
# THREE RIVERS QUEST

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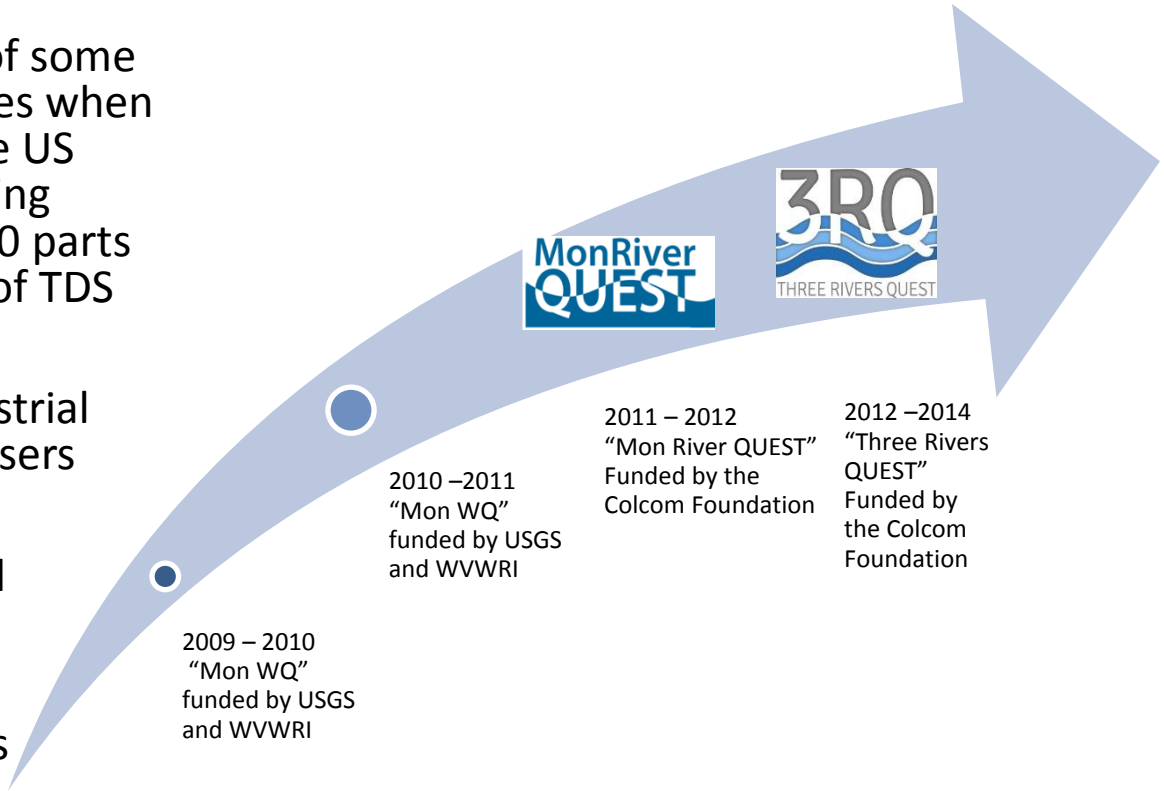
# PROGRAM BACKGROUND

- High TDS events in late summer/early fall 2008
  - Lead to a shut down of some municipal water intakes when the river exceeded the US EPA's secondary drinking water standards of 500 parts per million (or mg/L) of TDS
  - Complaints from industrial and residential river users
  - Dunkard Creek fish kill September 2009
  - Evidence that TDS was increasing

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# Allegheny Monongahela Ohio


## Sub Basins (HUC 8)

- Beaver
- Connoquenessing
- Mahoning
- Shenango
- Upper Ohio
- Upper Ohio-Wheeling
- Clarion
- Conewango
- French
- Middle Allegheny-Tionesta
- Upper Allegheny
- Conemaugh
- Kiskiminetas
- Lower Allegheny
- Middle Allegheny-Redbank
- Cheat
- Lower Monongahela
- Tygart Valley
- Upper Monongahela
- West Fork
- Youghiogheny

## *MONONGAHELA RIVER BASIN*

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## *ALLEGHENY RIVER BASIN (southern)*

