

# Long-term Water Quality Trends in the Monongahela River Basin: 2009 to 2025

2026 WVMDTF

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# Overview



Introduction



TDS Issue



Solution



3 Rivers  
Quest



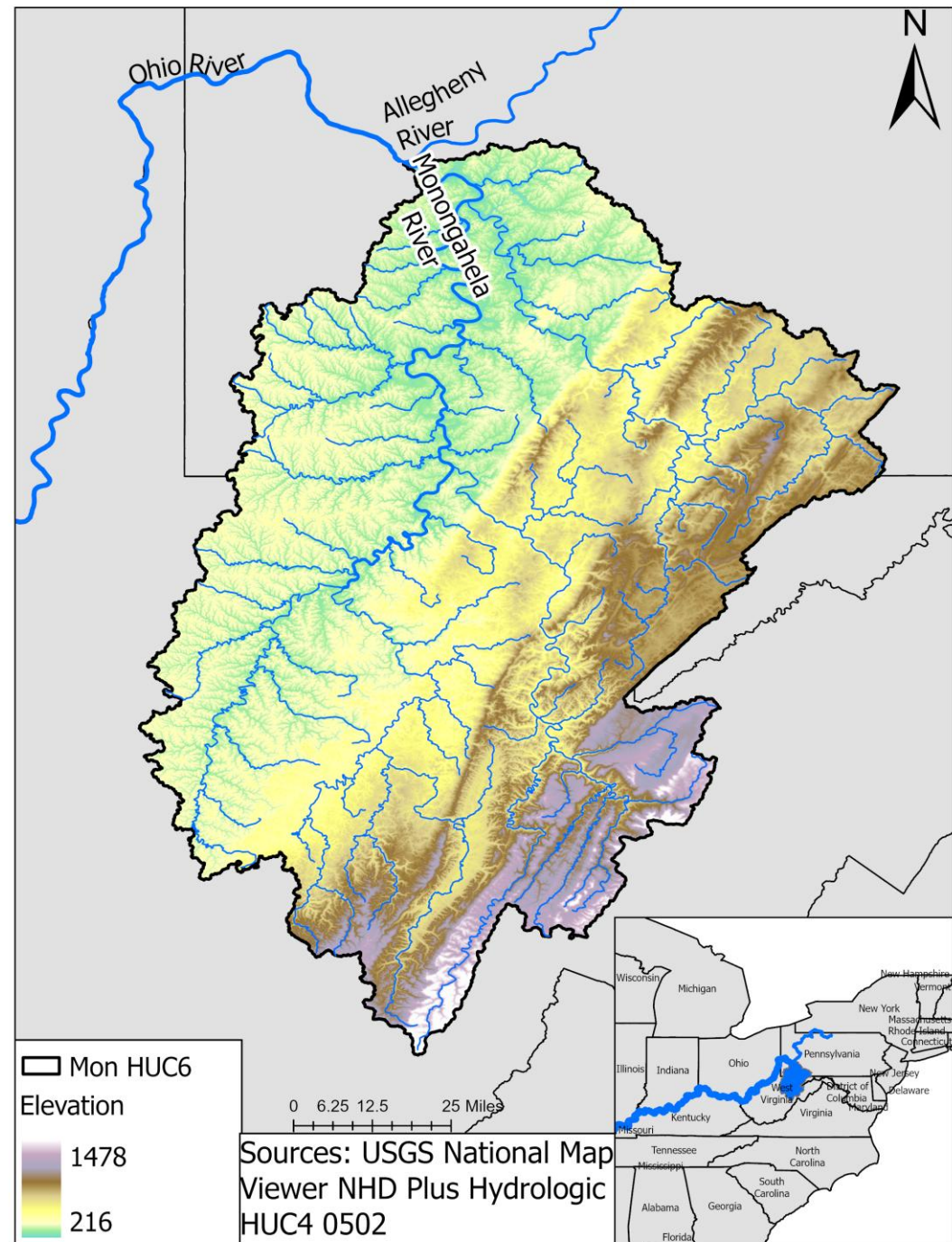
Results



Summary

