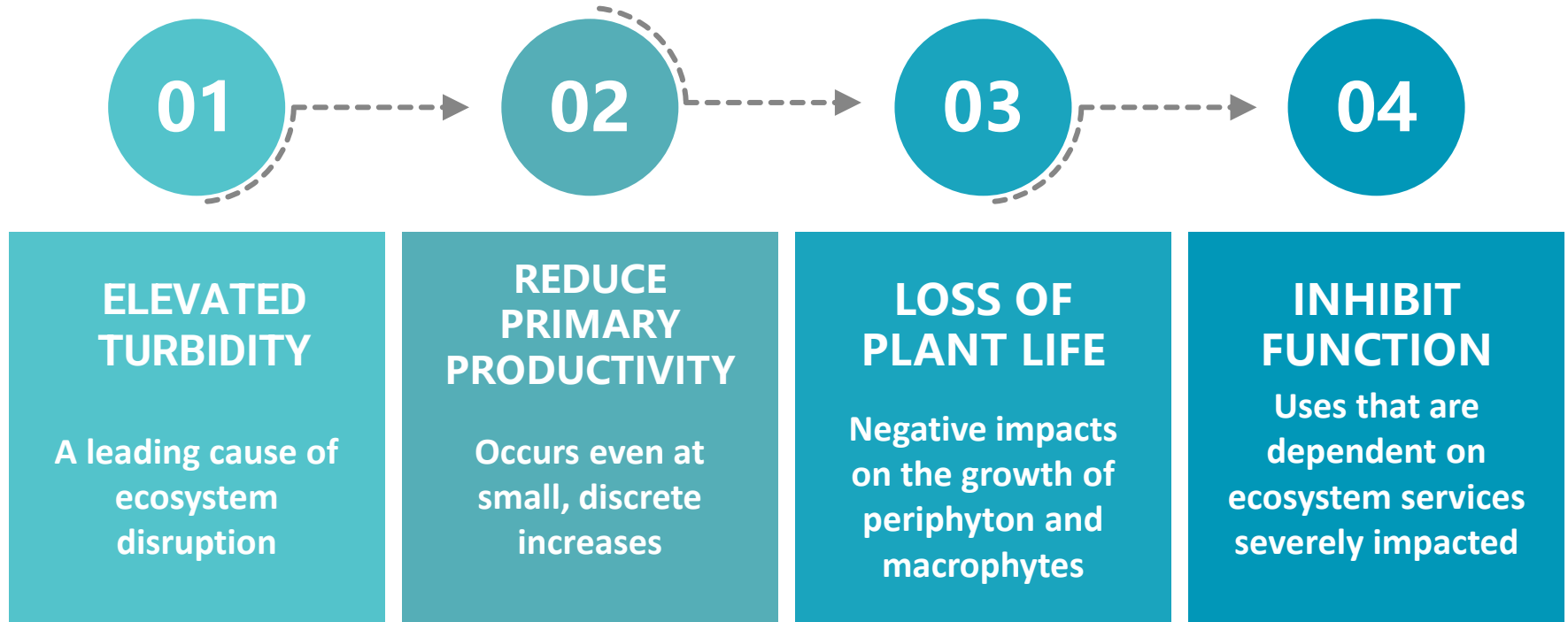
Parts not approved for CWA purposes

Antiquated methods

Limited data and documentation

Seasonal component unclear

Bottom-Up Effects of Turbidity



Elevated Turbidity Impacts a Variety of Uses



PRIMARY RECREATION

Perceptions of cleanliness & pathogen abundance are sensitive to small changes in turbidity.

SECONDARY RECREATION

Desire and success for secondary recreation is reduced.



AQUATIC LIFE

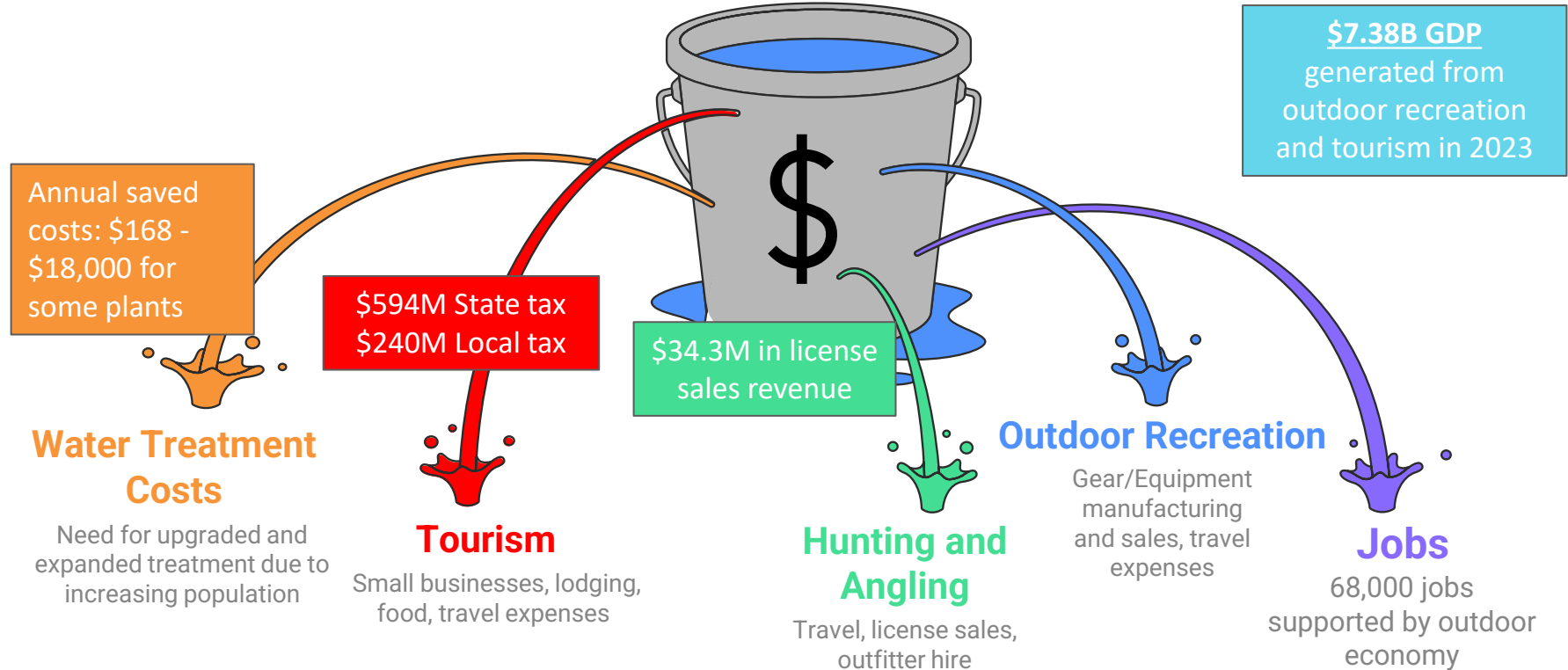
Habitat degradation, life history alterations, increased pressure.

DRINKING WATER

Water treatment costs increase & treatment effectiveness decreases with increases in turbidity.



Ecosystem Disruptions from Turbidity have Major Implications for Arkansas' economy



Factors Considered in Data Analysis



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Determining Criteria



Scientific support

EPA approved method, literature and statistical support



Sophisticated supplemental analyses

Strong dataset = rigorous analytical methods



Protection of all uses

SPATIAL VARIABILITY

Ecoregion specific factors

SEASONALITY

Flow and Turbidity

LABORATORY CONSIDERATIONS

**Laboratory methods applied
in criteria development**

INVESTIGATE BACKGROUND CONDITION

Anthropogenic influence

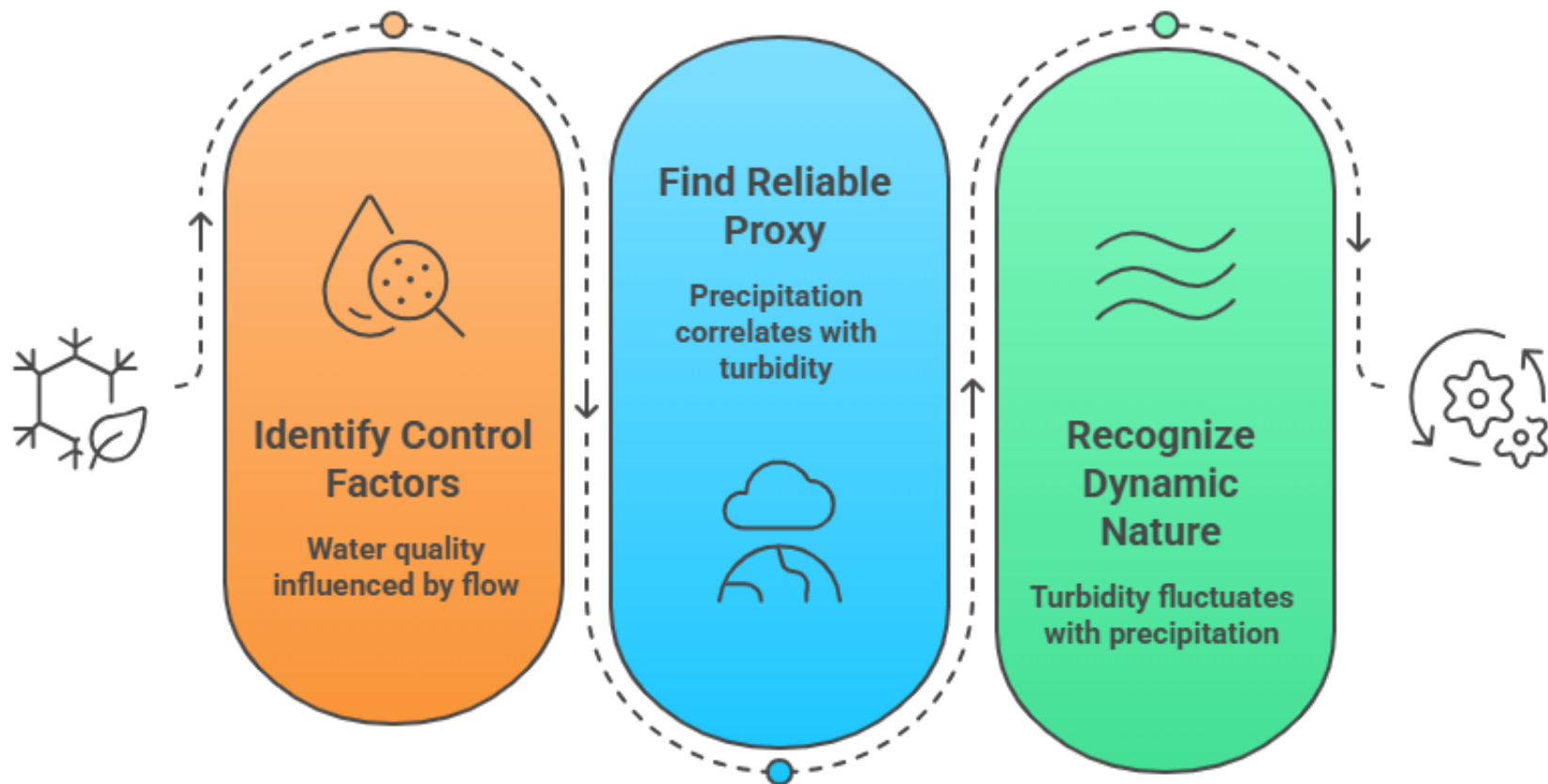
Spatial variation

- ✓ Turbidity regimes differed across low gradient ecoregions
- ✓ Similar patterns in turbidity were observed in high gradient ecoregions

Turbidity heavily influenced by terrestrial activity

- ✓ Similarities in geology
- ✓ Land use and cover ecoregion dependent
- ✓ Elevation gradient and stream order

Determining Turbidity Criteria



Seasonality

- ✓ Flow Regime
- ✓ Factors influencing runoff

Precipitation Threshold

- ✓ Rolling 30-day total by county from publicly available NOAA data
- ✓ Wet season - ≥ 5 inches of precipitation
- ✓ Dry season - < 5 inches of precipitation



PRECIPITATION DATA

01

CORRELATION

Precipitation had a correlation value of 0.2-0.3 across ecoregions.

02

LITERATURE

Literature supports precipitation as a proxy*. Report supports seasonal break**.

03

GMM AND T-TEST

GMM shows distinct groupings at 5-5.5 inches. T-test supports this threshold.

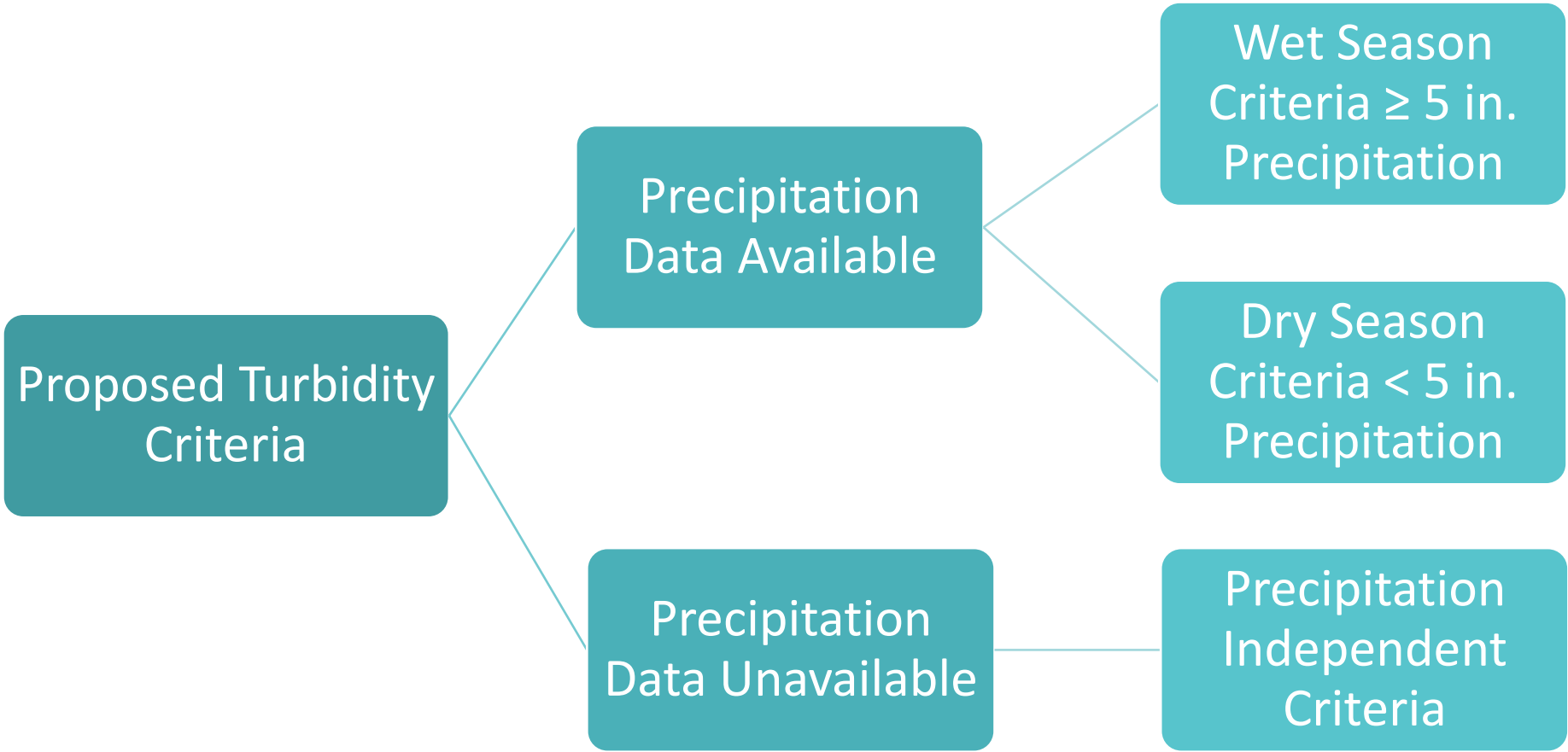
04

PRECIP. TREND ANALYSIS

Trend analysis shows increase in precipitation, seasonal threshold shift.

*Towler, E., Rajagopalan, B., Summers, R. S., & Yates, D. (2010). An approach for probabilistic forecasting of seasonal turbidity threshold exceedance. *Water Resources Research*, 46(6).

**Pugh, A. L., & Westerman, D. A. (2014). *Mean annual, seasonal, and monthly precipitation and runoff in Arkansas, 1951-2011* (No. 2014-5006). US Geological Survey.



Criteria Derivation with Laboratory Considerations

✓ LEAST DISTURBED SITES AVAILABLE

75th percentile of the least disturbed data

✓ NO LEAST DISTURBED SITES AVAILABLE

50th percentile of the general population data

✓ LABORATORY METHOD

The DEQ lab has a 20% relative percent difference (RPD) allowed between the samples and duplicates.

Fixed Criteria

Based on traditional, potentially outdated, seasonal patterns.

Fixed month approach assesses streams inaccurately



Inflexible to shifts in weather patterns.

Weather patterns are dynamic.



Ineffective assessment with static criteria

Using fixed seasonal criteria was not effective.



Basis for determination

Adaptability to weather

Reliability for the future

Dynamic Criteria



Based on recent, real-time environmental conditions.

Rolling 30 day precipitation totals inform criteria.



Responsive to unpredictable weather patterns.

Allows flexibility in what criteria are applied



Maintains accuracy by adjusting to current conditions.

Can be confident our criteria are appropriate.