DUQUESNE UNIVERSITY

**John Stolz**
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## ALLEGHENY RIVER BASIN (northern)

IRON FURNACE CHAPTER TROUT UNLIMITED

**Bruce Dickson**
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## UPPER OHIO RIVER BASIN

WHEELING JESUIT UNIVERSITY

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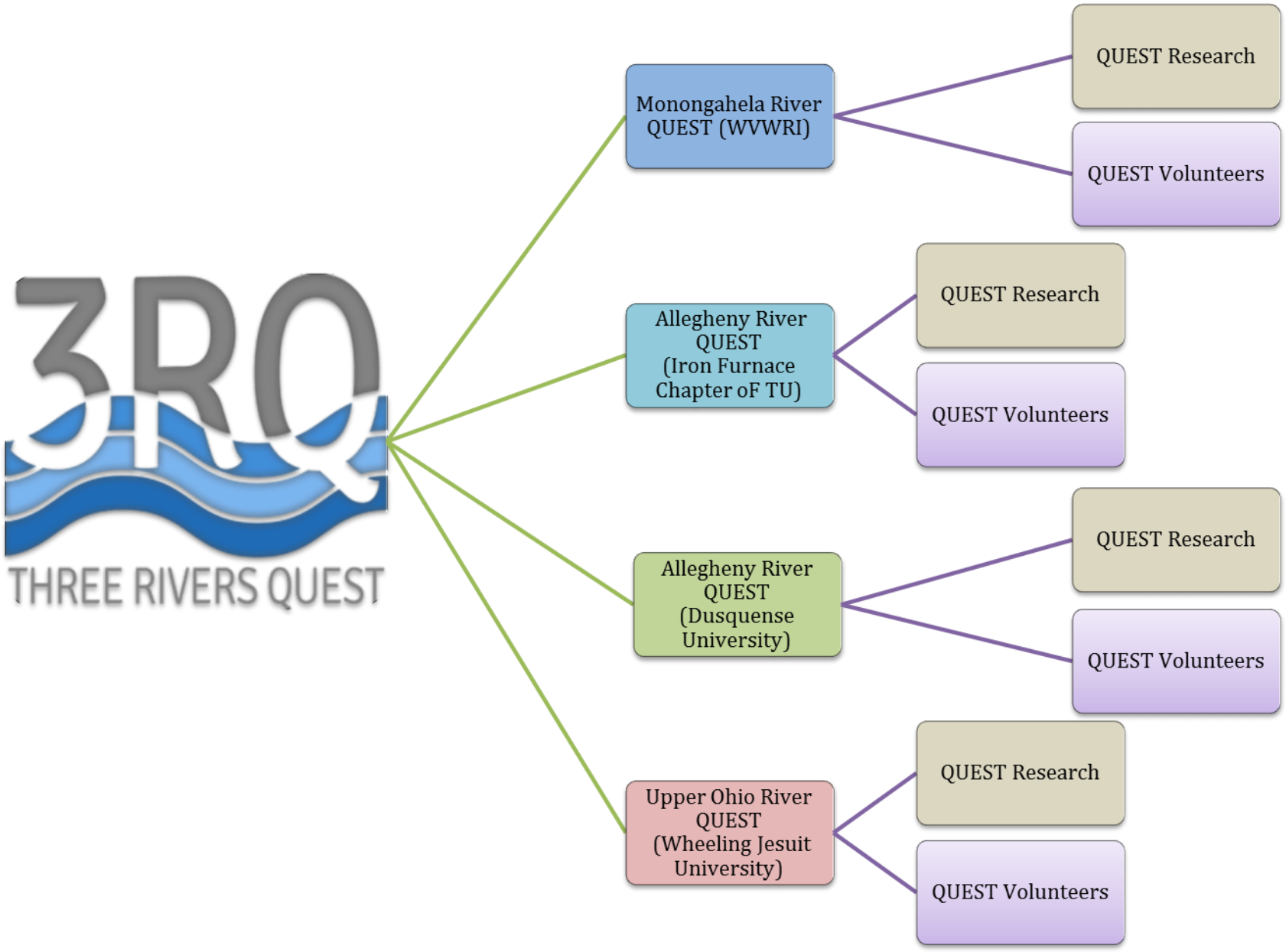
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Monongahela River QUEST (WVWRI)
QUEST Research
QUEST Volunteers
Allegheny River QUEST (Iron Furnace Chapter oF TU)
QUEST Research
QUEST Volunteers
Allegheny River QUEST (Dusquense University)
QUEST Research
QUEST Volunteers
Upper Ohio River QUEST (Wheeling Jesuit University)
QUEST Research
QUEST Volunteers

# Key Water Issue: Dissolved Solids

- Total Dissolved Solids, or TDS, is a general indicator of overall water quality.
- It is a measure of inorganic and organic materials dissolved in water.
- Increased TDS may impart a bad odor or taste to drinking water.
- It also affects residential and industrial users by causing a scaling of pipes and corrosion.

Dissolved Solids of Concern

- Sulfates ($SO_4$)
- Chlorides (Cl)
- Sodium (Na)
- Magnesium (Mg)
- Calcium (Ca)
- Bromide (Br)

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# Primary Sources of Dissolved Solids

- Coal Mine Drainage:
  - Abandoned mines
  - Active mines' - treated effluent
- Sodium/ Calcium Sulfates

- Brine: Gas development
  - Marcellus returned frac water (RFW)
  - Produced water
- Sodium Chlorides (higher chloride to sulfate ratio)

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# Treated AMD vs. Marcellus water

| | USDOE samples 1990's Marcellus Horizon | | Mine drainage | | | |
|---|---|---|---|---|---|---|
| | Central PA | Central WV | | | | |
| interval | ft. PA | ft. WV | A | B | C | $C_{max}$ |
| Cl | 149,000 | 125,200 | 9 | 253 | 97 | |
| Na | 63,400 | 34,200 | 183 | 2,470 | 206 | |
| Ca | 23,600 | 36,800 | 151 | 798 | 244 | |
| Sr | 5,000 | 2,200 | | 6.31 | 0.82 | |
| K | 3,900 | 6,900 | | 24 | 5.68 | |
| Mg | 1,950 | 3,040 | 48 | 202 | 111 | |
| Fe | 1,300 | 580 | 7.1 | 0.21 | 0.14 | |
| Ba | 840 | 200 | | 0.01 | 0.00 | |
| Br | 273 | 480 | 0.02 | 1.87 | 0.62 | 3.2-12.9 |
| SO4 | 0 | 22 | 1,109 | 6,250 | 1,619 | |