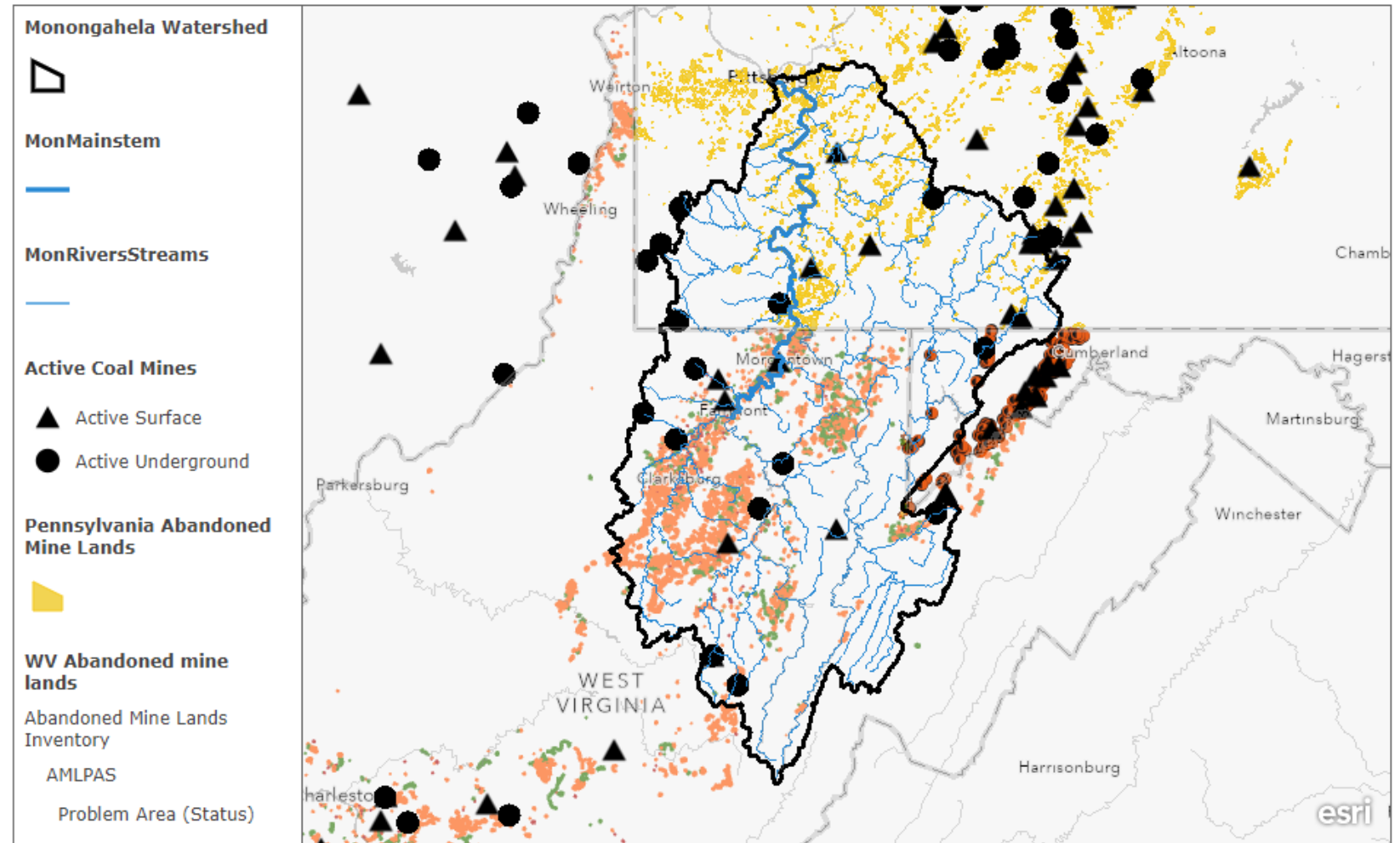
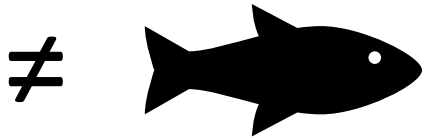
# Introduction: The Monongahela River Basin

- Drains 7,340 square miles of PA, WV, and MD
- The Mon is 130-mile-long navigable river.
- Has 8 Locks and dams
- Serves as drinking water for ~1 million people