Proposed Turbidity Criteria



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Ecoregion

High Gradient Ecoregions

Arkansas Valley

South Central Plains

**Least-altered Mississippi
Alluvial Plain**

**Channel-altered Mississippi
Alluvial Plain**



High Gradient Ecoregions & Trout Waters

Supporting Biological Analysis



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Analysis	Output	Relationship to Biology in High Gradient/Trout Systems	Value
Threshold Indicator Taxa Analysis	TITAN	Point where abundance of tolerant taxa begins to decline	6.6 NTU
Species Sensitivity Distribution	HC05	Hazard coefficient where 5% of most sensitive species are expected to decline	4.14 NTU
Species Sensitivity Distribution	XC95	Extirpation concentration where 95% of genera are expected to be lost	11.56 NTU

Some Species Loss is Likely Occuring

High Gradient Ecoregions

Dataset:

DEQ

1990 – 2025

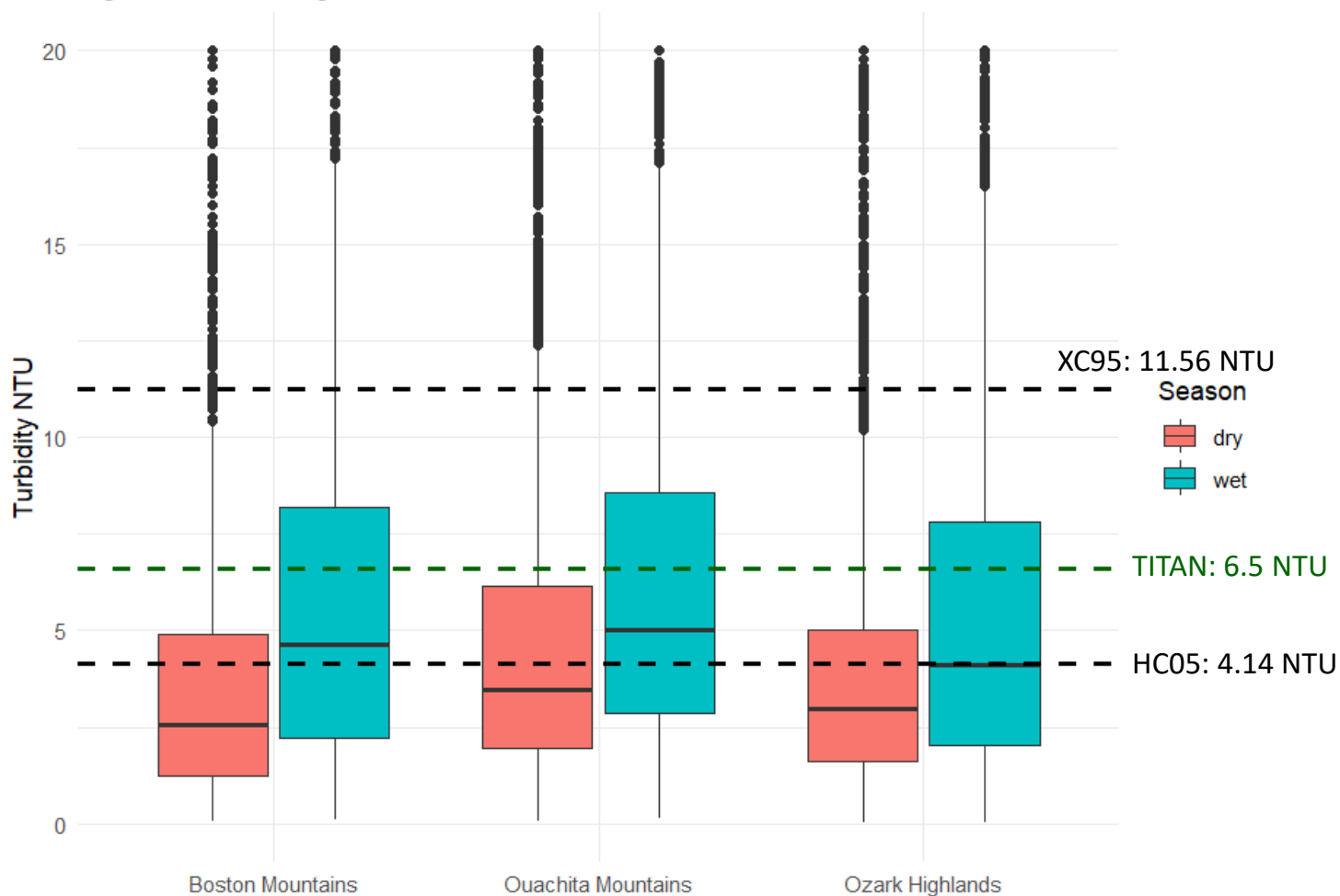
Season:

Wet ≥ 5 in.

Dry < 5 in.

TITAN: 6.5 NTU

HC05: 4.14 NTU



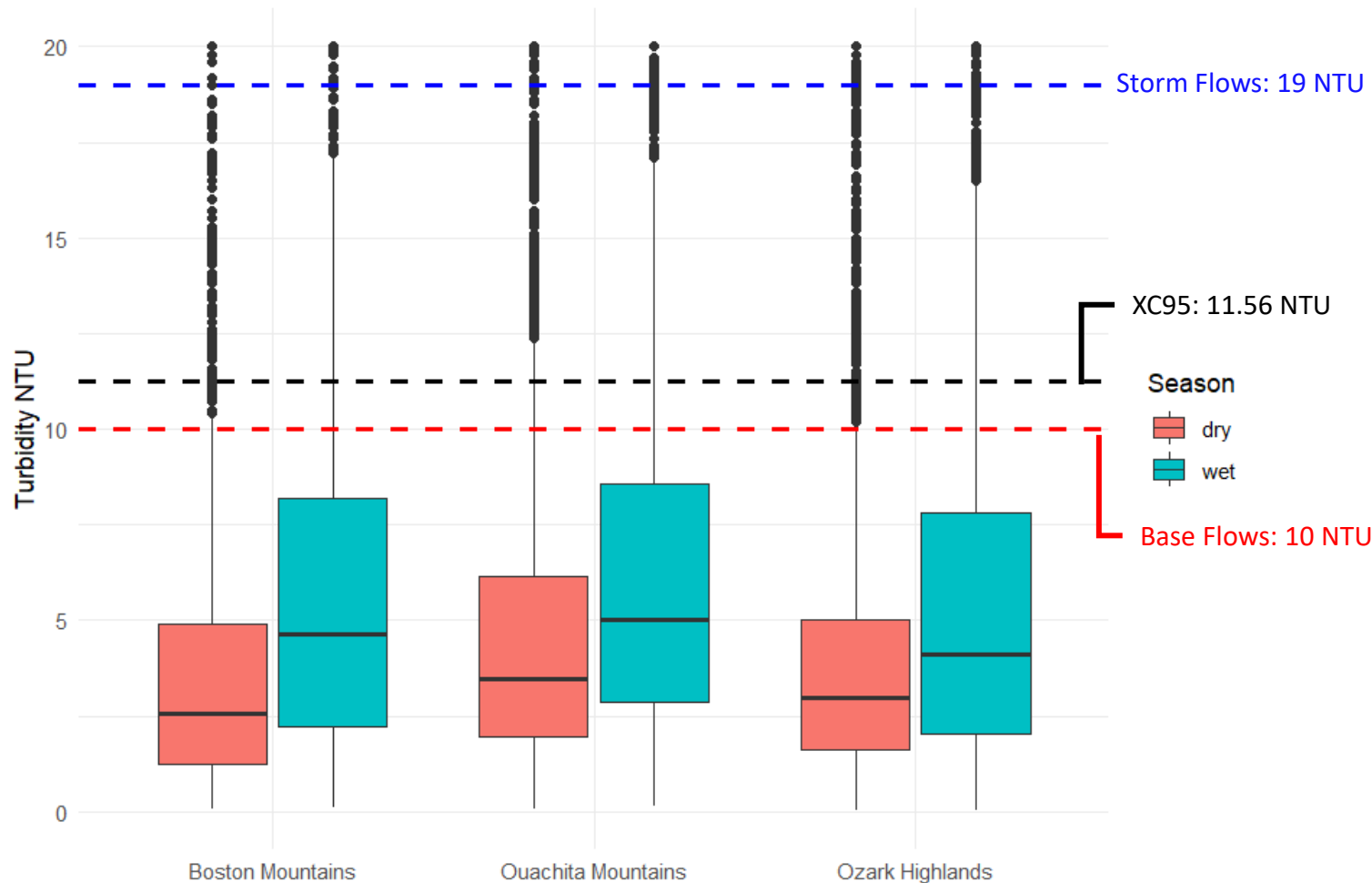
Current Criteria Allows for Species Loss

High Gradient Ecoregions

Dataset:
DEQ
1990 – 2025

Season:
Wet ≥ 5 in.
Dry < 5 in.

TITAN: 6.5 NTU
HC05: 4.14 NTU



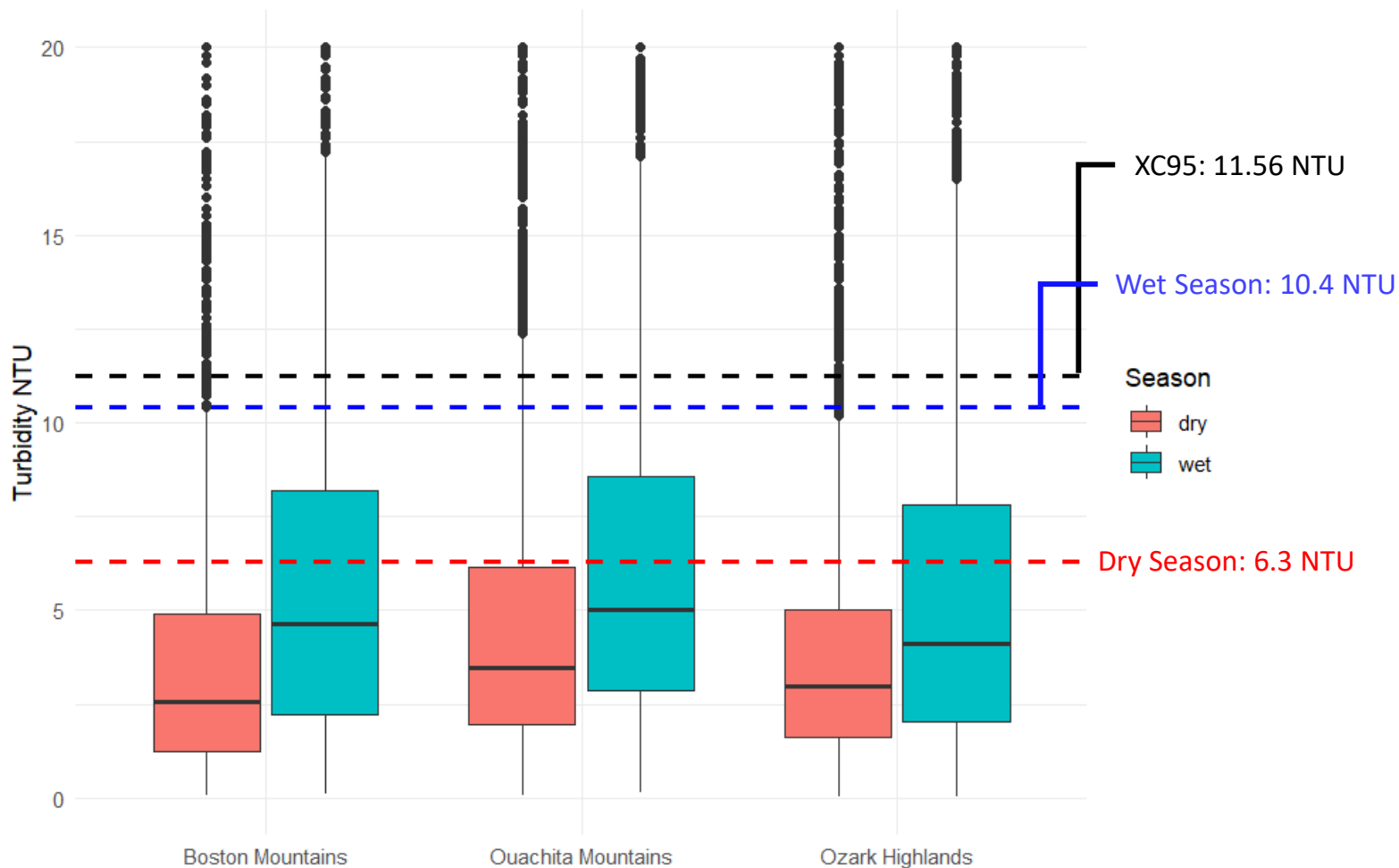
Proposed Criteria is Protective High Gradient Ecoregions

Dataset:
DEQ
1990 – 2025

Season:
Wet ≥ 5 in.
Dry < 5 in.

TITAN: 6.5 NTU
HC05: 4.14 NTU

Method:
75th %tile + RPD
of reference sites



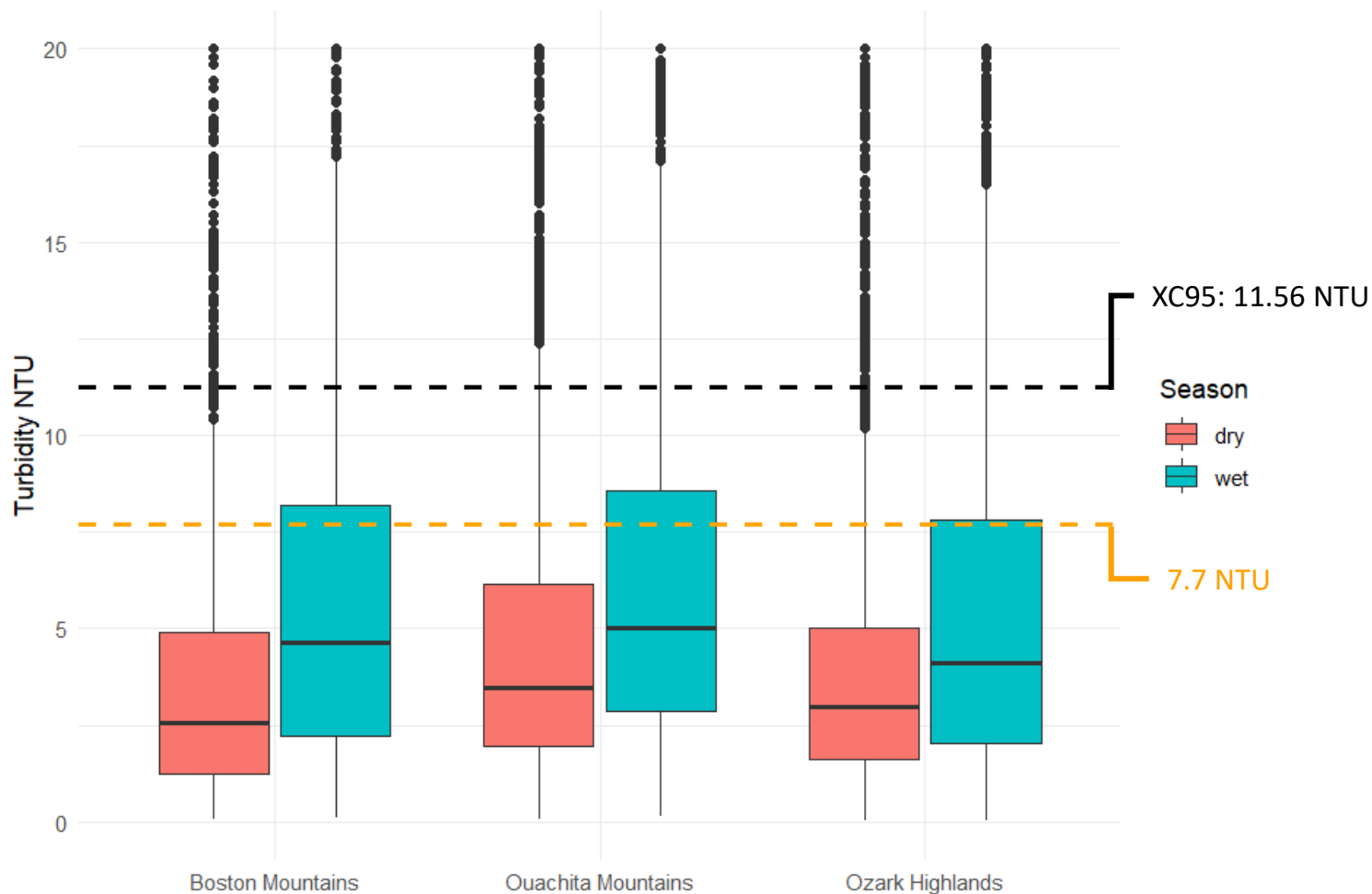
Precipitation Independent Criteria High Gradient Ecoregions

Dataset:
DEQ
1990 – 2025

Season:
Wet ≥ 5 in.
Dry < 5 in.

TITAN: 6.5 NTU
HC05: 4.14 NTU

Method:
75th %tile + RPD
of reference sites



Low Gradient Biological Analysis



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Analysis	Output	Relationship to Biology in Low Gradient Systems	Value
Threshold Indicator Taxa Analysis	TITAN	Point where abundance of tolerant taxa begins to decline	15.6 NTU
Species Sensitivity Distribution	HC05	Hazard coefficient where 5% of most sensitive species are expected to decline	17.4 NTU
Species Sensitivity Distribution	XC95	Extirpation concentration where 95% of genera are expected to be lost	43.31 NTU



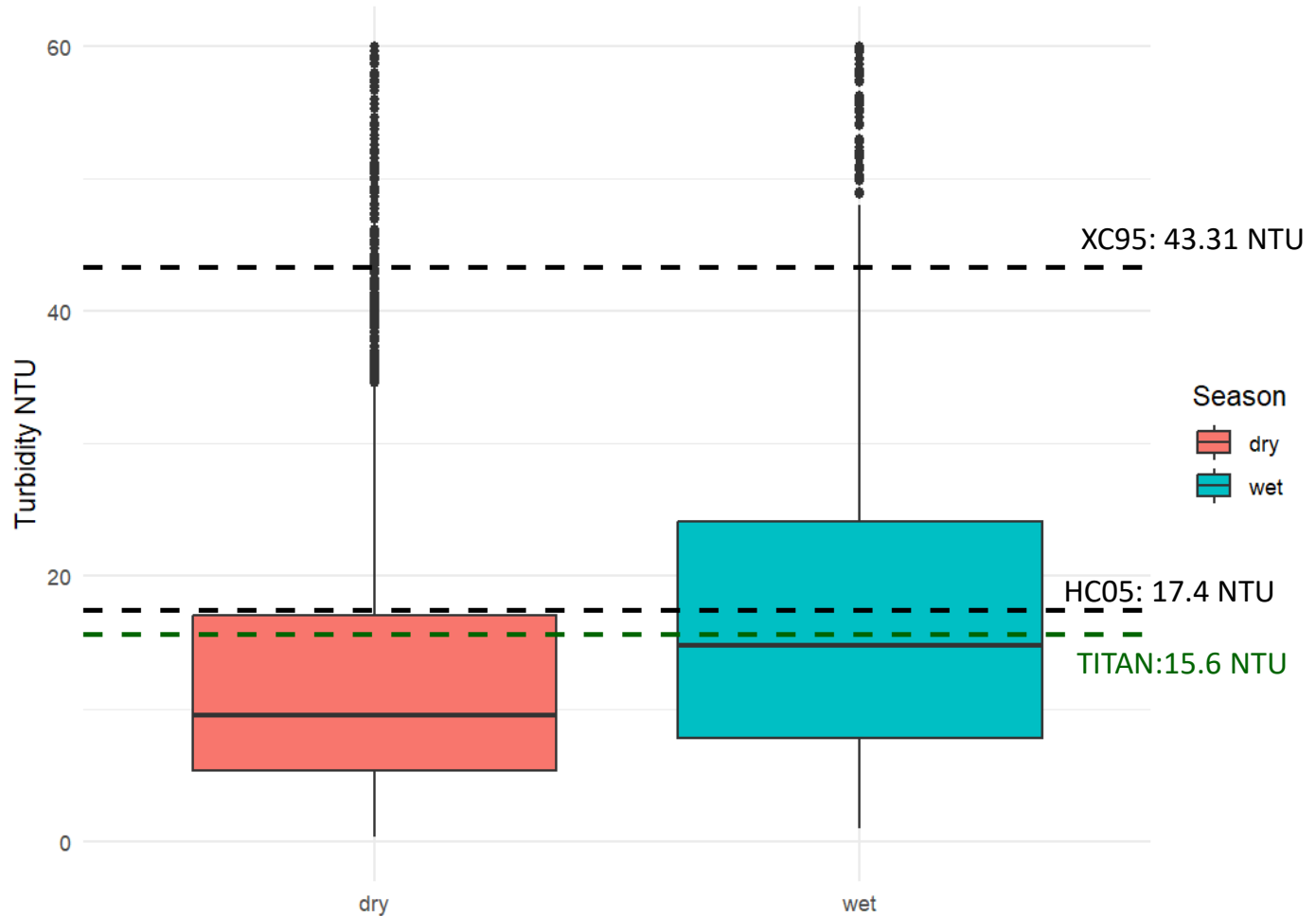
Arkansas Valley

Limited Species Loss is Likely

Arkansas Valley

Dataset:
DEQ
1990 – 2025

Season:
Wet ≥ 5 in.
Dry < 5 in.