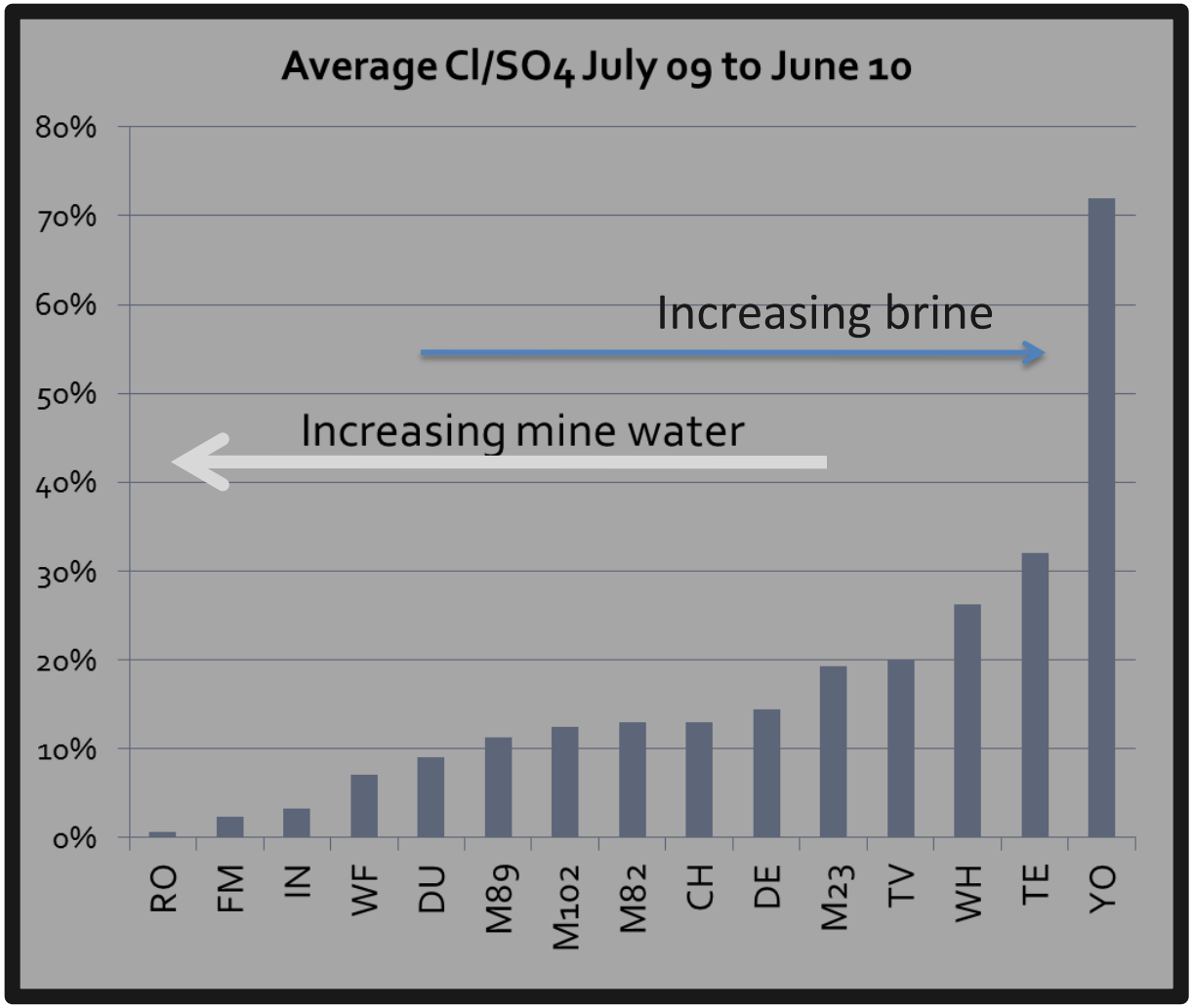
A: recent average of 19 sites

B: Deep Pgh mine treated (1 site)

C: Cravotta data (43 sites)

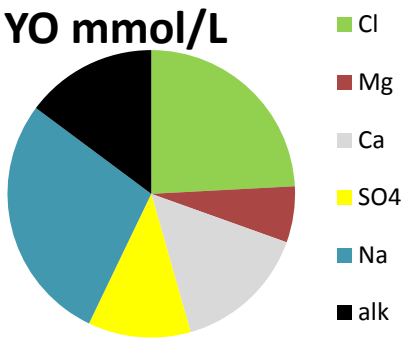
# RFW is predominantly Cl, Na, Ca

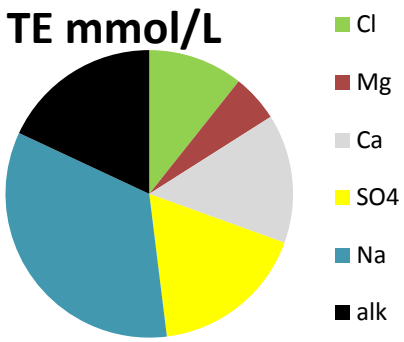
* The ratio to chloride to sulfate ions  looks like a good way to distinguish water from coal mines from frac water.
* Coal mining influence increases to the left
* Frac water influence increases to the right