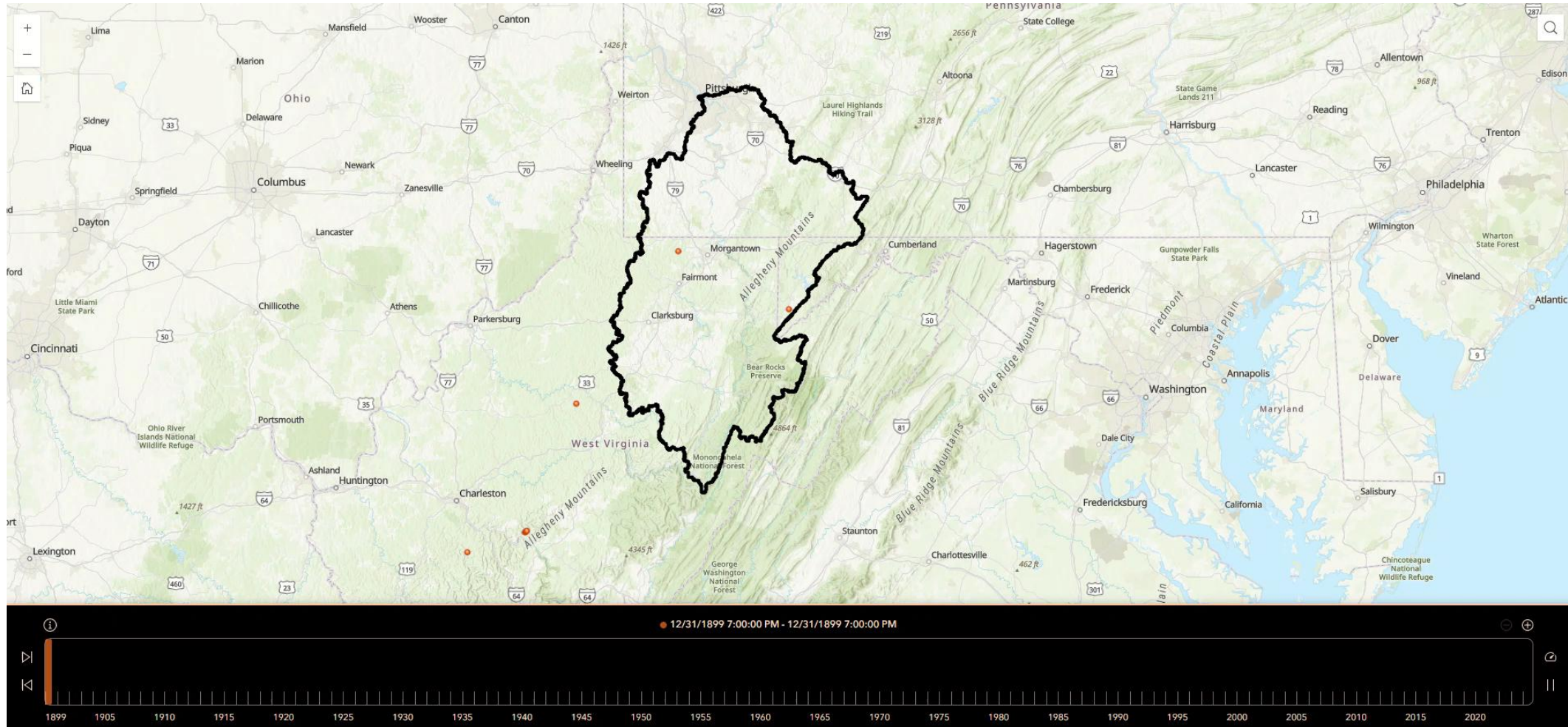
# Industry in the Mon Watershed

- Industry drove growth of the cities and towns along the river
- 200 years of coal mining
  - Produced acidity and metal impacts on Mon and tributaries



Jaron Hawkins, MDE, Land Management Administration - Abandoned Mine Lands Division | VGIN, Esri, TomTom, Garmin, FAO, NOAA, USGS, EPA, NPS, USFWS | VGIN, Esri, TomTom, Garmin, FAO, NOAA, USGS, EPA, NPS, USFWS | VGIN, Esri, TomTom, Garmin, FAO, NOAA, USGS, EPA, NPS, USFWS