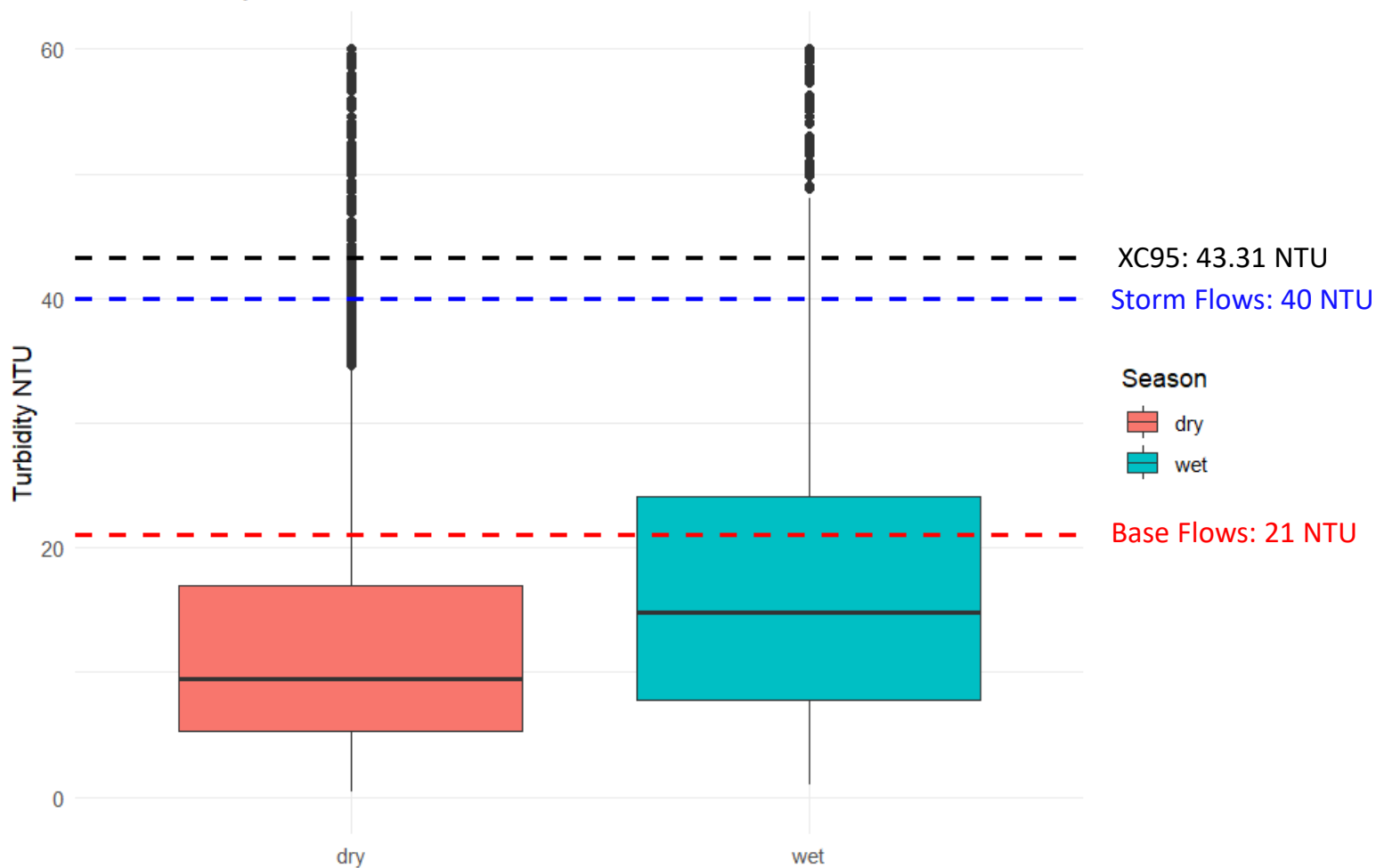
Degradation is Likely with Current Criteria

Arkansas Valley

Dataset:
DEQ
1990 – 2025

Season:
Wet ≥ 5 in.
Dry < 5 in.

TITAN: 15.6 NTU
HC05: 17.4 NTU



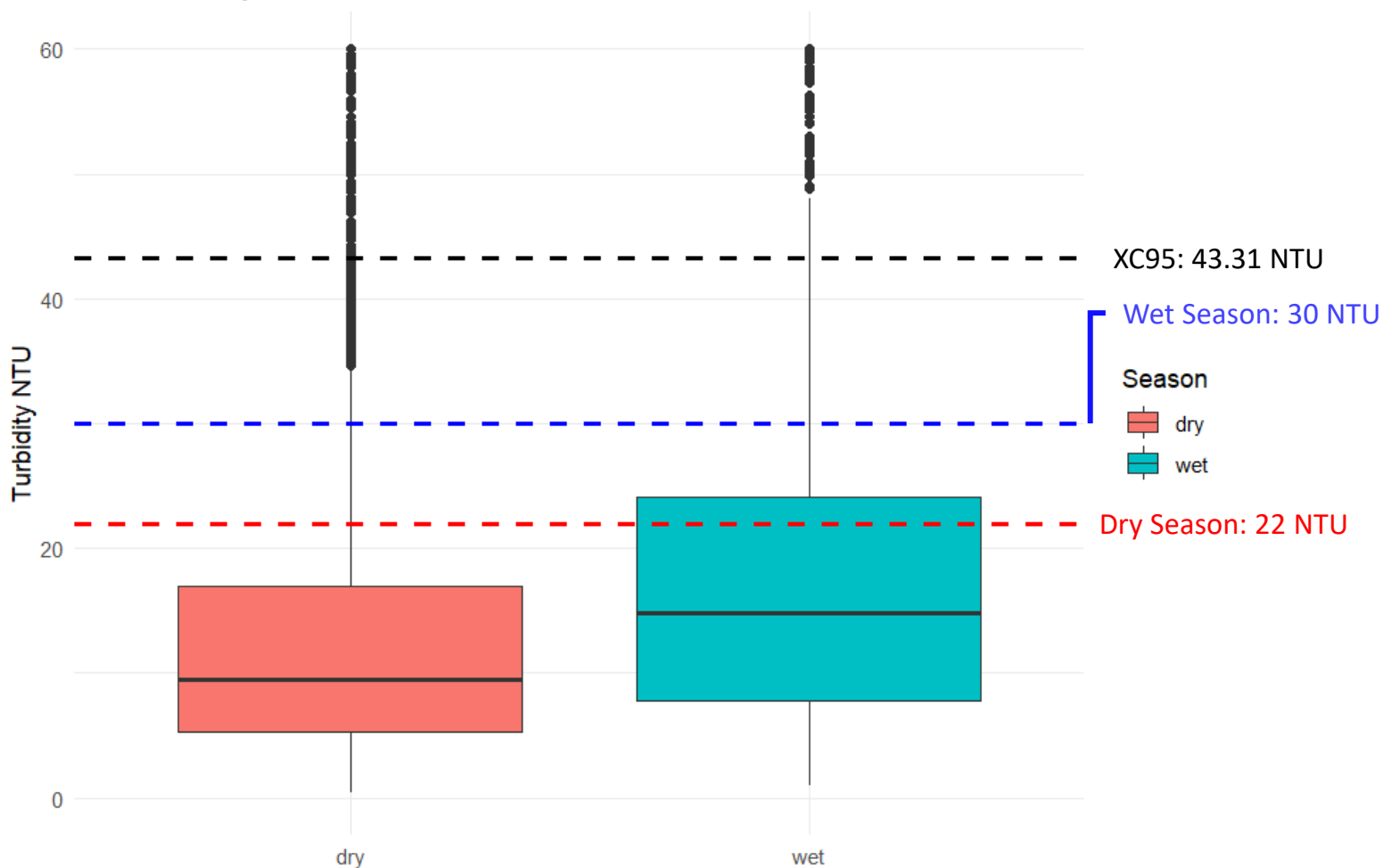
Proposed Criteria is Protective Arkansas Valley

Dataset:
DEQ
1990 – 2025

Season:
Wet ≥ 5 in.
Dry < 5 in.

TITAN: 15.6 NTU
HC05: 17.4 NTU

Method:
75th %tile + RPD
of reference sites



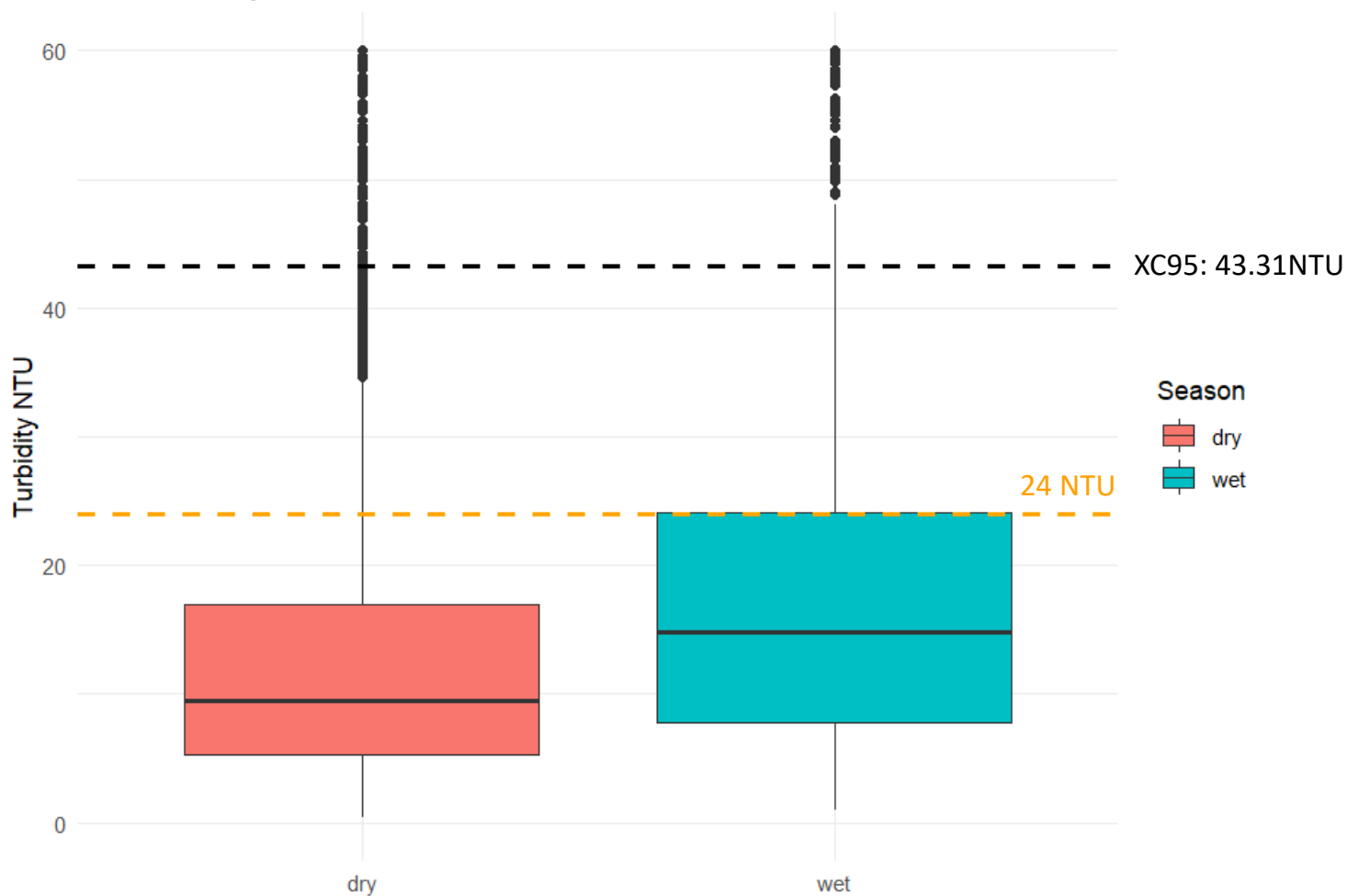
Precipitation Independent Criteria Arkansas Valley

Dataset:
DEQ
1990 – 2025

Season:
Wet ≥ 5 in.
Dry < 5 in.

TITAN: 15.6 NTU
HC05: 17.4 NTU

Method:
75th %tile + RPD
of reference sites





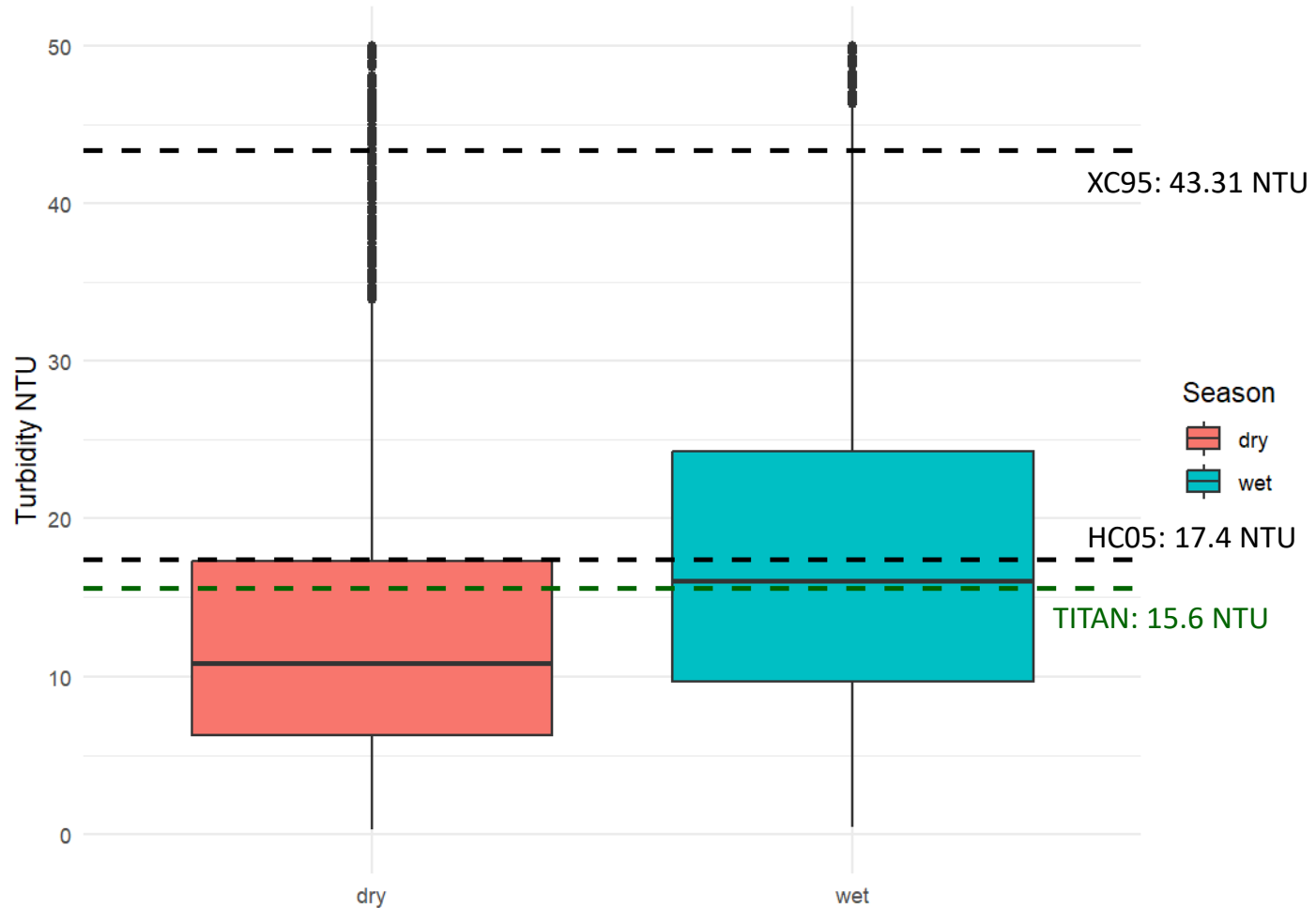
South Central Plains

Limited Species Loss is Likely

South Central Plains

Dataset:
DEQ
1990 – 2025

Season:
Wet ≥ 5 in.
Dry < 5 in.



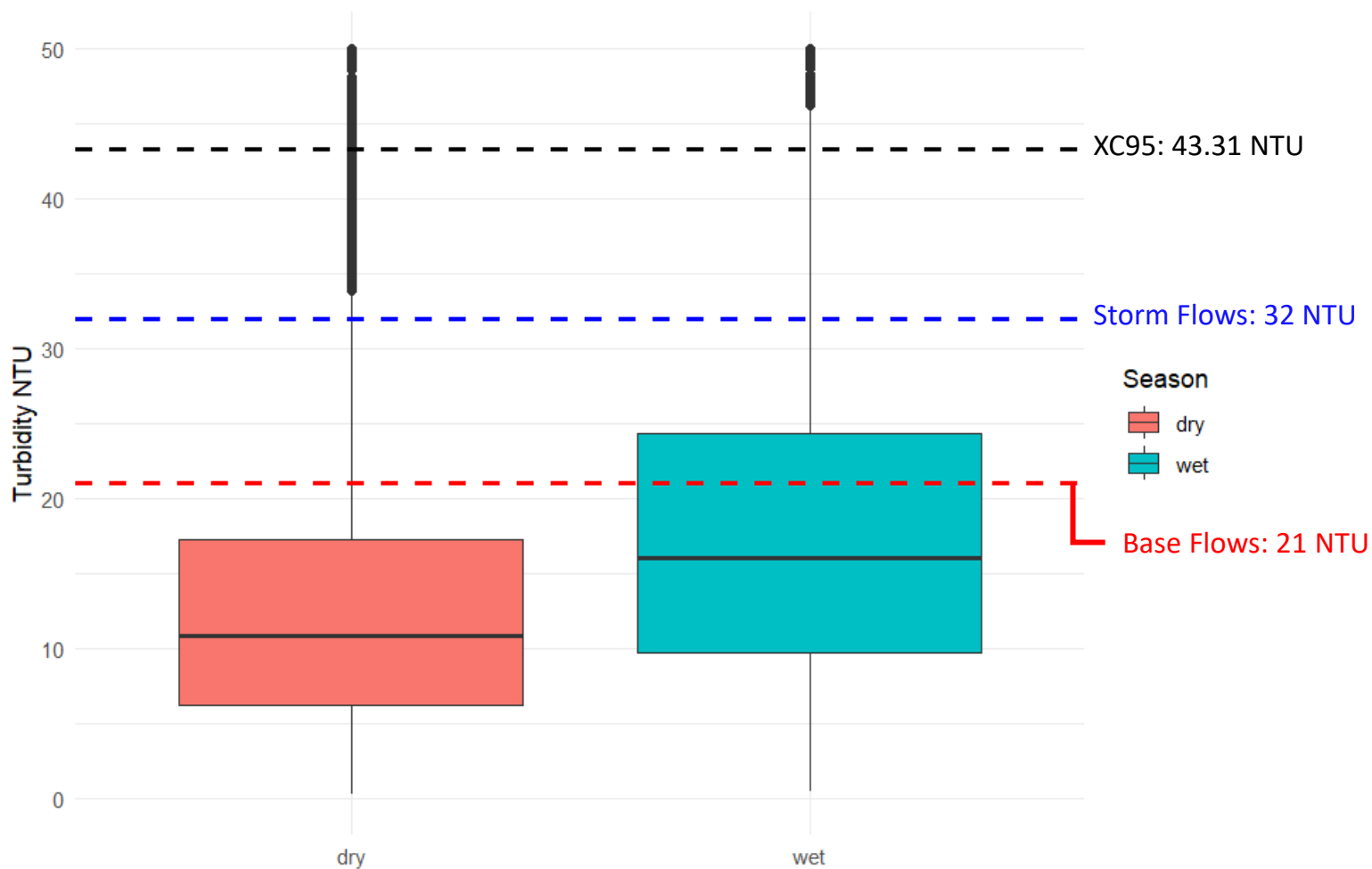
Current Criteria Developed with Outdated Methods

South Central Plains

Dataset:
DEQ
1990 – 2025

Season:
Wet $\geq$ 5 in.
Dry $<$ 5 in.