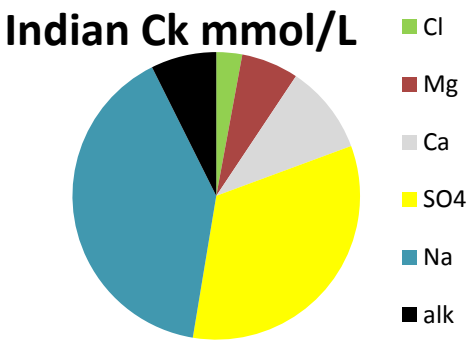
# CBM/Marcellus Brine and Mine Water Have Different chemical signatures

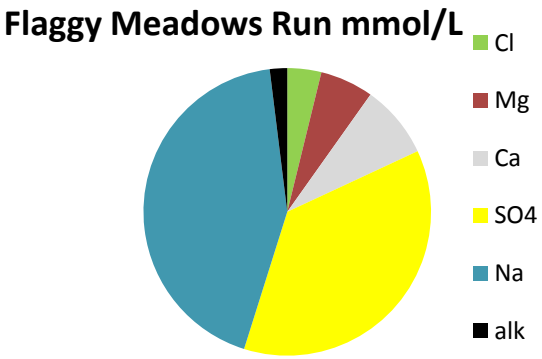
Brine

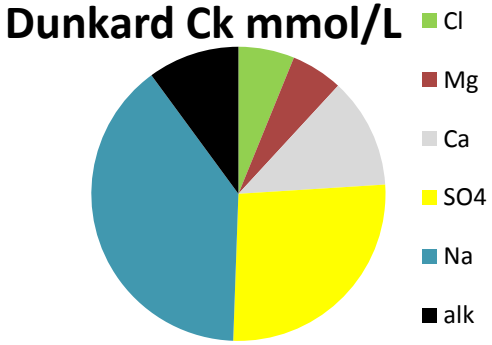



Mine water

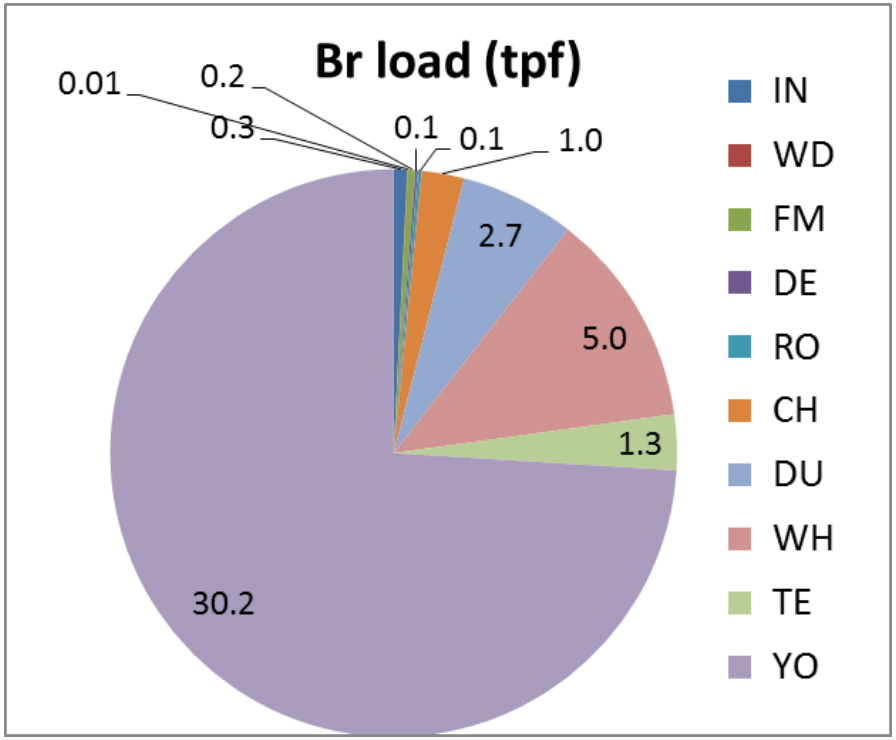


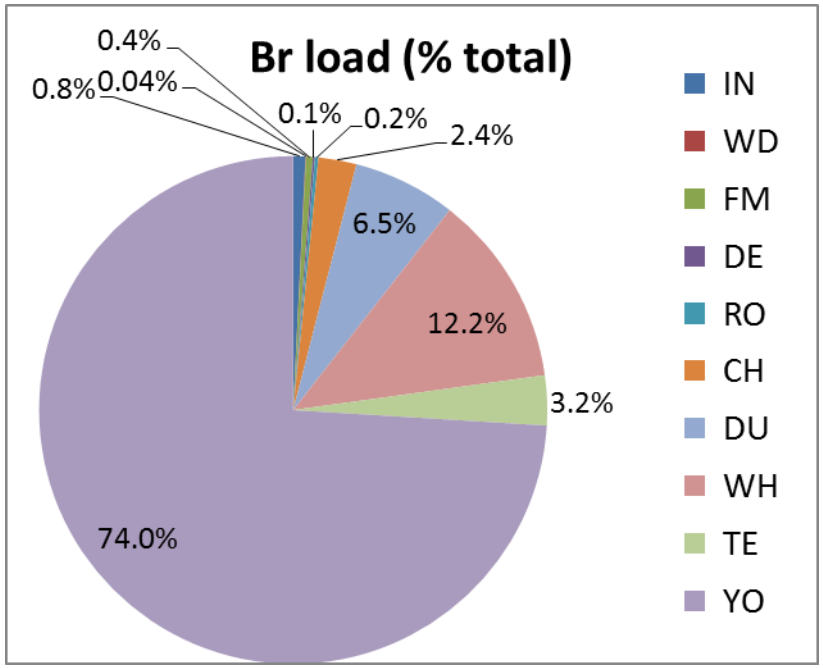



# Tributary Bromide Loads

## Average load

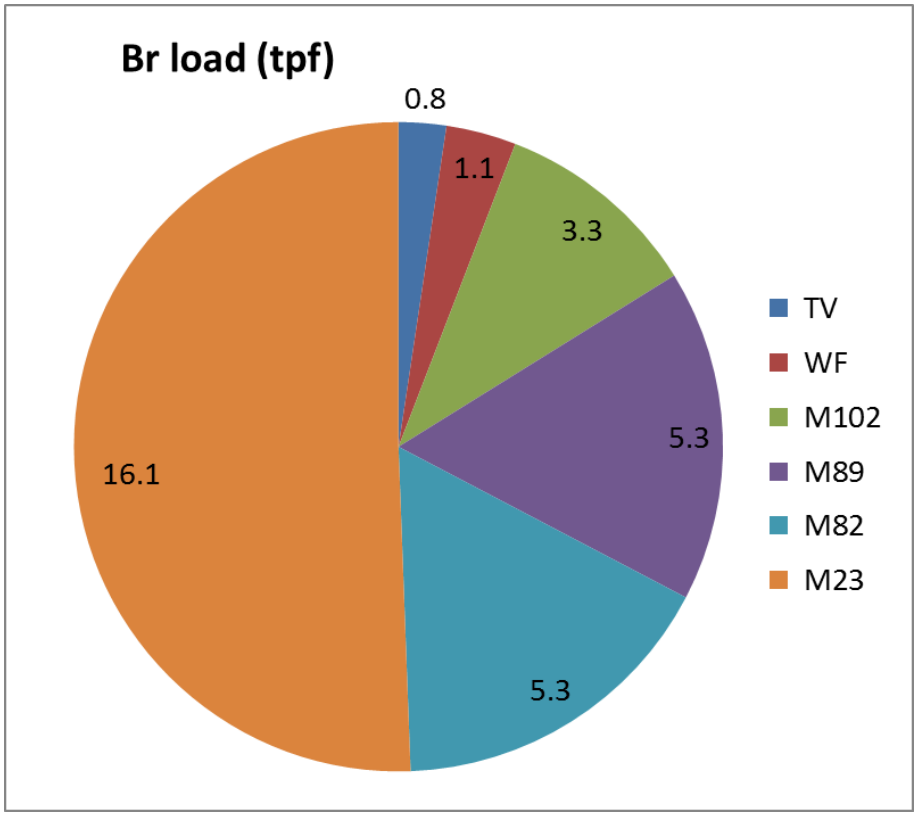