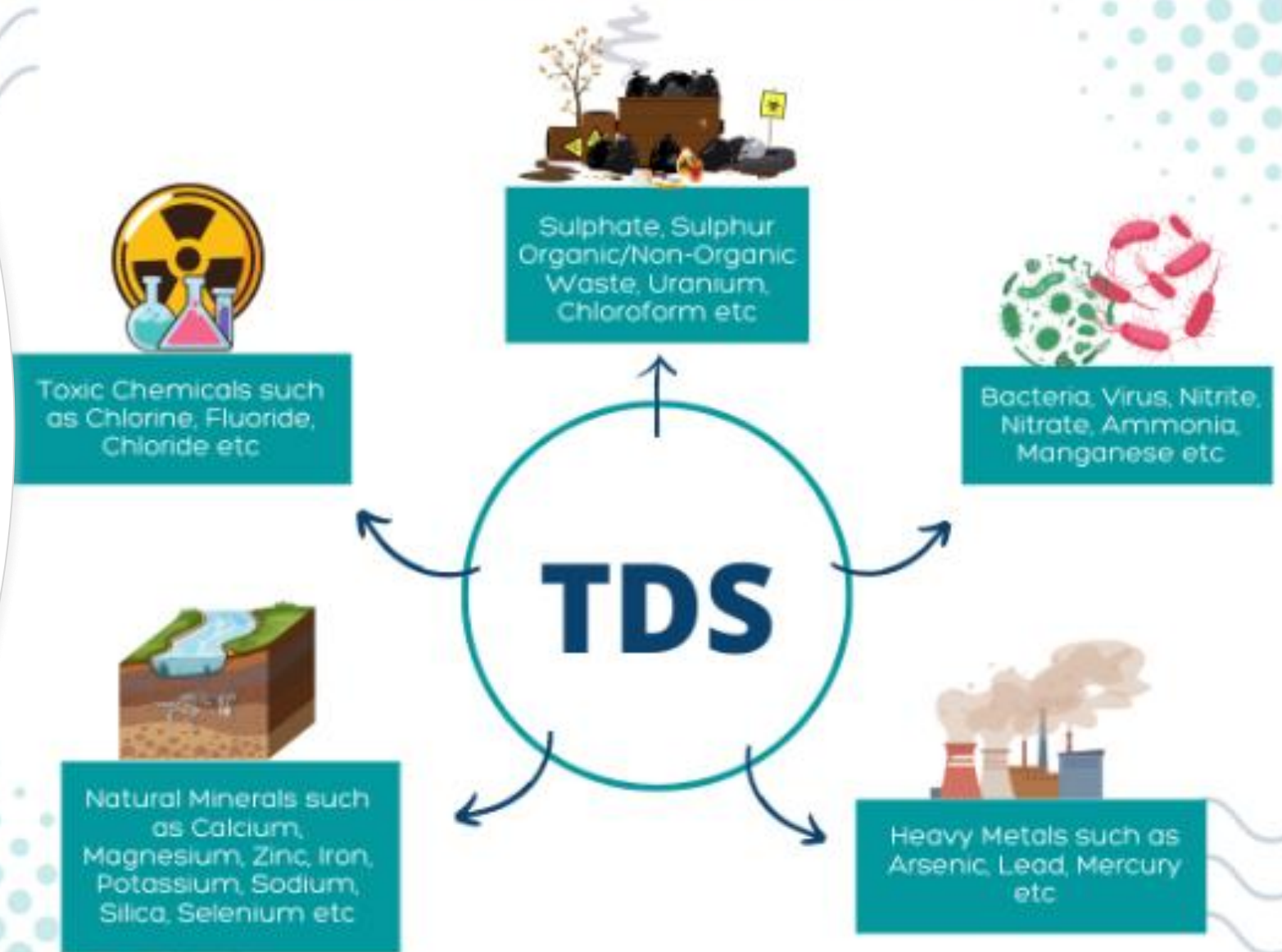
# Industry in the Mon Watershed



# TDS (Total Dissolved Solid / Total Dissolved Salt) in Parts Per Million (PPM) (mg/litre)

## Total Dissolved Solids (TDS)

- In 2008, the Mon had 2x the normal level of TDS and Sulfates
- Affected public drinking water supplies, industrial users along the river, pipe corrosion, scaling, taste, and odor problems