TITAN: 15.6 NTU
HC05: 17.4 NTU



Proposed Criteria Developed with Updated Methods

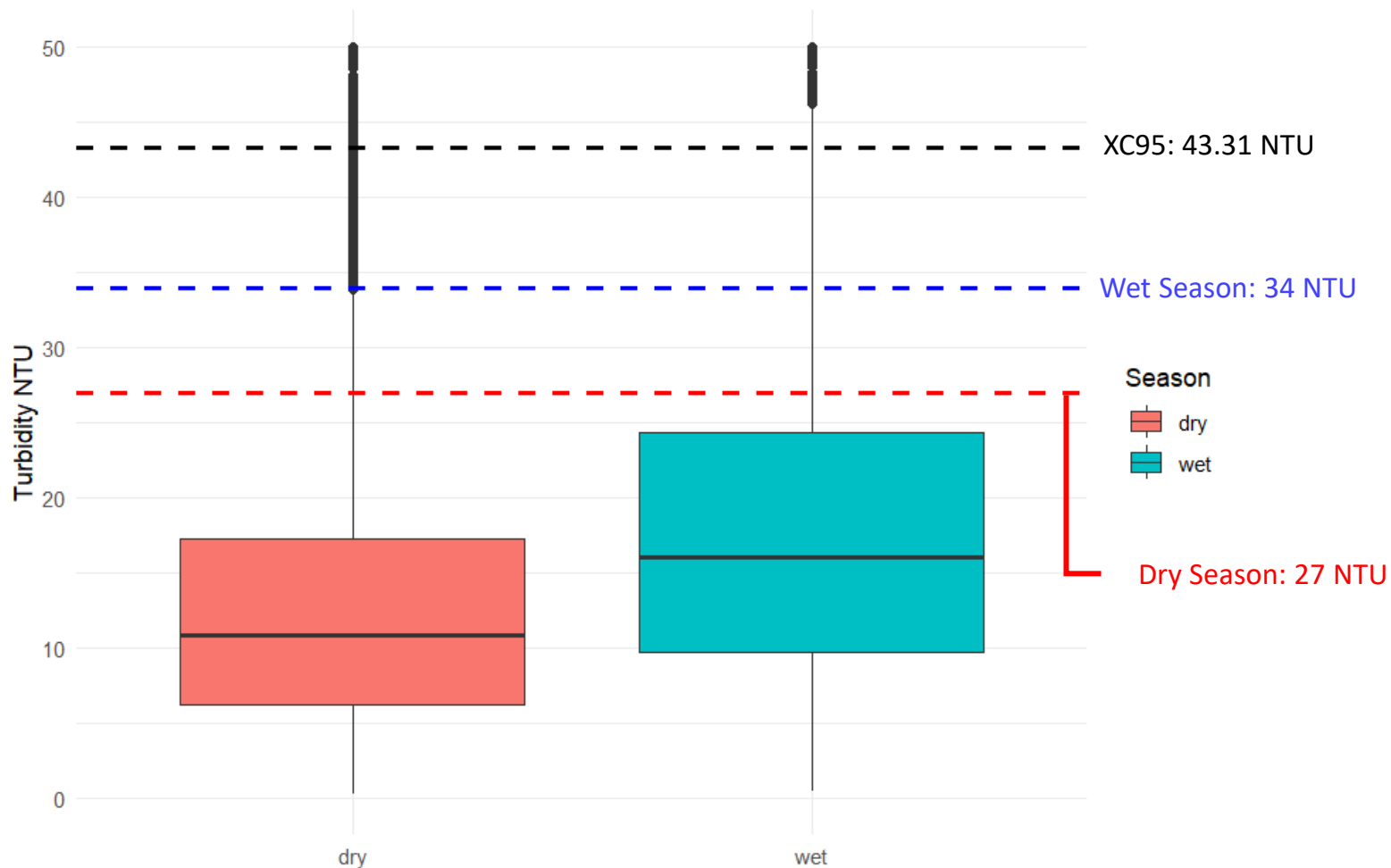
South Central Plains

Dataset:
DEQ
1990 – 2025

Season:
Wet $\geq$ 5 in.
Dry $<$ 5 in.

TITAN: 15.6 NTU
HC05: 17.4 NTU

Method:
75th %tile + RPD
of general
population



Precipitation Independent Criteria

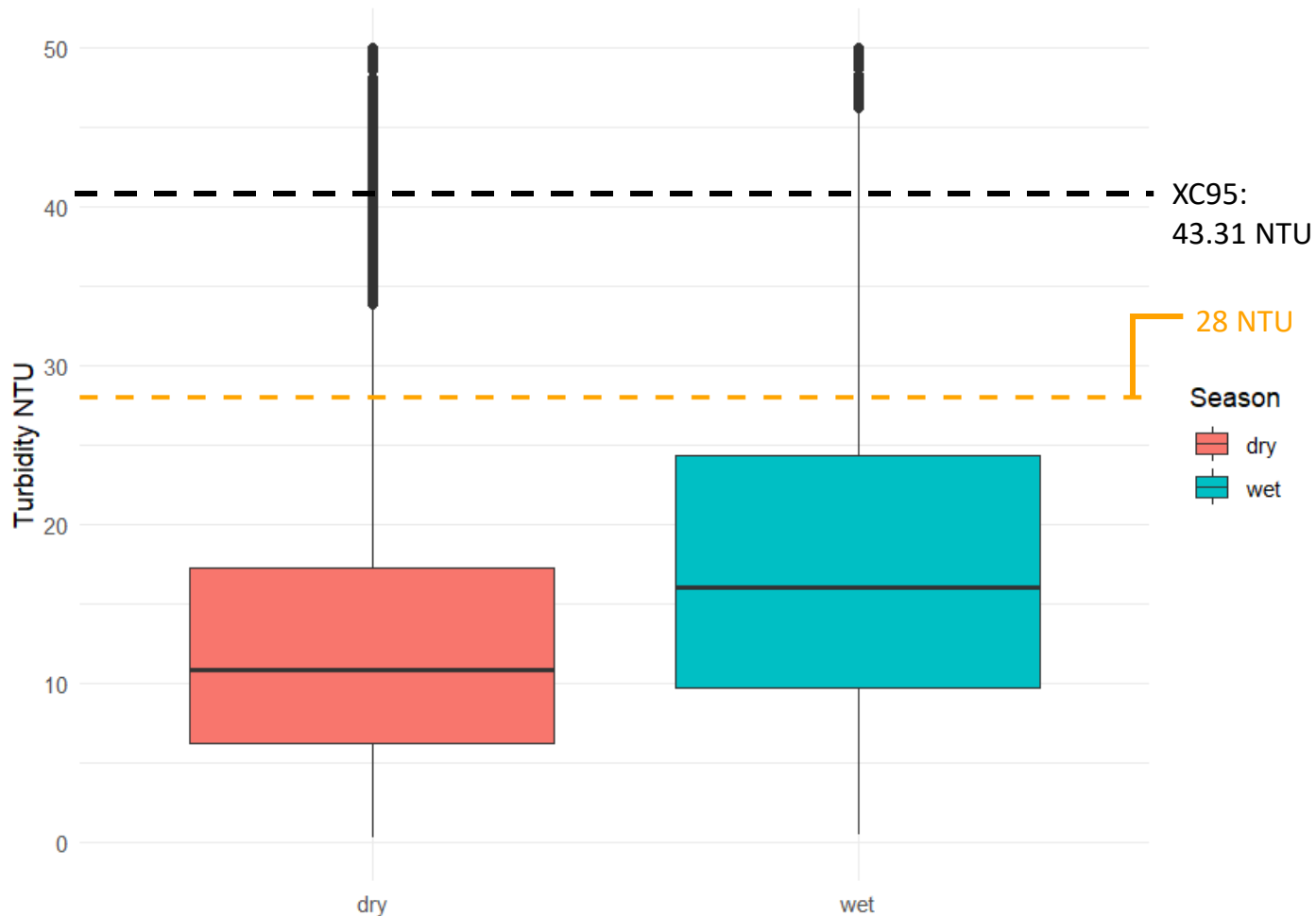
South Central Plains

Dataset:
DEQ
1990 – 2025

Season:
Wet ≥ 5 in.
Dry < 5 in.

TITAN: 15.6 NTU
HC05: 17.4 NTU

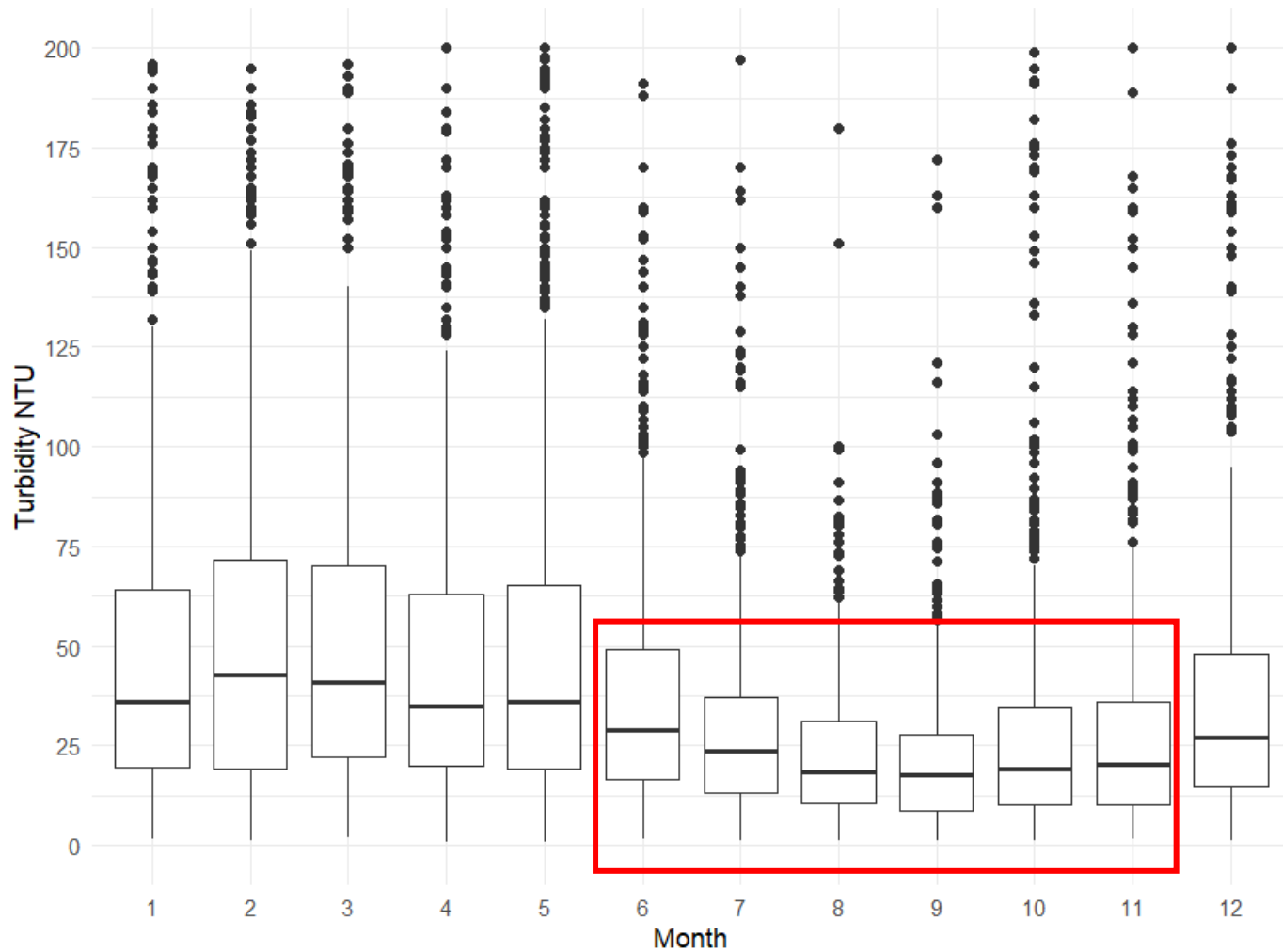
Method:
75th %tile + RPD
of general
population





Channel-Altered Mississippi Alluvial Plain

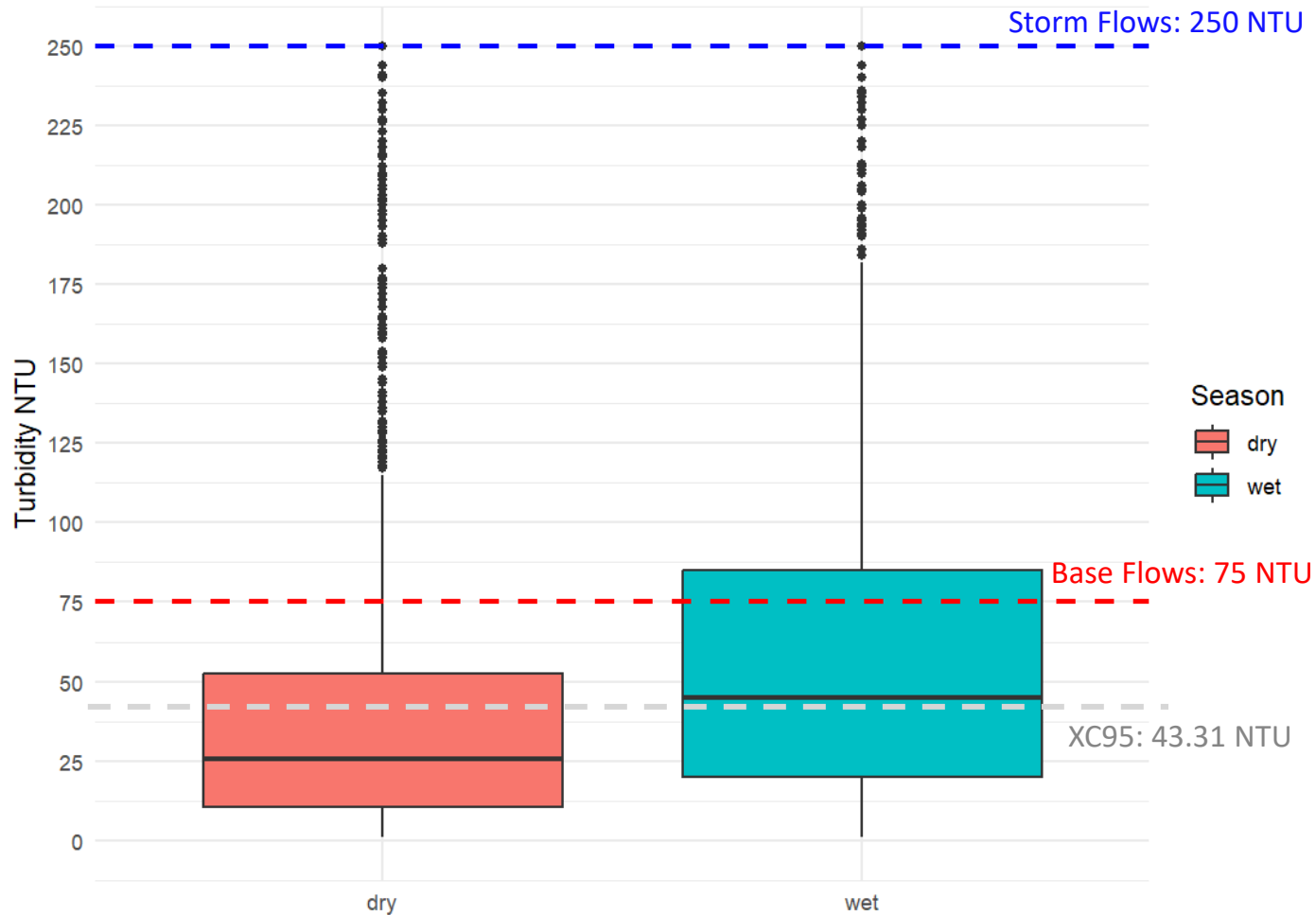
Groundwater Influences Turbidity Distribution in MAP



Current Criteria
Channel-Altered Mississippi Alluvial Plain

Dataset:
DEQ
1990 – 2025

Season:
Wet ≥ 5 in.
Dry < 5 in.



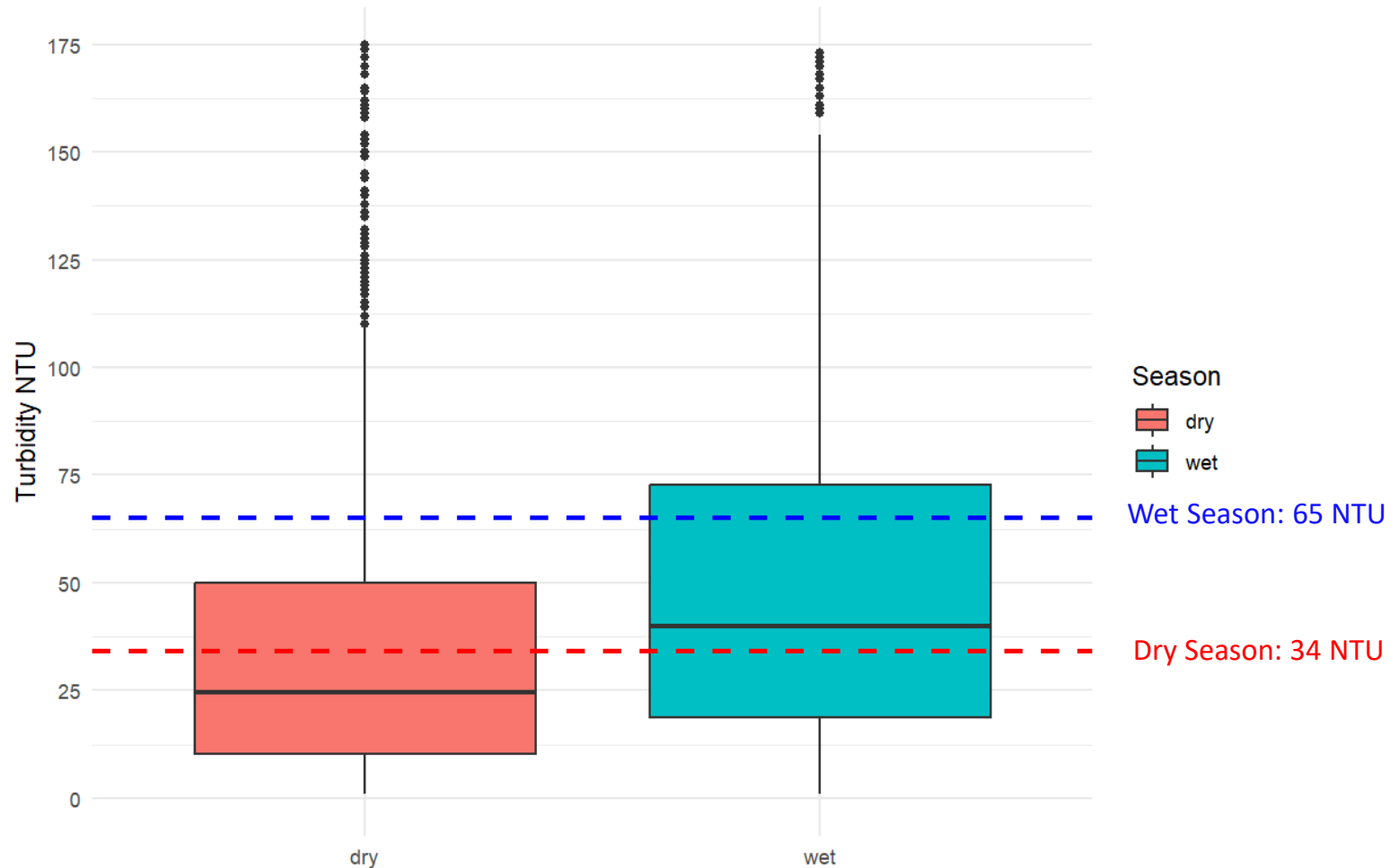
Proposed Precipitation Dependent Criteria

Channel-Altered Mississippi Alluvial Plain

Dataset:
DEQ
1990 – 2025

Season:
Wet ≥ 5 in.
Dry < 5 in.