## Proportion of all tribs

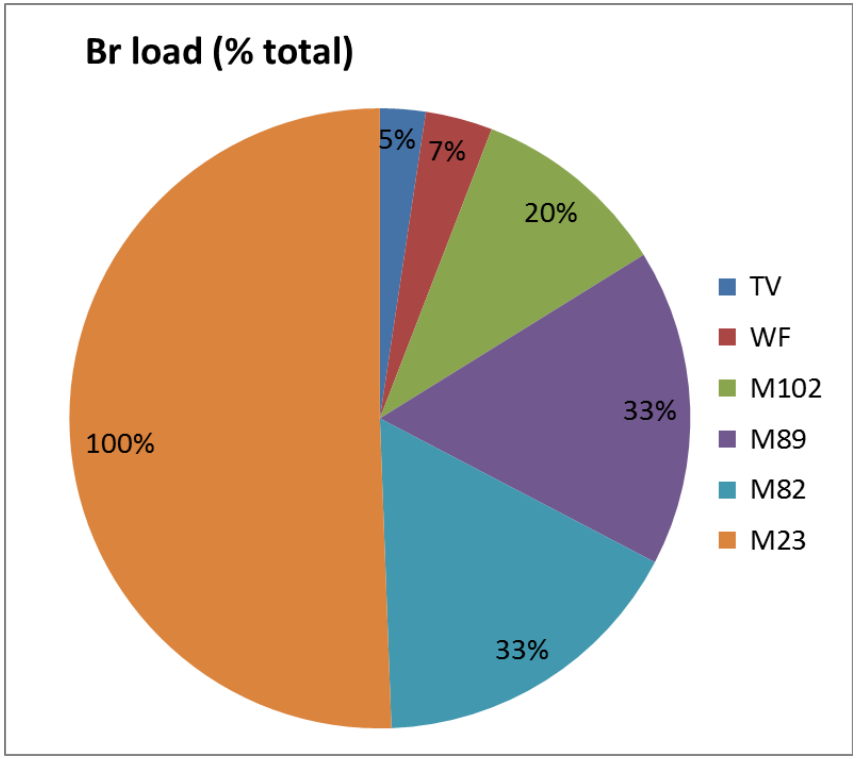


# Cumulative Bromide loads in the Monongahela River

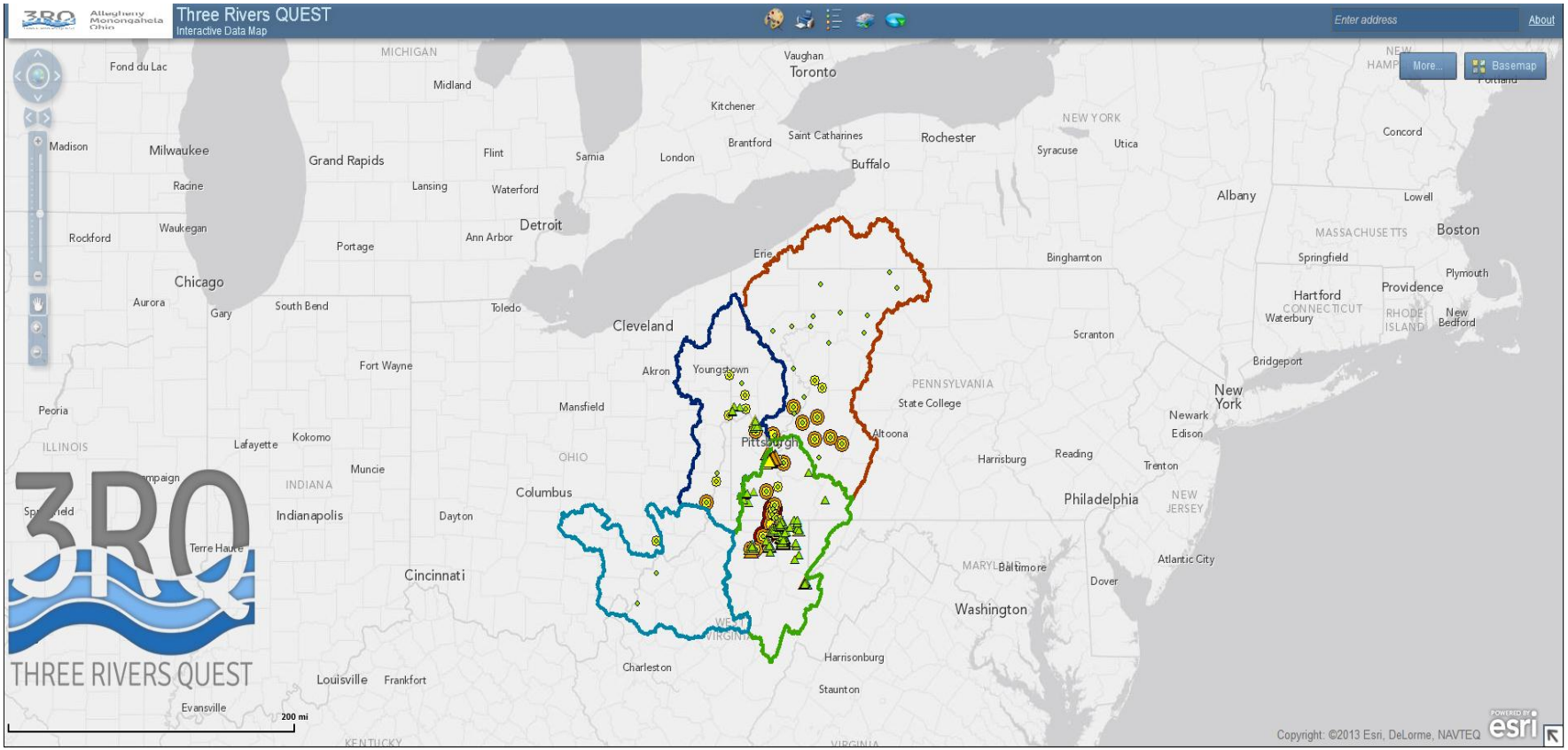
**average load**



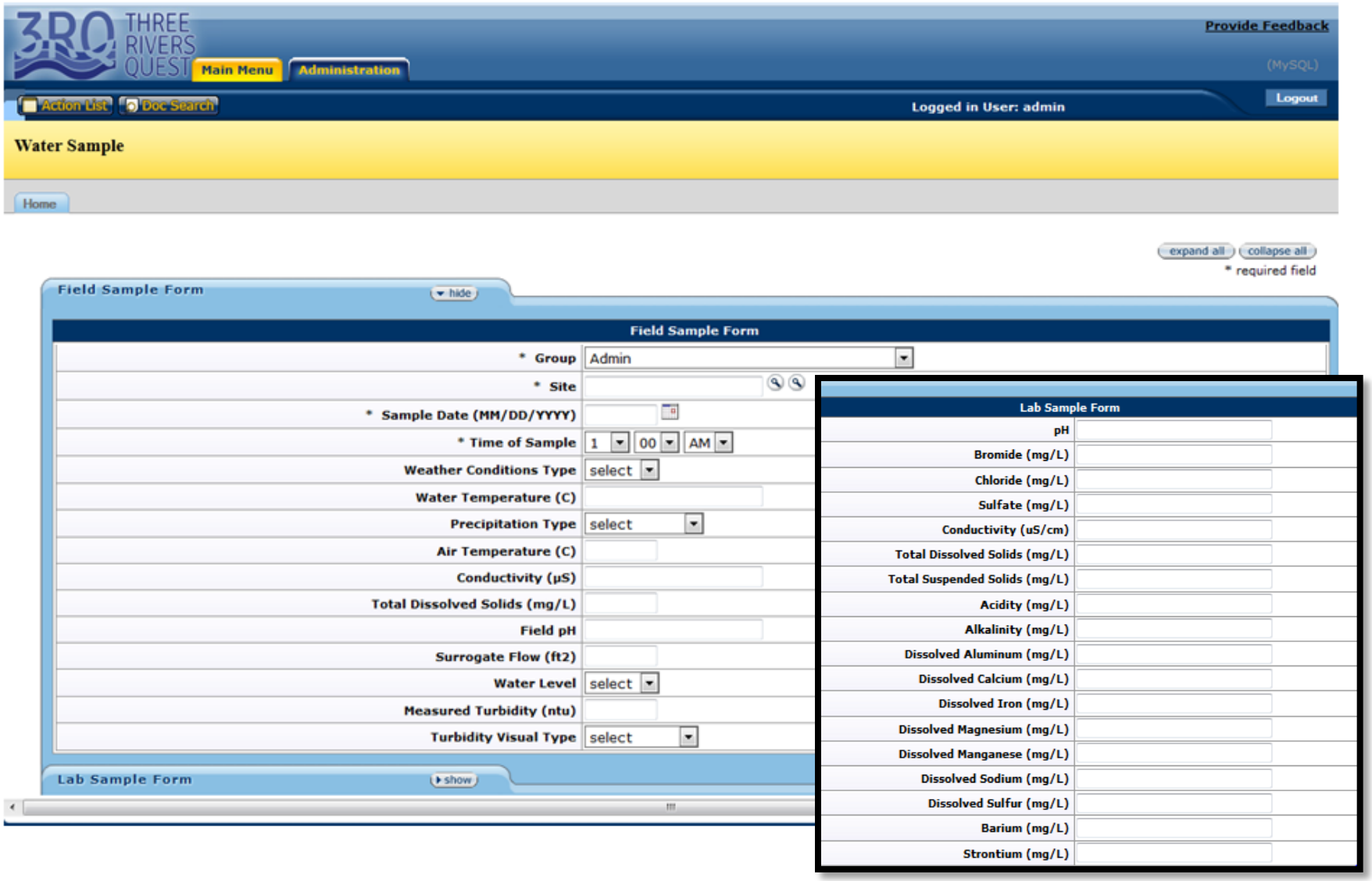

**proportion of all river stations**



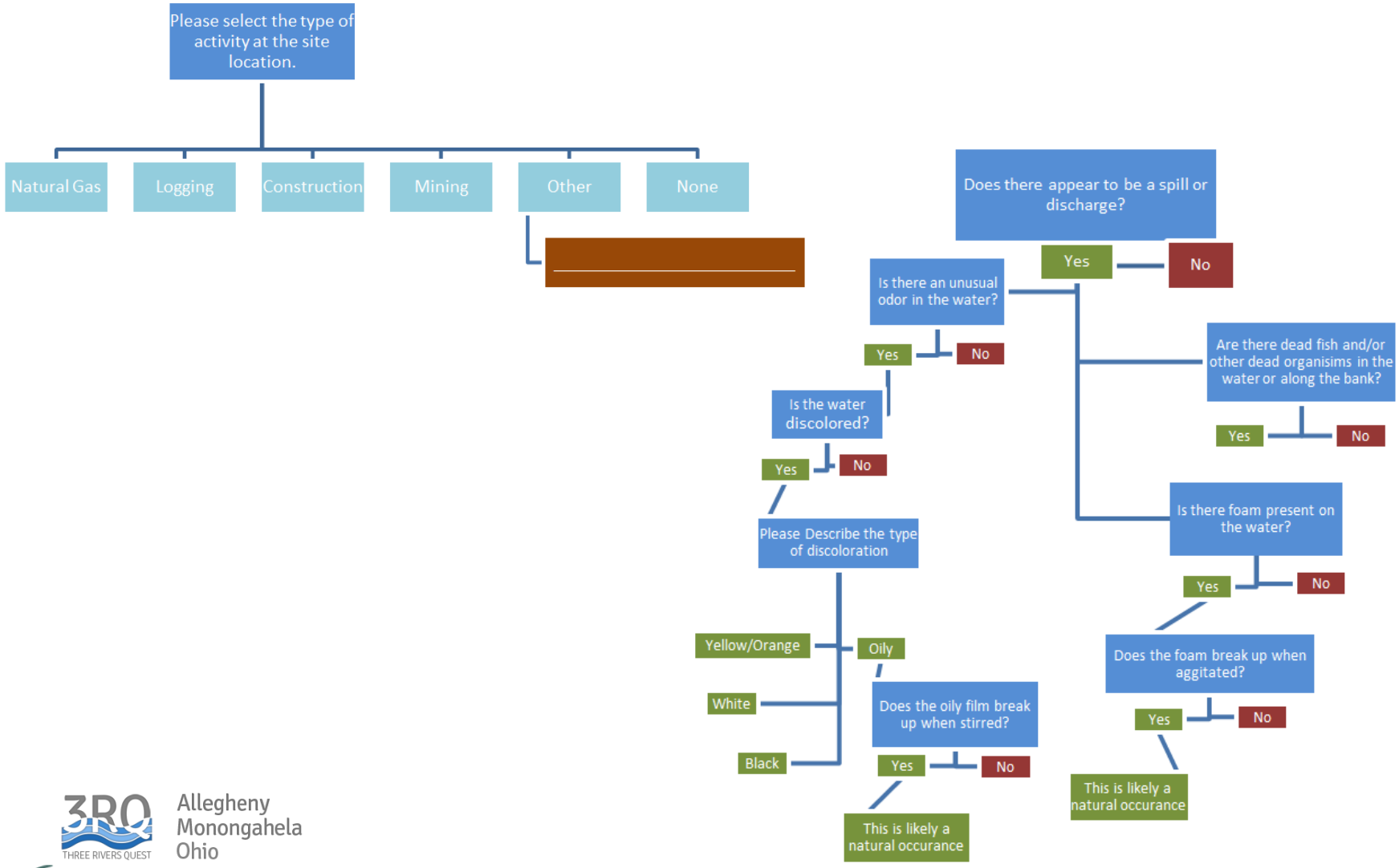
# DATA VISUALIZATION: INTELLIGENT WEB MAPPING



# DATA MANAGEMENT: ONLINE ENTRY



# DATA