# 3RQ Monitoring Program

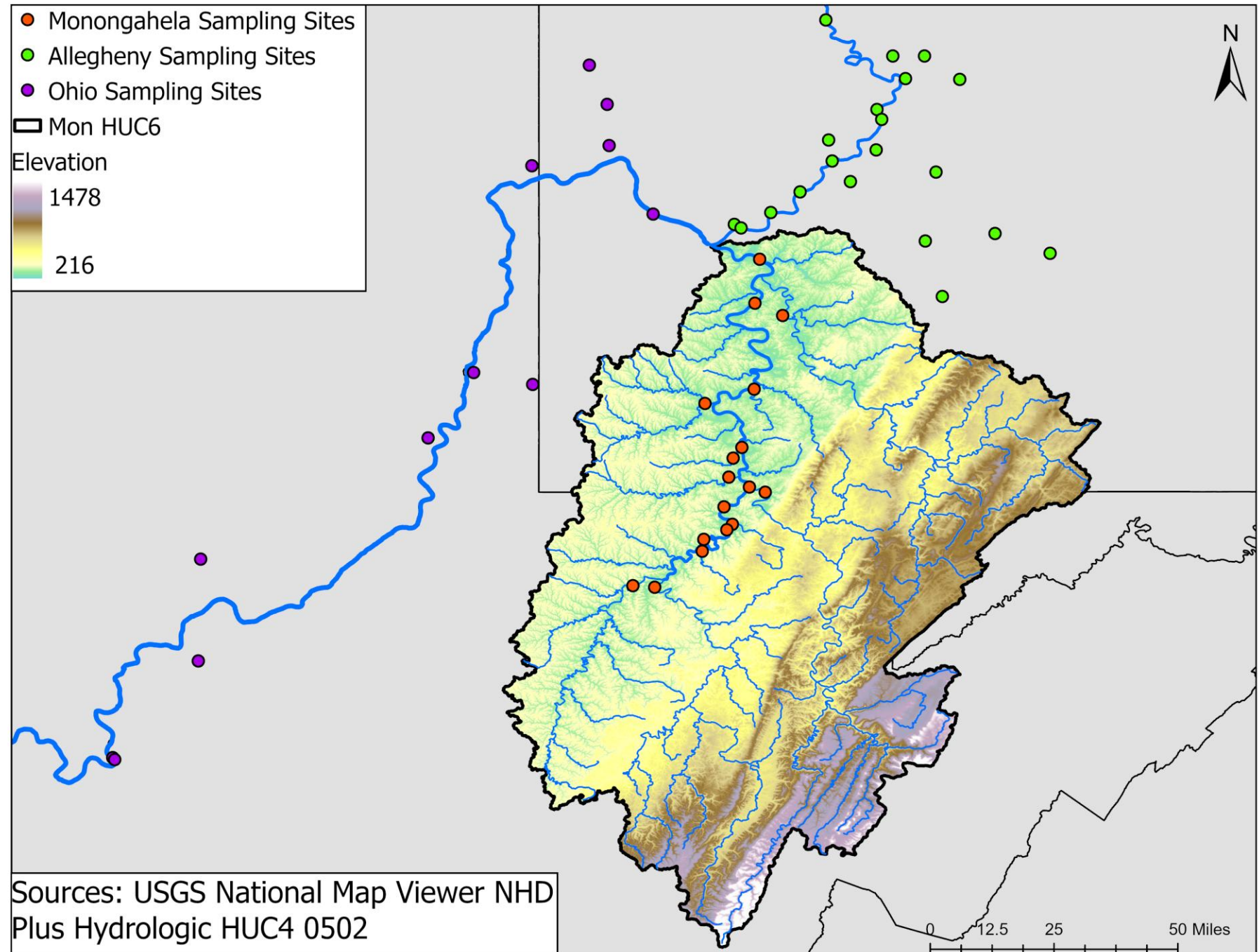
- WVWRI initiated a monitoring program
- Track 12 mainstem sites and 6 tribs
  - water temperature, pH, TDS, and conductivity
  - discharge from a USGS gage (or calc.)
  - Dissolved alkalinity, Aluminum, Barium, Calcium, Iron, Manganese, Magnesium, Sodium, Strontium, Bromide, Chloride, **Sulfate, TDS**