Method:
50th %tile + RPD
of general
population

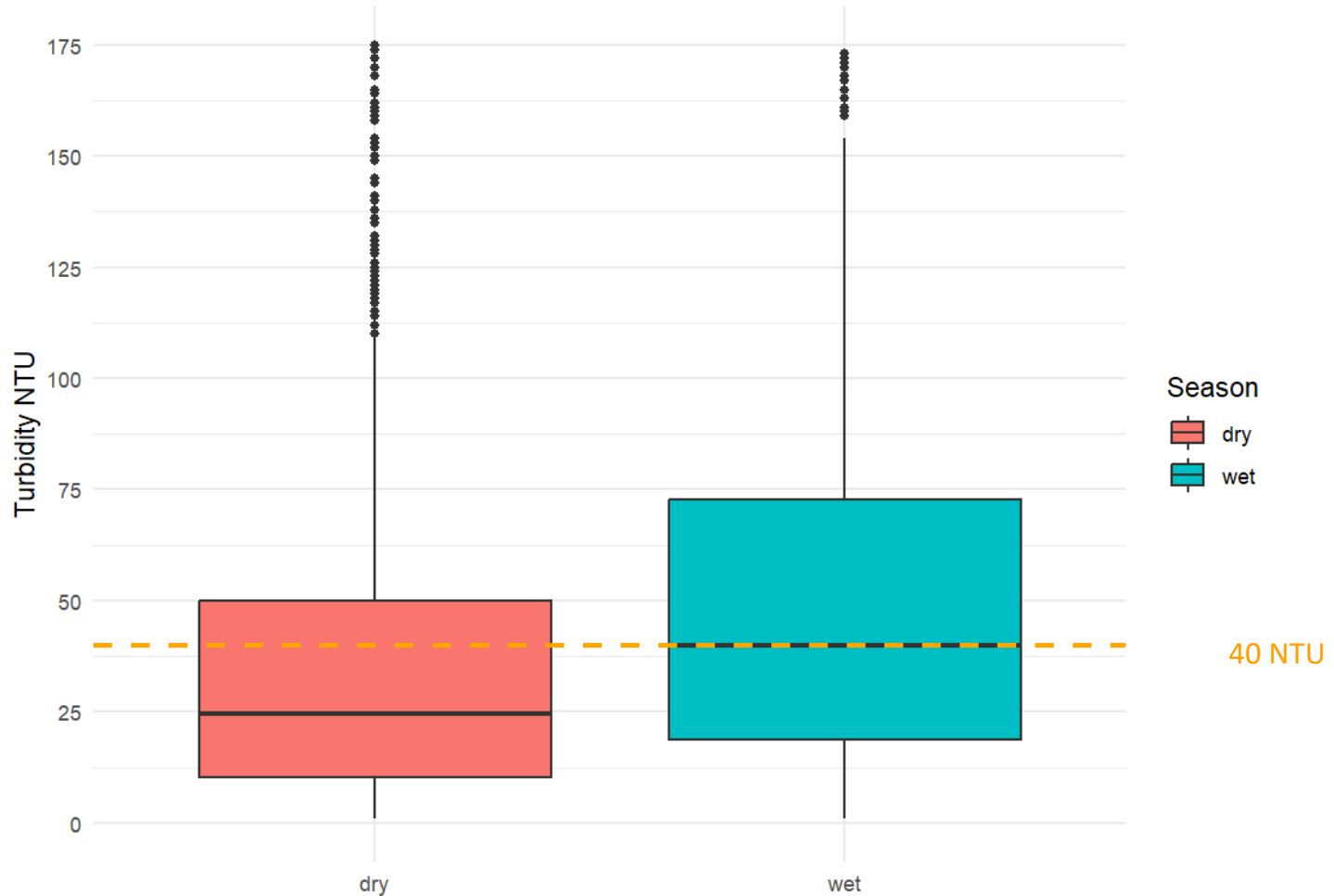


Precipitation Independent Criteria Channel-Altered Mississippi Alluvial Plain

Dataset:
DEQ
1990 – 2025

Season:
Wet ≥ 5 in.
Dry < 5 in.

Method:
50th %tile + RPD
of general
population



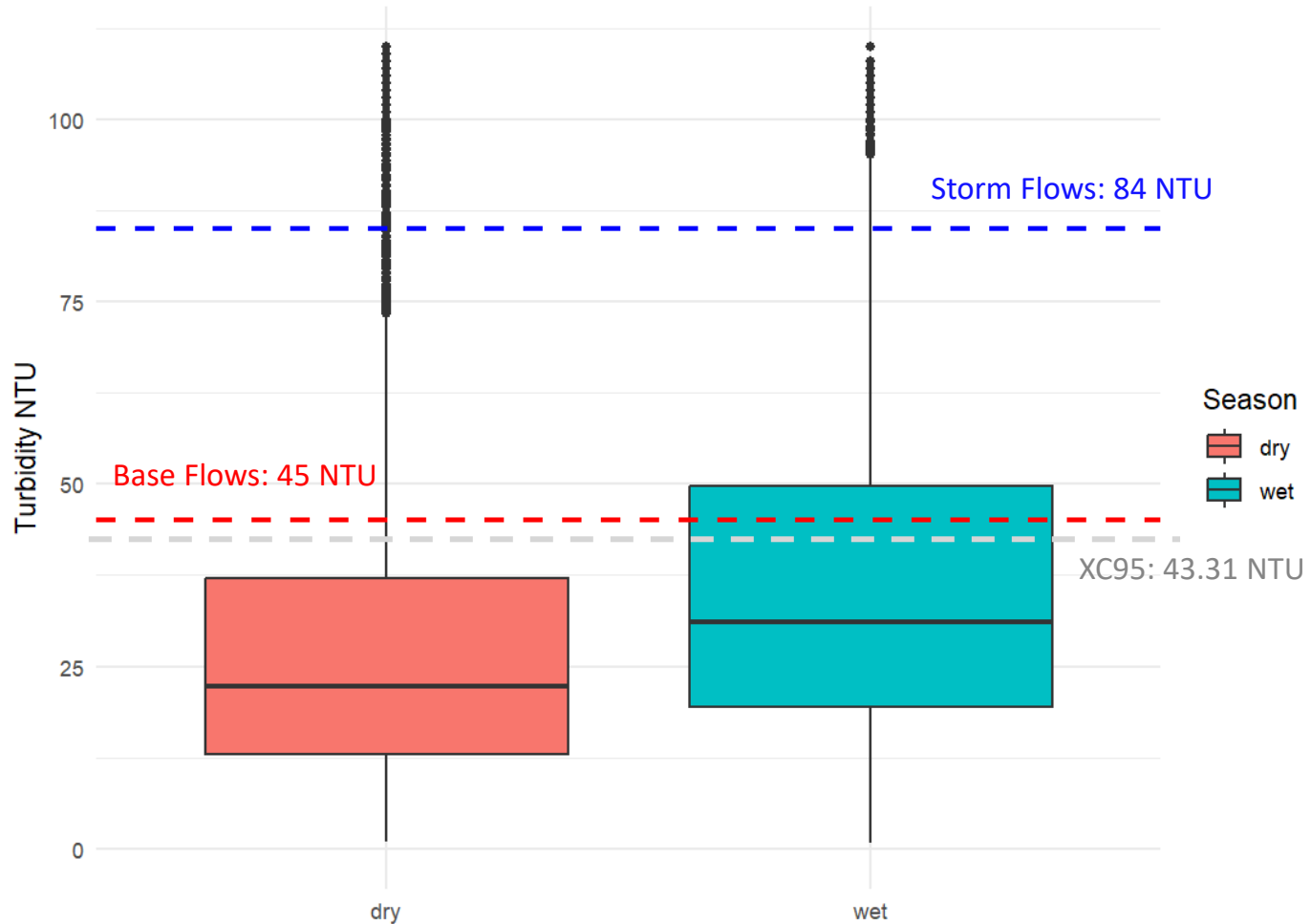
A photograph of two people kayaking in a swampy forest. The kayakers are wearing life jackets and hats, and a dog is sitting in the middle of the kayak. The forest is filled with large, ancient-looking cypress trees with prominent buttresses. The water is calm, reflecting the trees and the colorful autumn foliage in the background. The text "Least-Altered Mississippi Alluvial Plain" is overlaid in white on the left side of the image.

Least-Altered Mississippi Alluvial Plain

Current Criteria
Least-Altered Mississippi Alluvial Plain

Dataset:
DEQ
1990 – 2025

Season:
Wet ≥ 5 in.
Dry < 5 in.



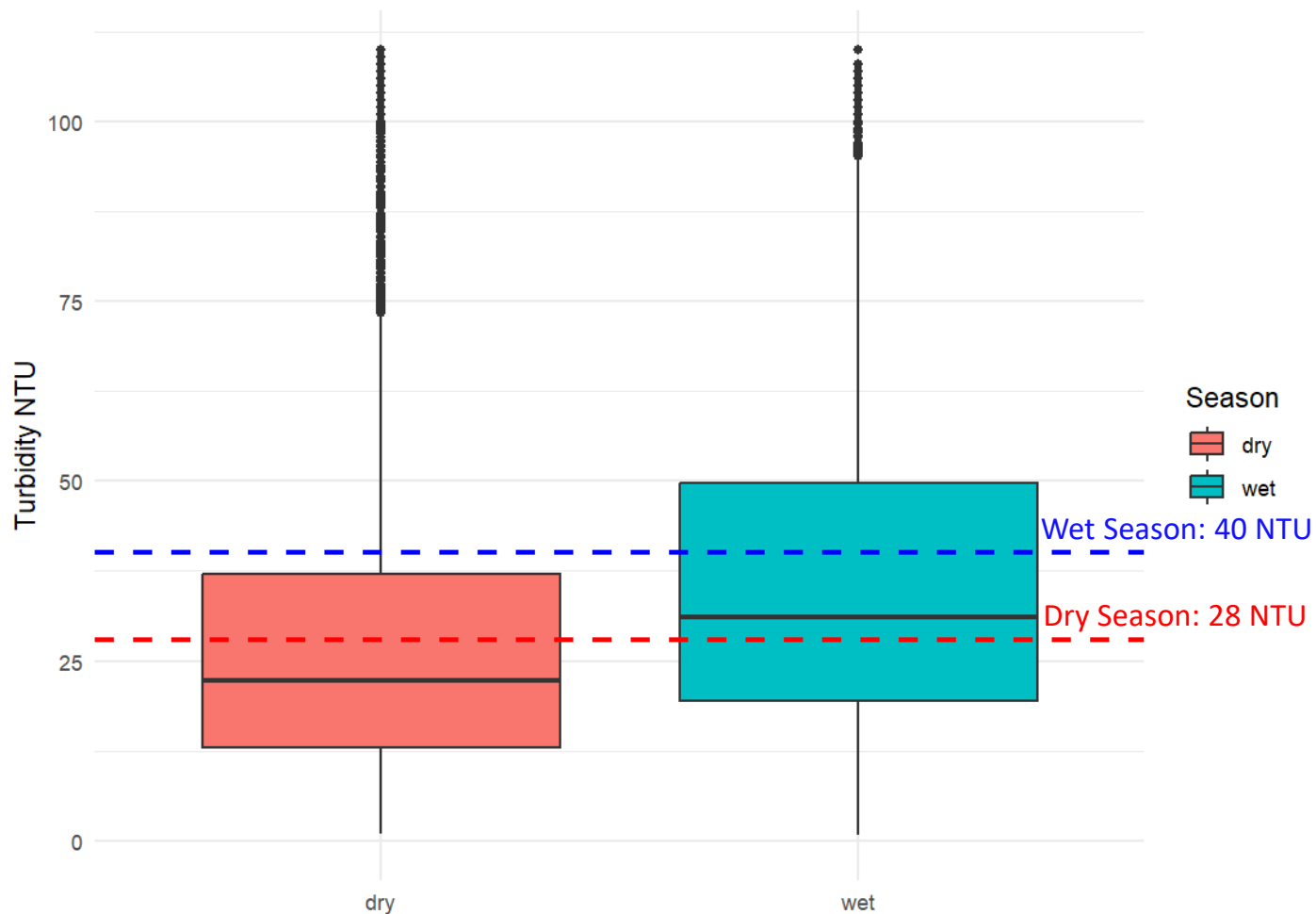
Precipitation Dependent Criteria

Least-Altered Mississippi Alluvial Plain

Dataset:
DEQ
1990 – 2025

Season:
Wet ≥ 5 in.
Dry < 5 in.

Method:
50th %tile + RPD
of general
population



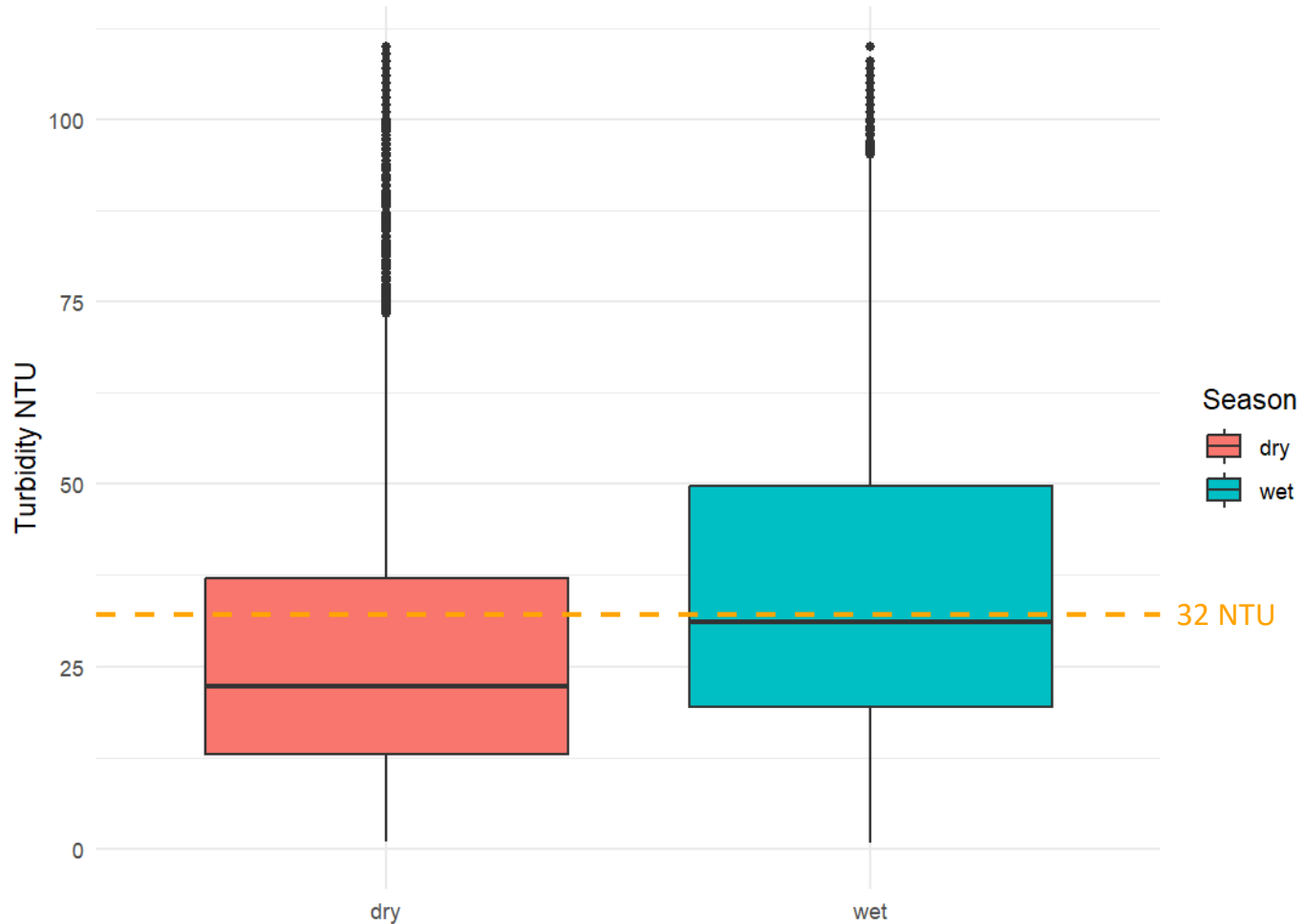
Precipitation Independent Criteria

Least-Altered Mississippi Alluvial Plain

Dataset:
DEQ
1990 – 2025

Season:
Wet ≥ 5 in.
Dry < 5 in.

Method:
50th %tile + RPD
of general
population





Large Rivers Arkansas, Red, Mississippi, & St. Francis

Proposed Criteria for Large Rivers

River	Precipitation Dependent		Precipitation Independent
	Dry (NTU)	Wet (NTU)	Year-round (NTU)
Arkansas River	31	60	40
St. Francis River	45	80	50
Red River	40	85	55
Mississippi River	--	--	45

**New criteria are dynamic,
protective, and rooted in sound
scientific evidence that ensure uses
are supported**



ARKANSAS
ENERGY & ENVIRONMENT

Turbidity Proposal Discussion



ARKANSAS
ENERGY & ENVIRONMENT

Proposal:

EPA “No Action”

Turbidity Language



ARKANSAS
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Proposed Turbidity Assessment Language - Streams

There shall be no distinctly visible increase in turbidity of receiving waters attributable to municipal, industrial, agricultural, other waste discharges, or instream activities.

Specifically, any such waste discharge, instream activity, or non-point source runoff shall not result in the exceedance of the in-stream wet season or dry season criteria in more than 25% of the samples.

Proposed Turbidity Definitions – Steams

- **Wet Season Turbidity:** when the total monthly precipitation for the county of data collection is $\geq$ to 5 inches during the month of data collection.
- **Dry Season Turbidity:** when the total monthly precipitation for the county of data collection is $<$ 5 inches during the month of data collection.