MANAGEMENT: VISUAL ASSESSMENT

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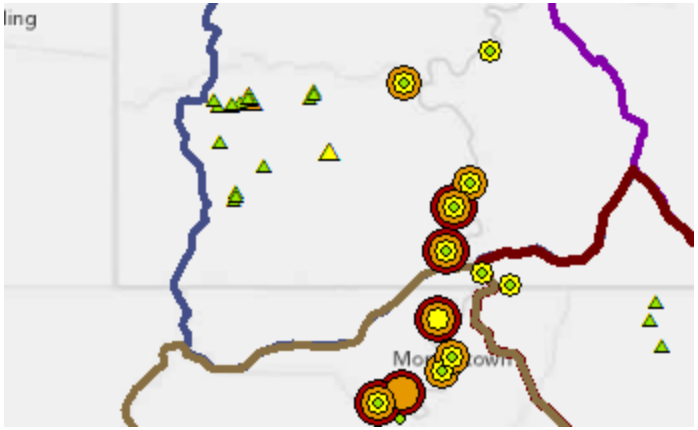
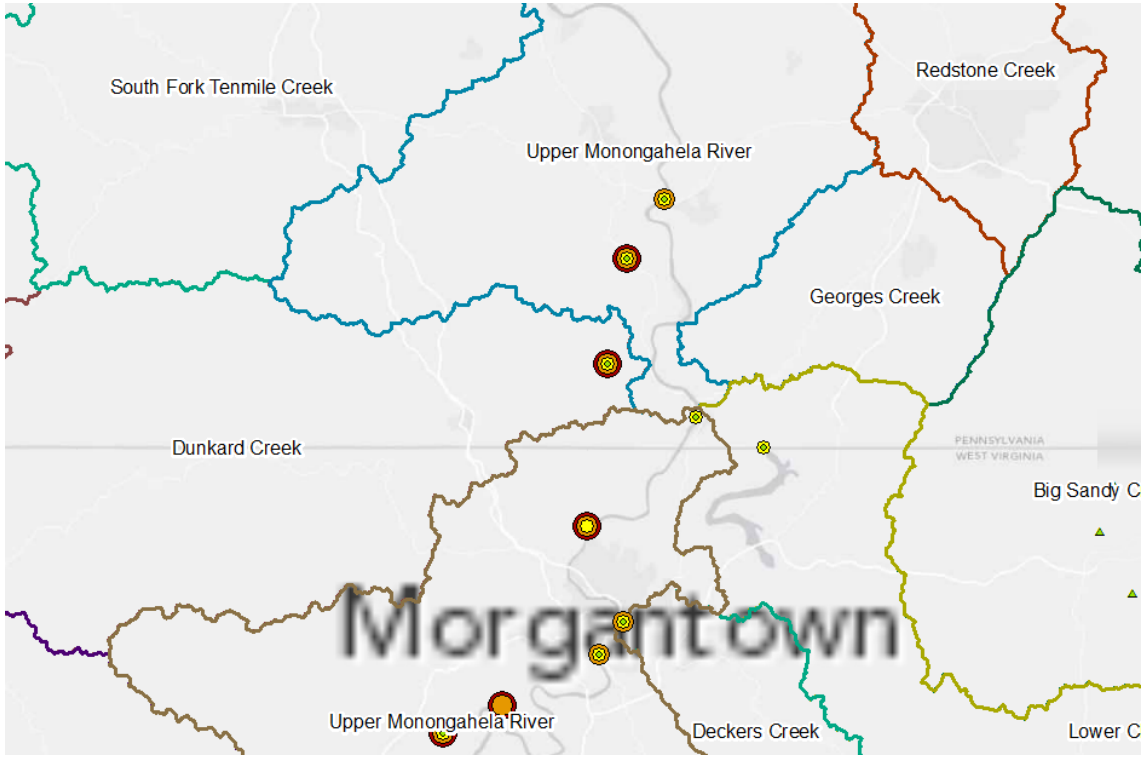
# DATA VISUALIZATION: Security



- Volunteer sites (triangles) disappear when zoomed in.
- Coordinates are not displayed.

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# PARTICIPATING 3RQ GROUPS

Captina Conservancy
Conemaugh-Kiski Stream Team
Crawford County Conservation District
Greene County Izaak Walton League
Greene County Watershed Alliance (multiple groups)
Elk County Conservation District
Friends of Cheat
Friends of the Blackwater
Friends of Deckers Creek
Friends of Deep Creek Lake
Friends of the Hughes
Friends of the Tygart
Guardians of the West Fork
McKean County Conservation District
Mountain Watershed Association
Peters Creek Watershed Association
Pittsburgh Botanical Society
Washington County Watershed Alliance (multiple groups)
Warren County Conservation District
Whiteday Creek Watershed Association
Trout Unlimited (multiple chapters)
Youghiogheny River Watershed Association

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# QUESTIONS?


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