# Dunkard Creek 2009 Fish Kill

- 40,000 fish of 40 different species died
  - Mudpuppies and mussels
- Extent attributed to oil and mining is not precise

# Three Rivers QUEST

- Monitoring continues today
- Includes the Allegheny and Ohio River Basins
  - Duquesne University
  - West Liberty University



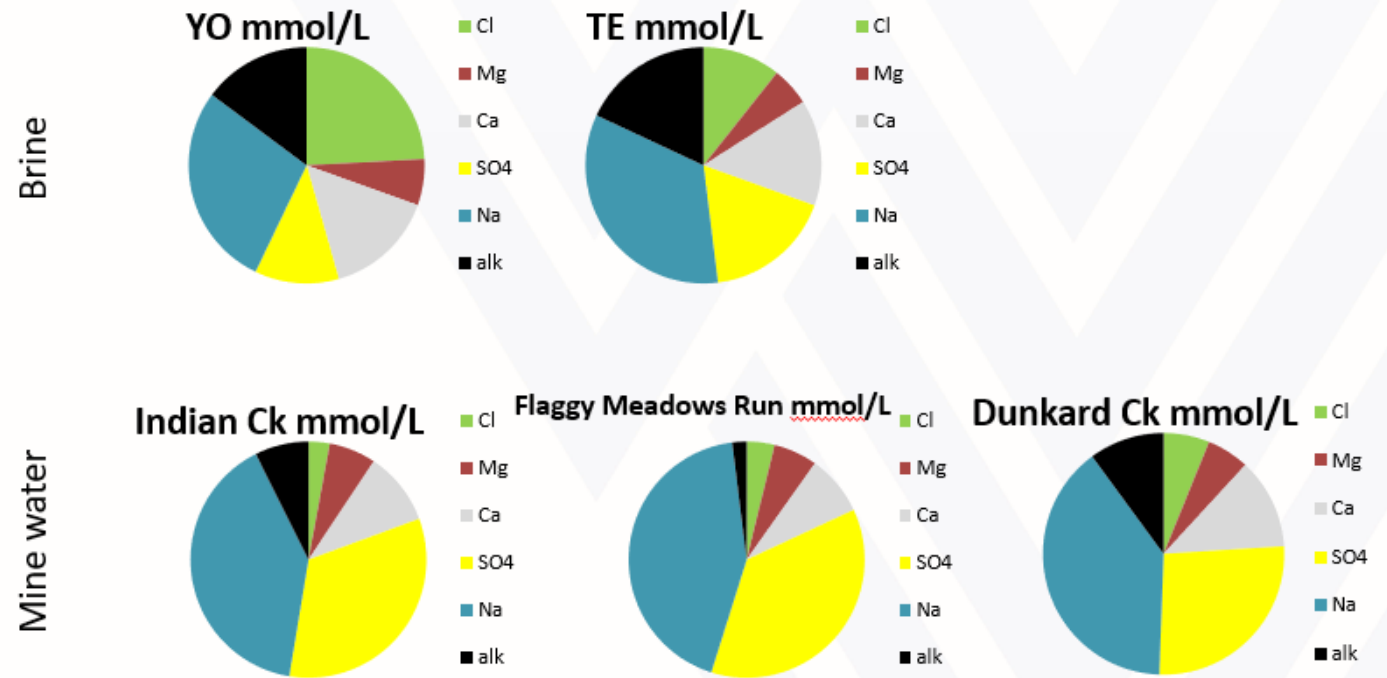
# Understanding the Issue

- Fracking water has a brine signature
  - High in salts:
    - Na, Cl, Ca

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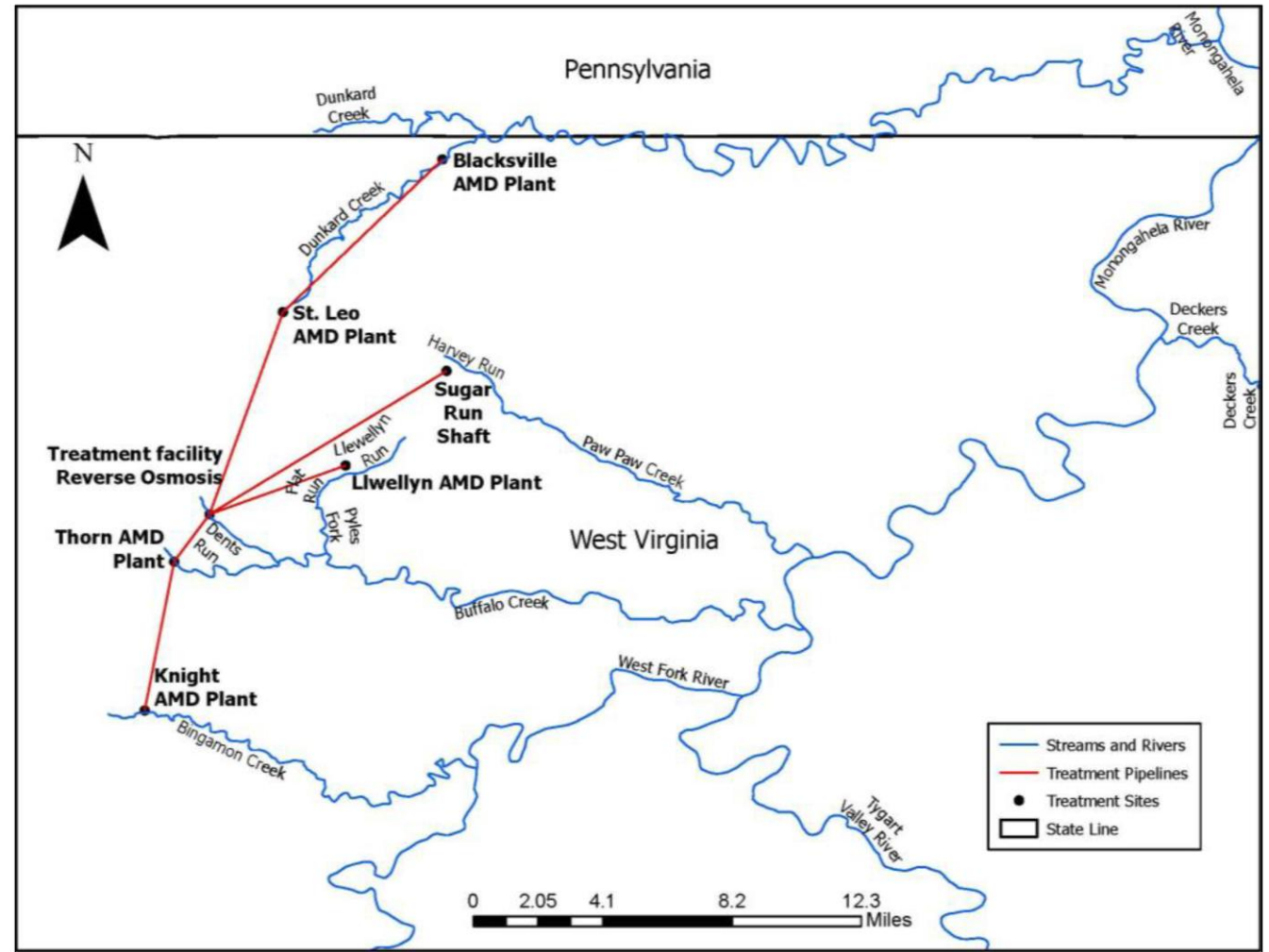
- Mine water has high sulfate content

Brine and Mine Water have different chemical signatures



# Developing Solutions

- Construction of a regional reverse osmosis treatment facility (2013)
  - Consol Energy
- PA prohibition of disposing produced water in publicly owned treatment facilities (2011)
  - State Legislature following public outcry
  - Nationwide ban in 2016



\*This is a schematic map and does not indicate exact locations of pipelines.