Turbidity Language Proposal Discussion



ARKANSAS
ENERGY & ENVIRONMENT

1 1/2 – HOUR LUNCH BREAK

Proposal:

8 CAR § 21-511(a) Minerals Language Change



ARKANSAS
ENERGY & ENVIRONMENT

Minerals – Site Specific Language History

Language that is in place through Clean Water Act approval process:

- “Mineral quality shall not be altered by municipal, industrial, other waste discharges or instream activities so as to interfere with designated uses. **The following limits apply to the streams indicated, and represent concentrations of chloride (Cl^-), sulfate (SO_4^{2-}) and total dissolved solids (TDS) not to be exceeded in more than one (1) in ten (10) samples collected over a period of not less than 30 days or more than 360 days.”**

During the 2007 triennial review, DEQ removed the last sentence and added language to the 303(d) Assessment Methodology:

- **25% exceedance rate over a 5-year period of record**

EPA took no action on the modification and discussion has been ongoing

Proposed Site Specific Minerals Language

“Mineral quality shall not be altered by municipal, industrial, other waste discharges or instream activities so as to interfere with designated uses. The following limits site specific criteria apply to the streams indicated, and represent concentrations of chloride (Cl^-), sulfate (SO_4^{2-}) and total dissolved solids (TDS) not to be exceeded in more than one (1) in ten (10) samples collected over a period of ~~not less than 30 days~~ or more than 360 days record.”

- No more than 360 days restricts the data available to use for impairment assessments
- 10% exceedance rate does not drastically increase impairments and is more in line with how the criteria were developed

Minerals Language Discussion



ARKANSAS
ENERGY & ENVIRONMENT

Proposal:

8 CAR § 21-509

Lake Nutrient Criteria



ARKANSAS
ENERGY & ENVIRONMENT

Why Propose Lake Nutrient Criteria?

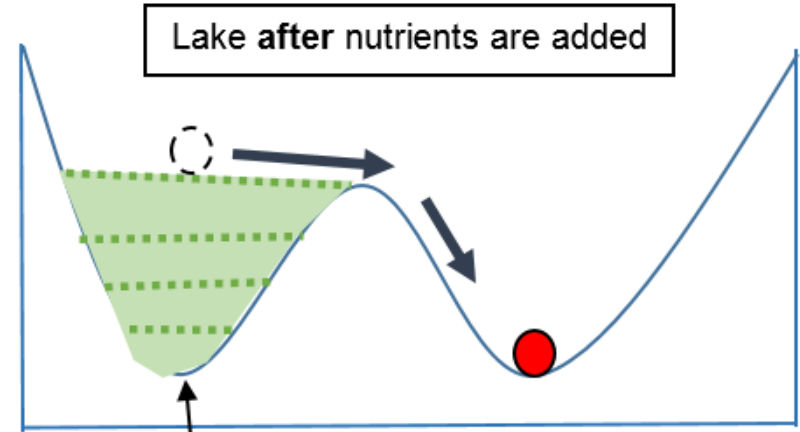
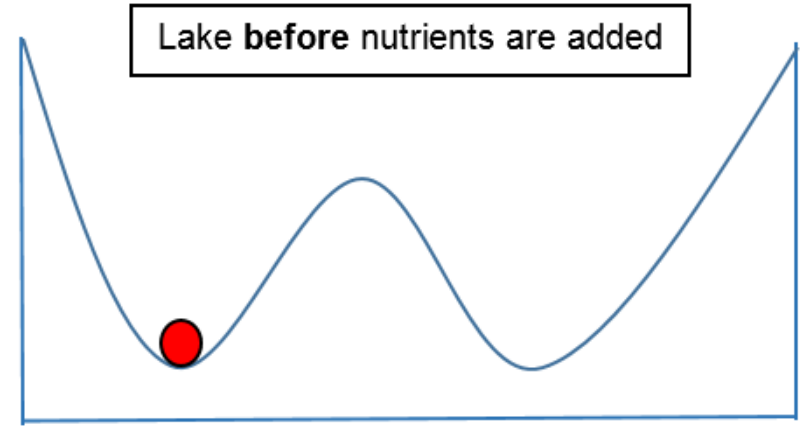
- ✓ Environmental impacts
- ✓ Health impacts
- ✓ Economic impacts
- ✓ Stakeholder requests



Image from Arkansas Division of Environmental Quality

Nutrient Tipping Point

- Lakes that shift into a eutrophic (nutrient rich) state are very difficult to restore
- Ecological resilience deteriorates



Nutrients fill the basin incrementally until filling the cup. Then the system's resilience is overcome and it falls into a new state.

Human Health, Environment, and Economic Impacts

- Low dissolved oxygen
 - Fish kills
- Taste and odor issues
- Nuisance algae blooms
- Reduced aesthetic/recreational value
- Disinfection byproducts
- Harmful algal blooms (HABs)



Image from Arkansas Division of Environmental Quality

LOCAL NEWS

Beaver Water District says algae is to blame for taste/odor issues in drinking water

Algal Bloom algae confirmed in south Arkansas by state department of environmental quality

LOCAL

Harmful algal bloom found in Poinsett County, AR lake

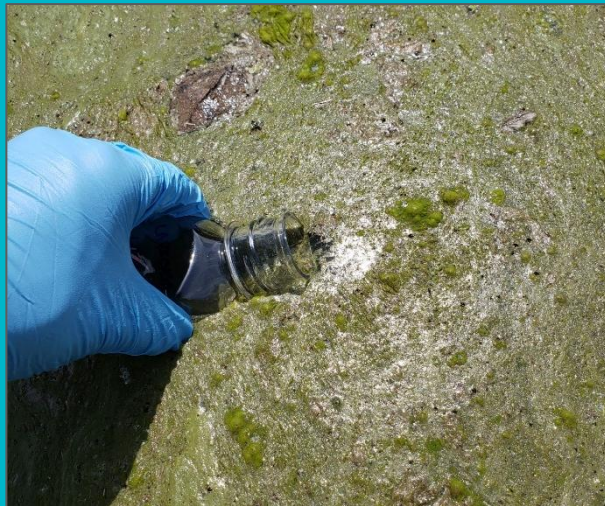
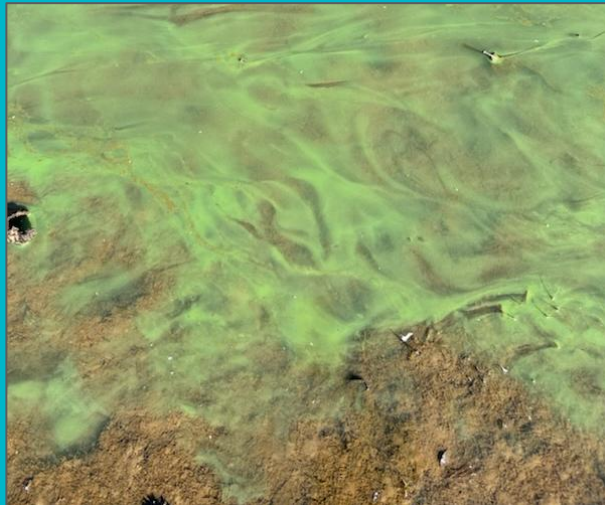
OUTDOORS NATURE

Harmful algal bloom detected at Lake Flint Creek

Researchers have been monitoring Lake Fayetteville's harmful algal blooms for 5 years. Here's what they found

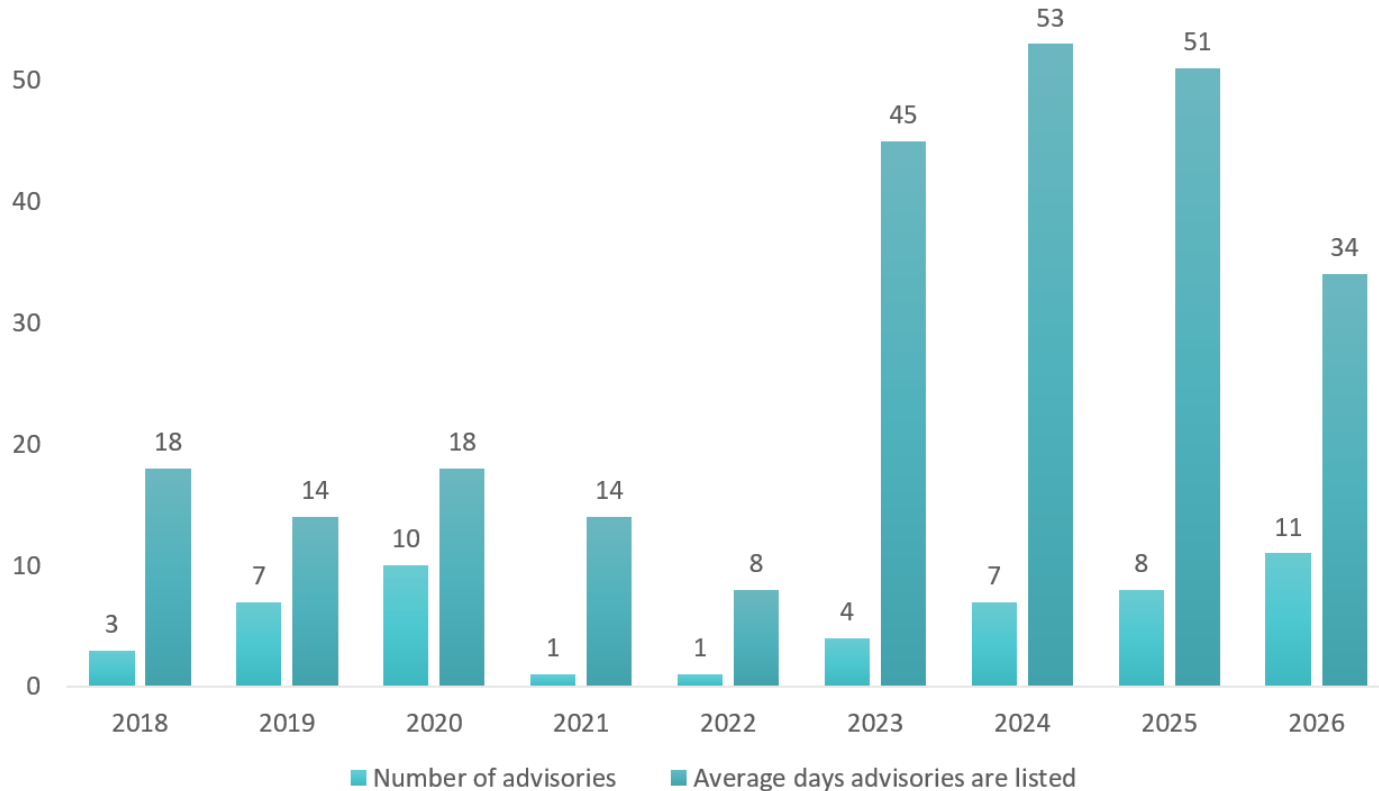
Harmful algal blooms can provide a myriad of toxins. More specifically, Lake Fayetteville has become susceptible to a liver toxin and possible human carcinogen.





All images from Arkansas Division of Environmental Quality

HAB Advisories in AR



*2018 – 2021 Advisory duration estimated

Health Impacts of Cyanotoxins

Note: Not all cyanotoxins lead to all of these health impacts. These listed impacts are caused by microcystins or cylindrospermopsin, the two cyanotoxins that EPA has issued Health Advisories for.

IN HUMANS

Brain

Source: Ingestion

Symptoms:

- Headache
- Incoherent speech
- Drowsiness
- Loss of coordination

Respiratory System

Source: Inhalation

Symptoms:

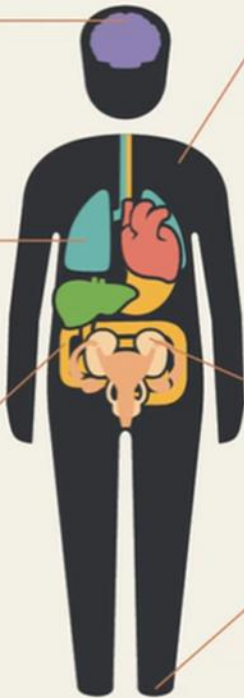
- Dry cough
- Pneumonia
- Sore throat
- Shortness of breath
- Loss of coordination

Digestive System

Source: Ingestion, drinking contaminated water, or eating contaminated fish

Symptoms:

- Abdominal pain
- Nausea
- Vomiting
- Diarrhea
- Stomach cramps



Body

Source: Contact, e.g. swimming

Symptoms:

- Irritation in eyes, nose, and throat
- Blistering around the mouth
- Skin rash, including tingling, burning and numbness
- Fever
- Muscle aches (from ingestion)
- Weakness (from ingestion)

Organs

Source: Ingestion

Symptoms:

- Kidney damage
- Abnormal kidney function
- Liver inflammation

Nervous System

Source: Ingestion

Symptoms:

- Tingling
- Burning
- Numbness

IN PETS

Symptoms:

Vomiting

Fatigue

Shortness of breath

Difficulty breathing

Coughing

Convulsions

Liver failure

Respiratory paralysis leading to death



National Economic Impact Estimates from HABs

- Zhang, et al., 2022: property values decrease by 4.3% on lakes that experience HABs
- US National Office for Harmful Algal Blooms: HABs cost an average of \$50 million per year
 - Response
 - Reduced tourism, fishing, and other recreational activities
 - Impacts to commercial fisheries
 - Drinking water treatment costs



Stakeholder Requests for Numeric Nutrient Criteria

Reg. 2.509(B), Nutrients– Site Specific Nutrient Standards

EPA

Comment: EPA encourages efforts such as the Beaver Lake project in moving towards nutrient criteria development; however, we strongly encourage ADEQ to move towards the establishment of numeric nutrient criteria for all waterbodies in lieu of the narrative criteria. Additionally, the standards should be linked to the aquatic life designated use.

2013

Beaver Water District

Comment: Second one's just a few comments about the Beaver Lake standards and those standards were the result, as several people have mentioned, of the workgroup that was pulled together by the department back in 2006. The purpose for pulling that workgroup together was to develop a protocol for developing **nutrient** regs or **nutrient** criteria for lakes in Arkansas and that was as deemed strongly encouraged by EPA, if not required. So the reason Beaver was selected

2020

Reg. 2.509, Nutrients

National Park Service

Comment: The latest draft has included 'Arkansas' in the following sentence; "However, when excess nutrients result in an impairment, based on Department assessment, by any Arkansas established, numeric water quality standard ". We believe that this regulation will not be enforceable until the state sets the needed numerical values, which are years from completion, leaving resources without proper protection. Until the Department finalizes values, we ask that 'Arkansas' be replaced with language accepting values approved by EPA in systems most similar to those found in Arkansas. Once the Department establishes numerical values, they will replace any non-state values.

2020

Rule 2.509 Nutrients

BRWA, Ozark Society, Fay Knox, Sandy Bernet, Shawn Porter, Carol Storthz, Michael E. Kelly, Richard Osborne, Brenda Scheffler, Larry and Marti Olsen, Mark Smith, Chris Cristoffel, Beth Ardapple, Fran Alexander, Linda Stith

Comment: "Materials stimulating algal growth shall not be present in concentrations sufficient to cause objectionable algal densities or other nuisance aquatic vegetation or otherwise impair any designated use of the waterbody."

2020

The BRWA & OS strongly supports the immediate implementation of numeric nutrient criteria for phosphorous and nitrogen. The current language is ambiguous, insufficient, not protective to Arkansas' water quality and allows for degradation of Extraordinary Resource Waters and other Tier III waters. In 2018, the Buffalo National River experienced a 90-mile long algal bloom. In previous years, the bloom was estimated to be 30 and 50 miles long respectively. Clearly these regulations are not providing water quality protection for the nation's first national river and are

Arkansas Game and fish Commission (AGFC)

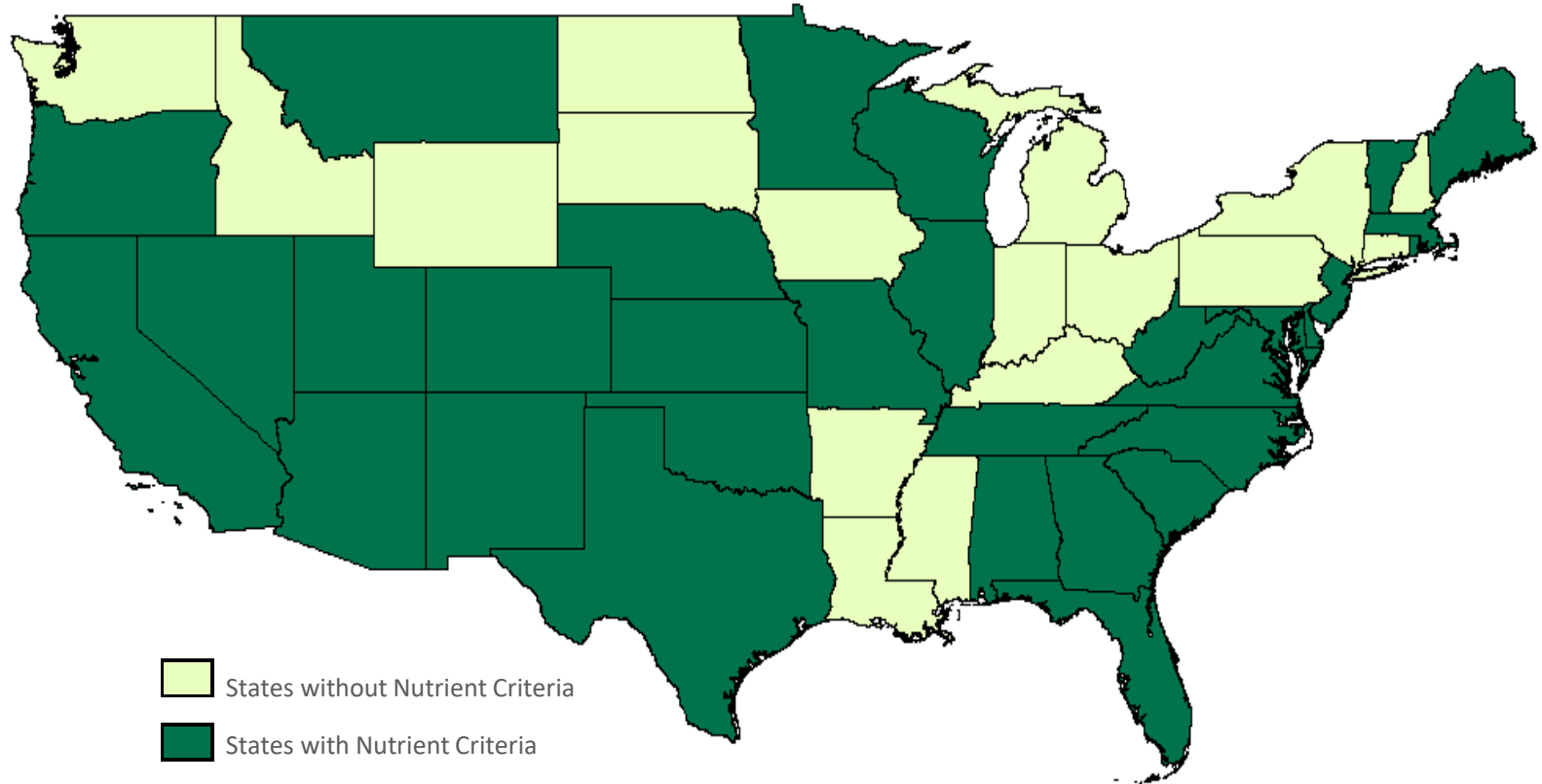
Comment: For more than two decades the US EPA has been providing guidance on how to properly develop scientifically defensible numeric nutrient criteria for the protection of the most sensitive beneficial uses (EPA 2000, EPA 2020). The AGFC recognizes DEQ's ecoregion approach and data collection efforts reported in Part III, Chapter Five of the 2018 Integrated Water Quality Monitoring Report. The DEQ reports data collected from Extraordinary Resource Waters (ERWs) were comparable to EPA Level III Aggregated Ecoregion values.