# Developing Solutions

- Treated mine water was the cause
  - Rich in calcium, sodium, and sulfate
- Low flows increased the amount per liter
- WVWRI worked with Active Coal companies
  - Voluntary Discharge Management Plan (VDMP) was developed

Voluntary Discharge Management Plan Model Example

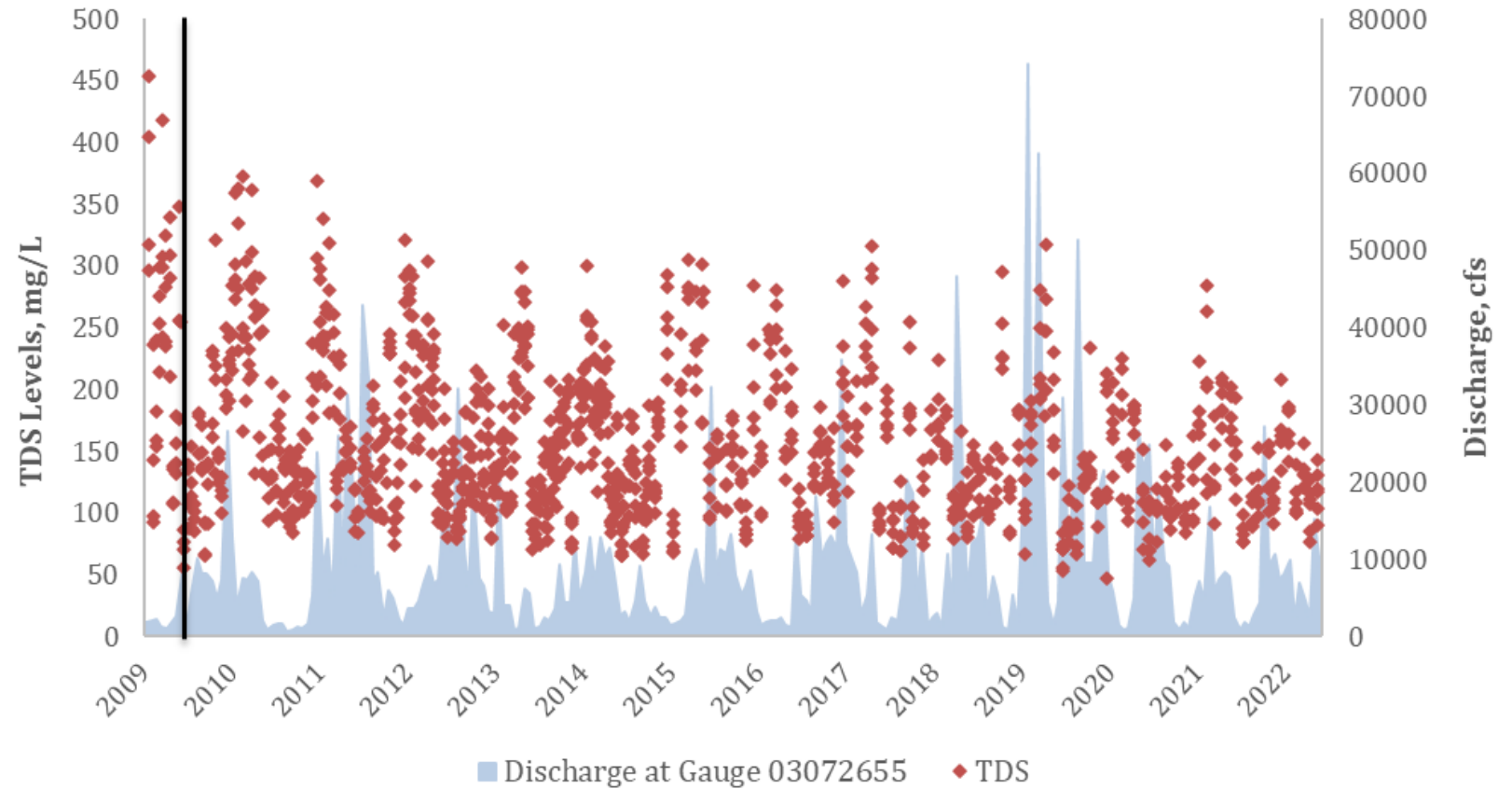
Low Flow Scenario			
INPUT			
Target stream TDS	500 mg/L		
Stream Discharge (Q)	500 cfs		
Factor of Safety	2.0		
OUTPUT			
		Pumping Rate	
AMD Plant		Q (cfs)	Q (gpm)
A		0.7	323
B		0.1	54
C		0.9	387
etc.			