2020

Until such time that the DEQ has completed thorough analysis and vetting of its completed stressor-response studies for all ecoregions, the AGFC encourages use of the 2002 EPA Level III Aggregated Ecoregion values for rivers and streams. Similarly, the EPA recently released updated values for lakes and reservoirs (EPA 2020). As the AGFC owns nearly 20,000 acres and manages fisheries for all the nearly 300,000 acres of significant publically owned waters in the state, we strongly support the DEQ promulgating US EPA recommended values until such a time that the DEQ can present site-specific or regional numeric nutrient criteria for the protection of reservoir beneficial uses.

2023

Nutrient/Chl a Criteria Across the US



**Nutrient
Scientific
Technical
Exchange
Partnership
and Support
(N-STEPS)
process**

Classification Analysis

```
graph TD; A[Classification Analysis] --> B[Chlorophyll Targets]; B --> C[TN or TP Criteria];
```

Chlorophyll Targets

TN or TP Criteria

N-STEPS Report

3 CLASSIFICATION

The goal for classification analysis was to divide Arkansas lakes into distinct classes that have different responses to water quality drivers and impacts. Variables considered as potential classifier variables included:

- Lake area
- Maximum lake depth
- Watershed area
- Watershed area: Lake area
- Elevation
- Latitude
- Longitude
- Ecoregion
- Purpose (i.e., designated use)

MBRP was used to identify significant splits in the following relationships, as measured by linear regression:

- Dissolved oxygen (DO) ~ chlorophyll
- pH ~ chlorophyll
- Chlorophyll ~ total nitrogen (TN)
- Chlorophyll ~ total phosphorus (TP)

Classifying Lakes

LIMNOLOGY
and
OCEANOGRAPHY

ASLO

Limnol. Oceanogr. 68, 2023, 2759–2773
© 2023 The Authors. *Limnology and Oceanography* published by Wiley Periodicals LLC on
behalf of Association for the Sciences of Limnology and Oceanography.
doi: 10.1002/lno.12457

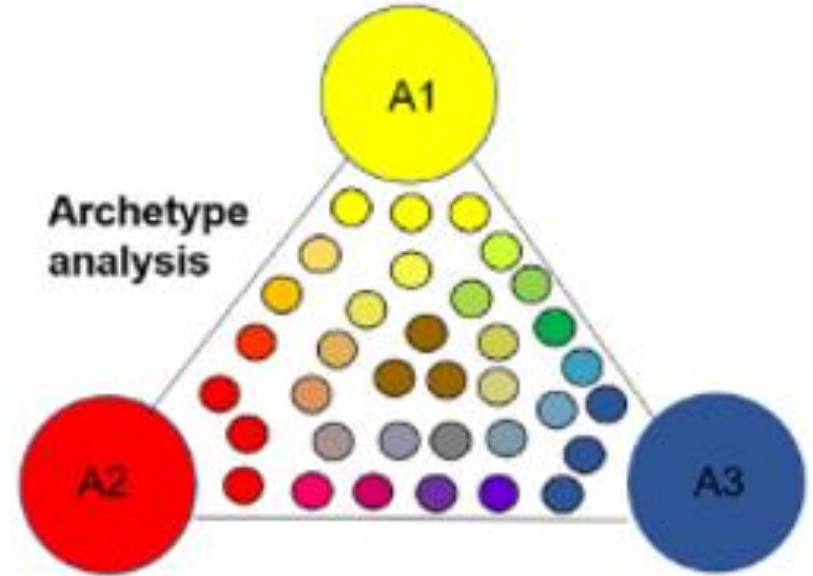
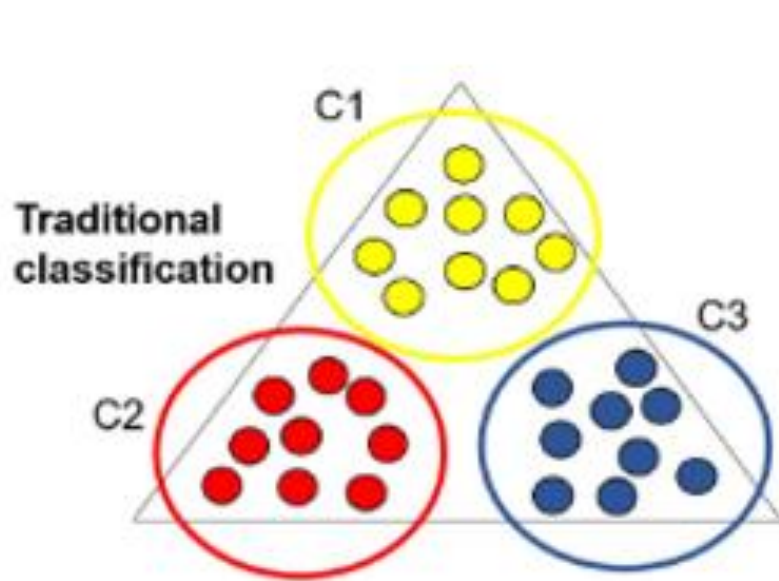
A continuous classification of the 476,697 lakes of the conterminous US based on geographic archetypes

Jean-Francois Lapierre,^{1,2*} Katherine E. Webster,^{3,4} Ephraim M. Hanks,⁵ Tyler Wagner ,^{5,6}
Patricia A. Soranno ,³ Ian M. McCullough,³ Kaitlin L. Reinl,⁷ Marcella Domka,³ Noah R. Lotting ⁸



Image from Arkansas Division of Environmental Quality

Why Archetype Instead of Traditional Cluster Analysis?



Characteristic Variables

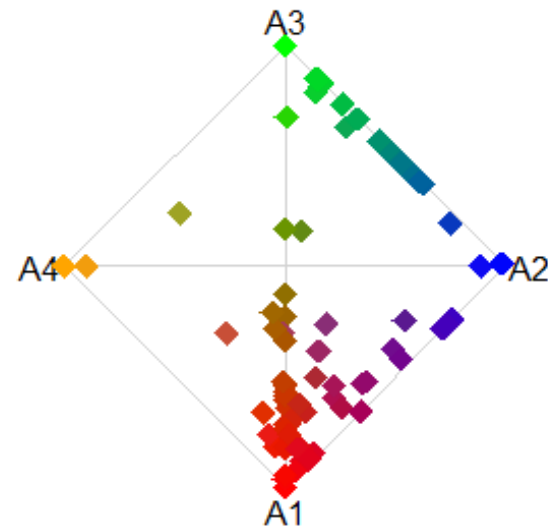
- Watershed Area (Lake CAT)
- Base Flow Index - the ratio of base flow to total flow, expressed as a percentage, within watershed. (Lake CAT)
- Elevation (Lake CAT)
- Surface Area (NID)
- Volume (NID)
- Maximum Depth (DEQ)



Image from Arkansas Division of Environmental Quality

Analysis Indicated Four Archetypes for AR Lakes

- 56 of the 90 (62.2%) lakes received a high weight score >0.75 in AR classification
- Only 10% of Lapierre et al. received a high weight score >0.75



Top Archetype Drivers

Positive
Drivers

Archetype 1

None

Archetype 2

+ Baseflow
Index
+ Elevation

Archetype 3

+Elevation
+Max Depth
+Watershed
Area

Archetype 4

+Surface Area
+Volume
+Watershed
Area

Negative
Drivers

- Elevation
- Max Depth
- Watershed
Area

-Watershed
Area
- Surface Area
- Volume

- Baseflow
Index
- Surface Area
- Volume

- Baseflow
Index

Archetype 1a vs 1b

- Lakes in Archetype 1 are split into two groups
 - Shallow lowland lakes (<5m)
 - Moderate lowland lakes (≥5m)

OPEN A functional definition to distinguish ponds from lakes and wetlands

David C. Richardson^{1,19}, Meredith A. Holgerson^{2,19}, Matthew J. Farragher¹, Kathryn K. Hoffman¹, Katelyn B. S. King¹, María B. Alfonso¹, Mikkel R. Andersen⁷, Kendra Spence Cheruvell¹, Kristen A. Coleman⁸, Mary Jade Farruggia¹⁹, Rocio Luz Fernandez²¹, Kelly L. Hondula¹², Gregorio A. López Moreira Mazacotte¹³, Katherine Paul¹, Benjamin L. Peierls²⁴, Joseph S. Rabaey¹⁵, Steven Sadro¹⁰, María Laura Sánchez¹⁶, Robyn L. Smyth¹⁷ & Jon N. Sweetman¹⁸

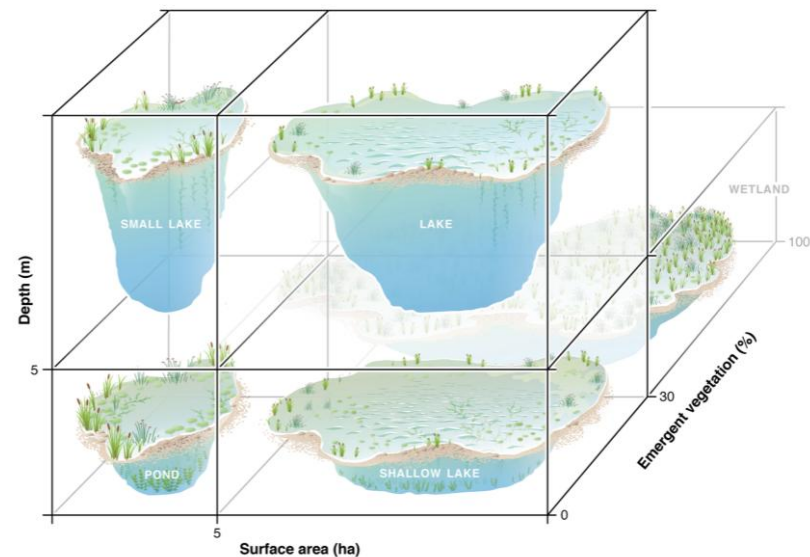
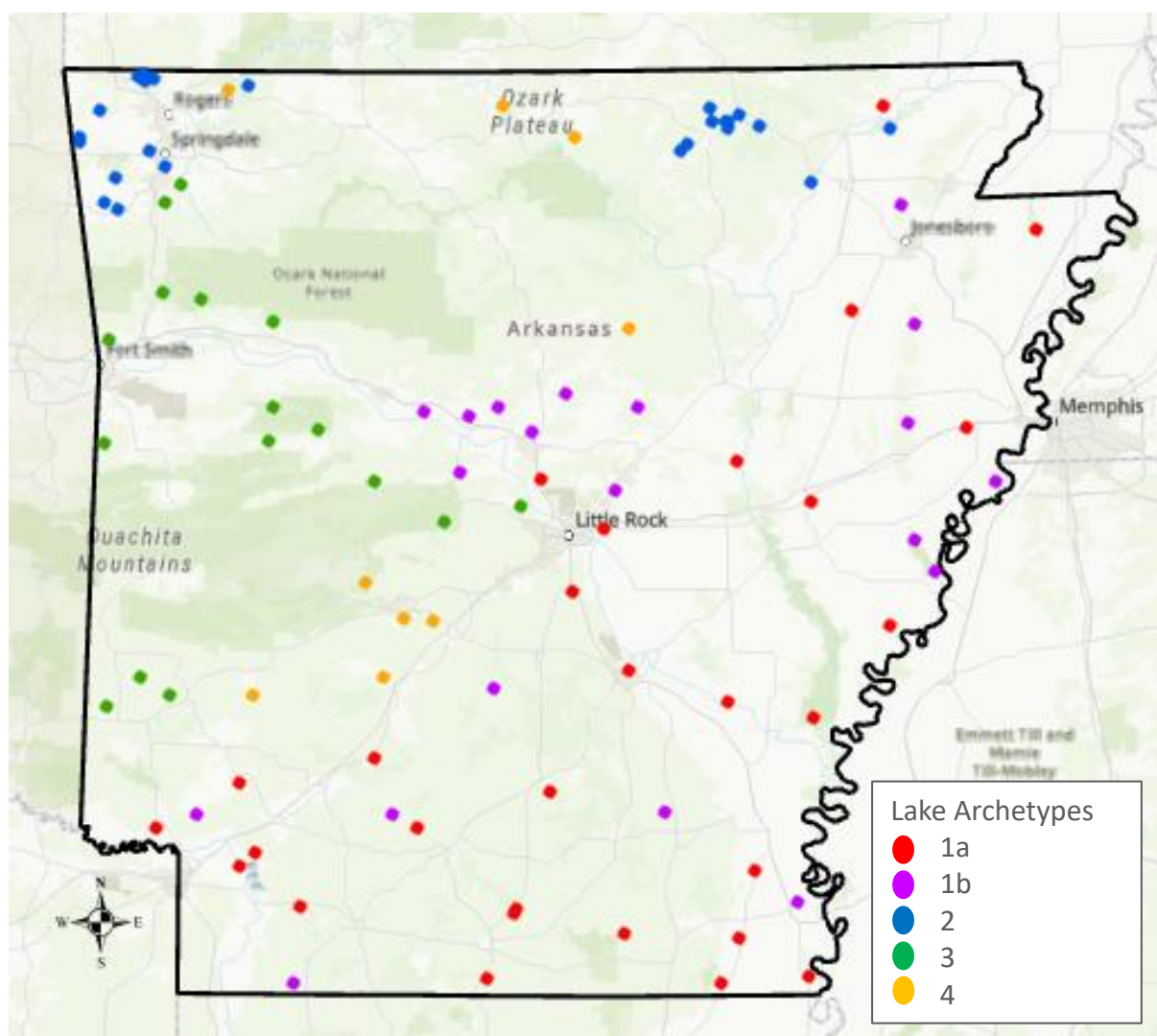


Figure 8. Conceptual model to define lentic waterbodies based on three different criteria (depth, surface area, and emergent vegetation). Boundaries for all three axes come from our analysis and are informed by existing pond, lake, and wetland definitions. Figure by Visualizing Science.



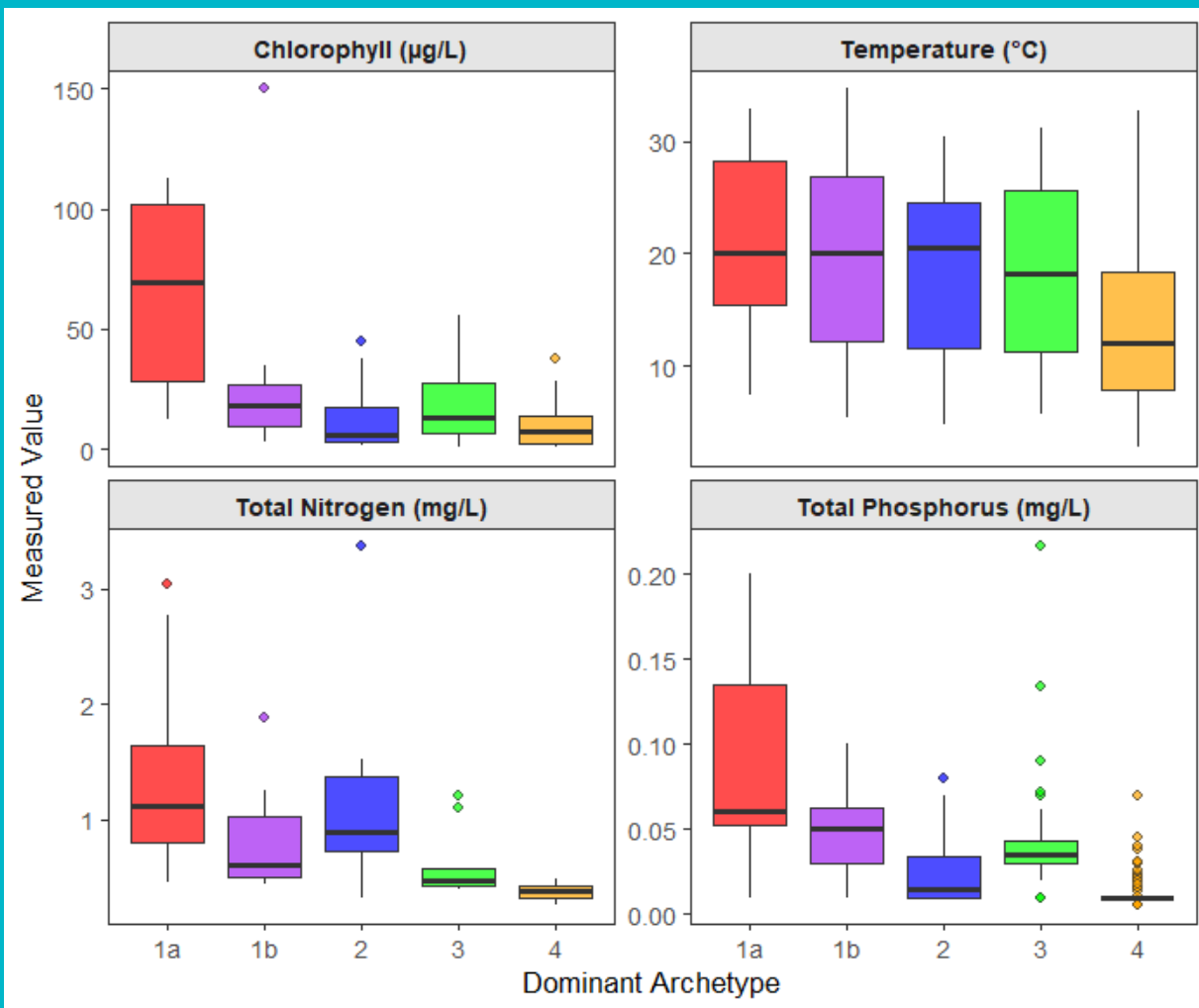
**Nutrient
Scientific
Technical
Exchange
Partnership
and Support
(N-STEPS)
process**

Classification Analysis

```
graph TD; A[Classification Analysis] --> B[Chlorophyll Targets]; B --> C[TN or TP targets];
```

Chlorophyll Targets

TN or TP targets



Chlorophyll Target Models

- Two state models were limited by sample size
 - DBP's ~ Chlorophyll
 - Cyanobacteria ~ Chlorophyll
- Two state models were re-ran using the new classifications
 - pH ~ Chlorophyll
 - DO ~ Chlorophyll
- National model outputs stayed the same as N-STEPS Report
 - Zooplankton ~ Chlorophyll
 - Microcystin ~ Chlorophyll

Chlorophyll Standards in other states

Similar Archetype	State	Classification	Standard/Target
1b	Virginia	Lowland site-specific lakes	40-60 µg/L
1b	South Carolina	Plains ecoregion lakes	40 µg/L
1b	Minnesota	Plains lowland ecoregion lakes	30-48 µg/L
2 & 3	Missouri	Ozark ecoregions	15-22 µg/L
2 & 3	Virginia	Upland ecoregions	20-40 µg/L
2 & 3	West Virginia	Warmwater upland lakes	20 µg/L
4	Oklahoma and Kansas	DWS lakes	10 µg/L
4	Texas	Similar site specific	9-12 µg/L
4	Tennessee	Similar site specific	18 µg/L

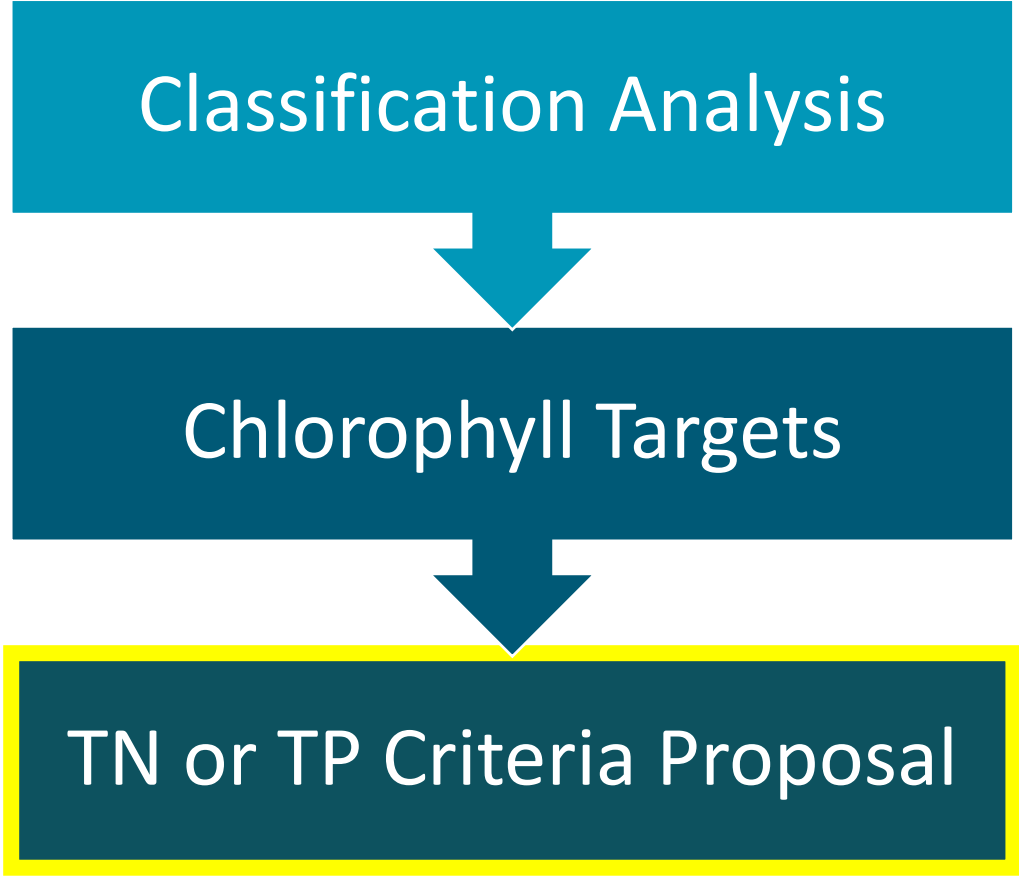
Chlorophyll Target Summary

Targets using archetype-based classification

Archetype	Chlorophyll Target (µg/L)	Rationale
1a	81.48	80 th percentile
1b	46.5	80 th percentile
2	26.46	80 th percentile
3	27.2	80 th percentile
4	9.12	80 th percentile

**Nutrient
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Classification Analysis

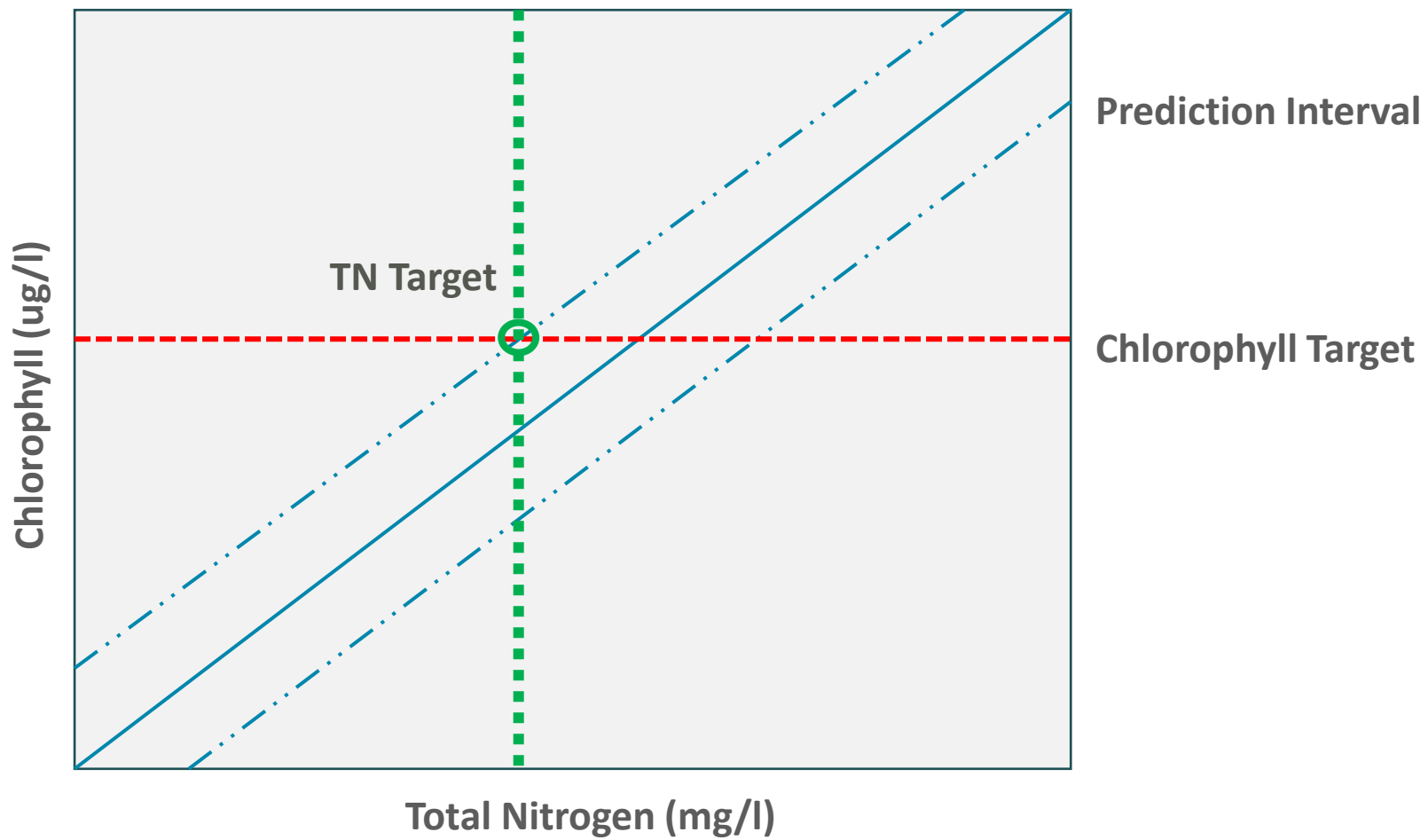


```
graph TD; A[Classification Analysis] --> B[Chlorophyll Targets]; B --> C[TN or TP Criteria Proposal];
```

The diagram illustrates a three-step process. The first step, 'Classification Analysis', is in a light blue box. A blue arrow points down to the second step, 'Chlorophyll Targets', which is in a dark blue box. Another blue arrow points down to the third step, 'TN or TP Criteria Proposal', which is in a dark blue box with a yellow border.

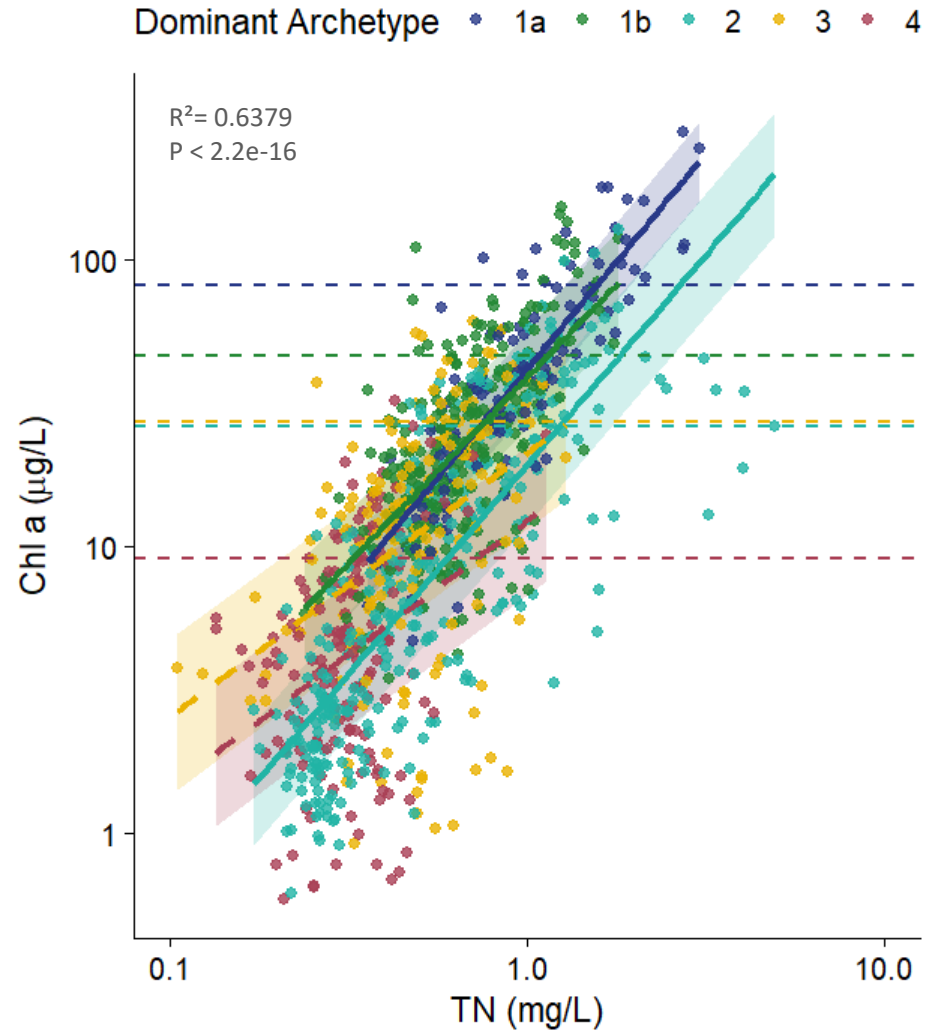
Chlorophyll Targets

TN or TP Criteria Proposal



TN vs Chlorophyll Model

Archetype	Chlorophyll Target (µg/L)	TN (mg/L) 50% PI
1a	81.48	1.27
1b	46.50	0.84
2	26.46	0.89
3	27.20	0.68
4	9.12	0.39



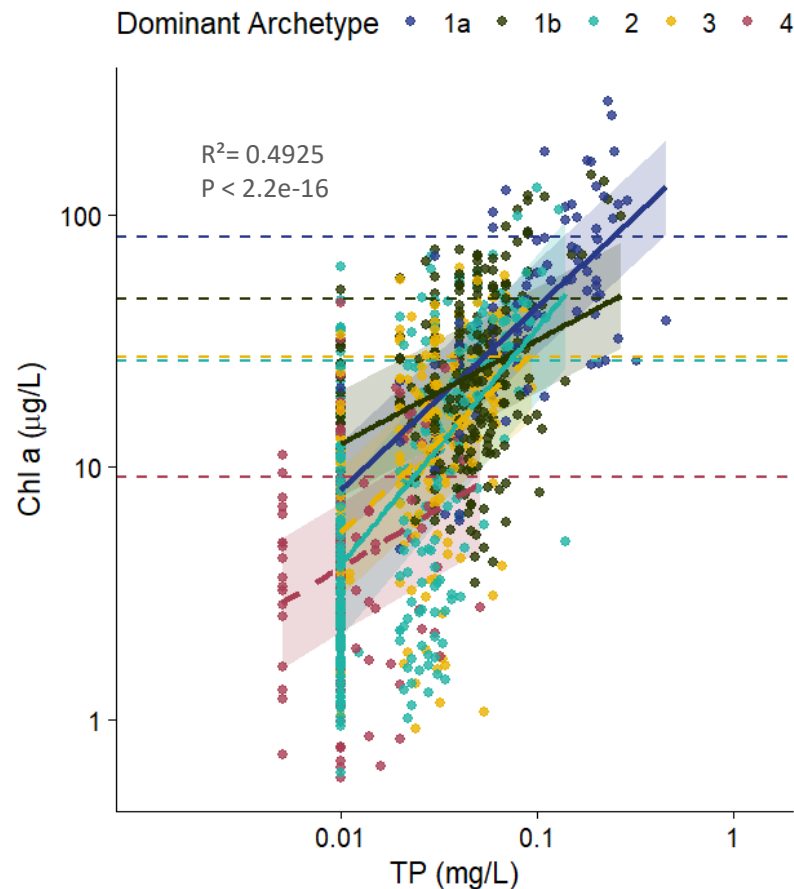
Comparing TN Criteria Proposal to the Distribution of the Data

Archetype	Chlorophyll Target ($\mu\text{g/L}$)	TN (mg/L) 50% PI
1a	81.48	1.27
1b	46.50	0.84
2	26.46	0.89
3	27.20	0.68
4	9.12	0.39

Archetype	Mean TN	75th TN	80th TN
1a	1.07	1.31	1.51
1b	0.71	0.84	0.94
2	0.69	0.89	1.00
3	0.52	0.66	0.71
4	0.33	0.37	0.39

TP vs Chlorophyll Model

Archetype	Chlorophyll Target (µg/L)	TP Criteria (mg/L) 50% PI
1a	81.48	0.135
1b	46.50	0.078
2	26.46	0.036
3	27.20	0.041
4	9.12	0.016



Comparing TP Criteria Proposal to the Distribution of the Data

Archetype	Chlorophyll Target (µg/L)	TP (mg/L) 50% PI
1a	81.48	0.135
1b	46.50	0.078
2	26.46	0.036
3	27.20	0.041
4	9.12	0.016

Archetype	Mean TP	75 th TP	80 th TP
1a	0.112	0.167	0.193
1b	0.050	0.060	0.065
2	0.026	0.035	0.040
3	0.031	0.040	0.042
4	0.013	0.010	0.014

Bloom Risk of Lakes Over Proposed Criteria

Bloom Risk was determined using historic HAB advisories and WHO chlorophyll thresholds

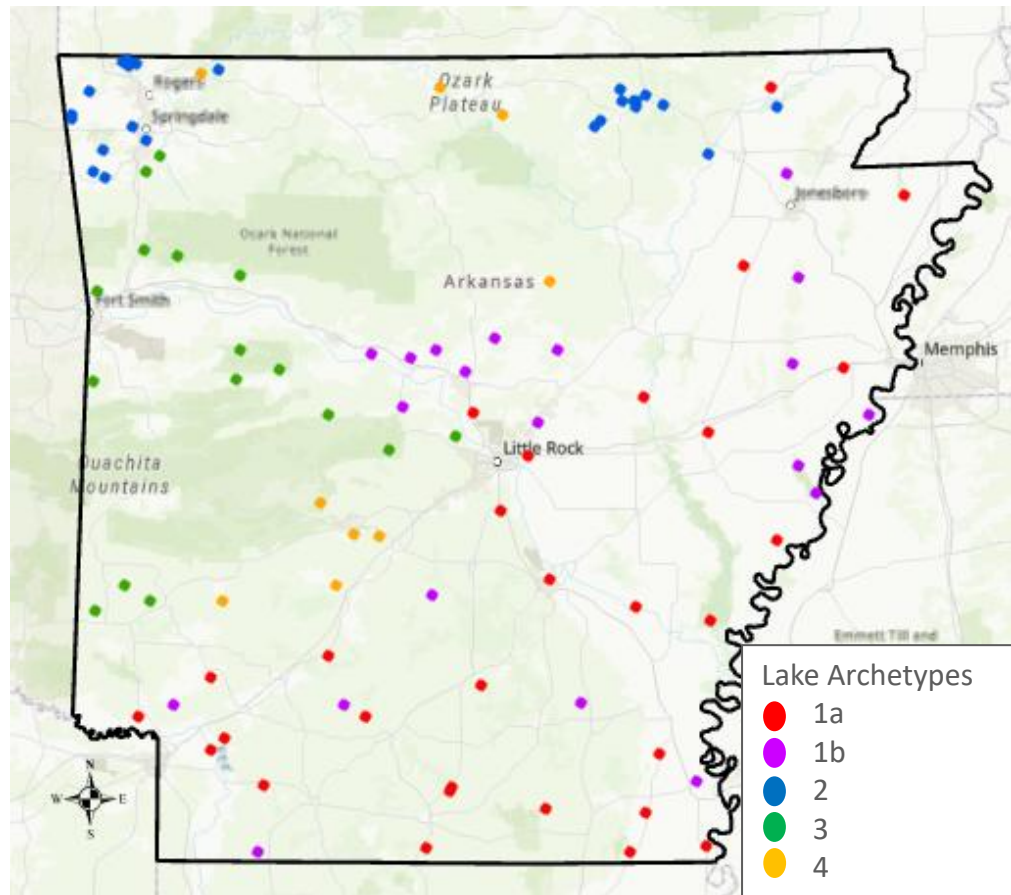
Number Lakes Over Proposed TN	Number Lakes Over Proposed TP	Bloom Risk of Lakes Over Proposed TN	Bloom Risk of Lakes Over Proposed TP
15	12	80%	100%

HABs on Lakes Over Proposed Criteria

Lake Name	Archetype	TP Over Proposed Criteria	TN Over Proposed Criteria	HAB History
Bear Creek Lake	1b		Yes	Yes
Bois D'Arc Lake	1a	Yes	Yes	Yes
Brewer Lake	1b	Yes	Yes	Yes
Gillham Lake	3	Yes		Yes
Horsehead Lake	3	Yes		Yes
Horseshoe Lake	1b	Yes	Yes	Yes
Lake Bennett	1b	Yes	Yes	Yes
Lake Catherine	4	Yes	Yes	Yes
Lake Charles	2	Yes	Yes	Yes
Lake Conway	1a	Yes	Yes	Yes
Lake Fayetteville	2	Yes	Yes	Yes
Lake Hamilton	4	Yes		Yes
Lake Hogue	1a	Yes	Yes	Yes
Lake June	1a	Yes	Yes	Yes
Lake Nimrod	3	Yes		Yes
Lake Wilson	3	Yes		Yes
Overcup Lake	1b	Yes	Yes	Yes

Proposed Lake Nutrient Criteria

Archetype	Proposed TN Criteria (mg/L)	Proposed TP Criteria (mg/L)
1a	1.27	0.135
1b	0.84	0.078
2	0.89	0.036
3	0.68	0.041
4	0.39	0.016



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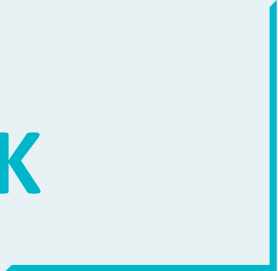
Lake Nutrient Criteria Proposals Discussion



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A teal-colored L-shaped bracket, consisting of a vertical line on the left and a horizontal line on the top, framing the text from the left and top.

15 – MINUTE BREAK

A teal-colored L-shaped bracket, consisting of a vertical line on the right and a horizontal line on the bottom, framing the text from the right and bottom.

**Any Follow up
Questions?**



KEEP IN TOUCH



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