High Flow Scenario			
INPUT			
Target stream TDS	500 mg/L		
Stream Discharge (Q)	3,600 cfs		
Factor of Safety	2.0		
OUTPUT			
		Pumping Rate	
AMD Plant		Q (cfs)	Q (gpm)
A		5.2	2,322
B		0.9	387
C		6.2	2,787
etc.			

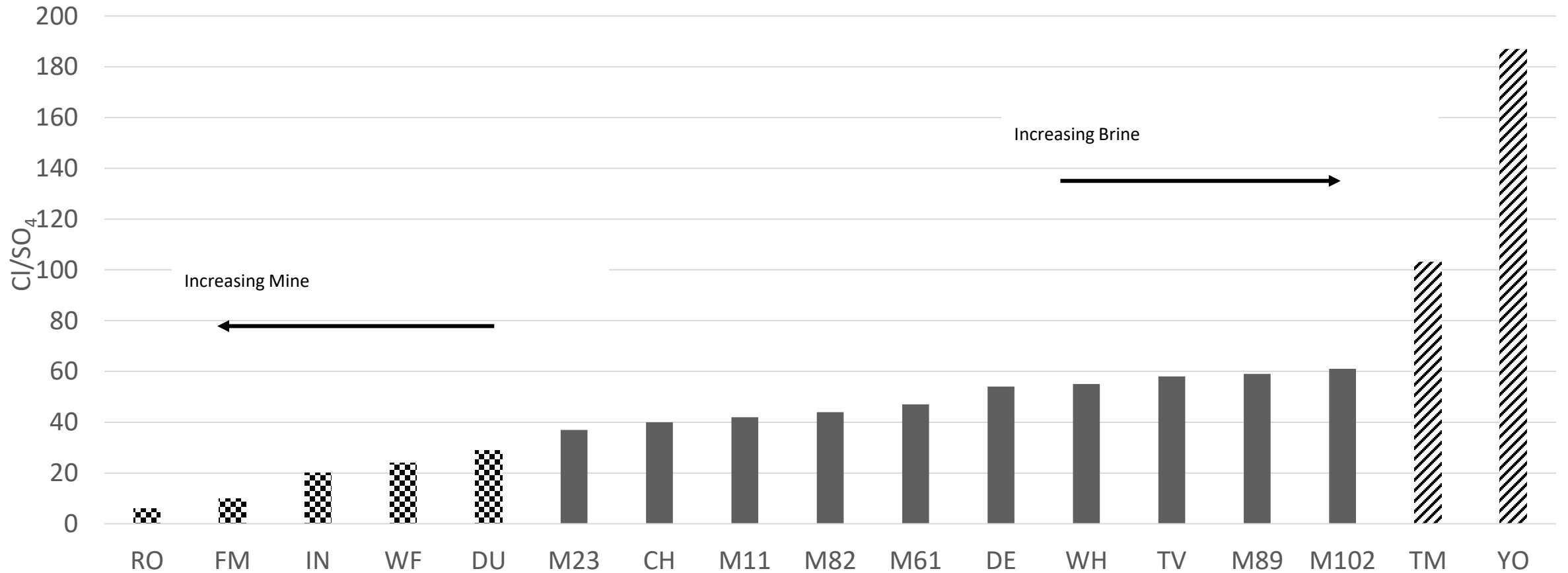
# Results: Mainstem

- TDS and discharge relationship
- TDS displays a long-term decrease
- TDS values have not exceeded the EPA's secondary standard of 500 mg/L

TDS and Discharge Levels in the Monongahela, 2009 to 2022



# Results: Tributaries



# Key Takeaways

- TDS and sulfate in the Monongahela have not exceeded the EPA's secondary standard since 2010
- Numerous groups benefit
  - Drinking water operators
  - Industry with intakes on the river
  - Recreationists
- In 2014, the Mon was removed from the PADEP's impaired list for sulfate
- TDS and sulfate remain highly variable for the Mon tributaries
- Voluntary TMDLs are effective, inexpensive, and rapid remedial actions
- Continued participation of coal industry is key

# Learn More

- [Long-term Water Quality Trends in the Monongahela River Basin](#)
- [Water Publication \(Feb 2023\)](#)
- Explore the Monongahela River StoryMap: [TDS Trends in the Monongahela River Basin: 2009-2022](#)
- [3RQ Mapping Hub](#) – Access to targeted Studies and 3RQ Mapping tool
- We are always looking for watershed groups to work with and support in the Upper Ohio River Basin. Reach out!!



# Acknowledgements

- United States Geological Survey
- Colcom Foundation
- Foundation for PA Watersheds
- Graduate and undergraduate student workers



*Colcom Foundation*



Questions?