WISCONSIN DEPARTMENT OF NATURAL RESOURCES

Statewide Surface Water PFAS and Black Earth Creek

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Today's Talk:

- What is PFAS?
- Statewide surface water PFAS results
  - Putting concentrations in context
- Black Earth Creek Water Results
- What we know about PFAS in Fish
- Black Earth Creek Fish Results vs Expected
- Conclusions and Lake Monona PFAS Project

PFAS Applications:

Photo: saferchemicals.org

Photo: papermart.com

Photo: woodard247.com

Photo: NYTimes.com

Photo: usa.fema.gov

Photo: industrialcoat.com

Photo: pchrome.com

Photo: fraufowler.com

Photo: toxifreefuture.org

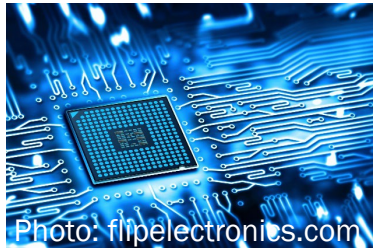

Photo: flipelectronics.com

Photo: sciencefocus.com

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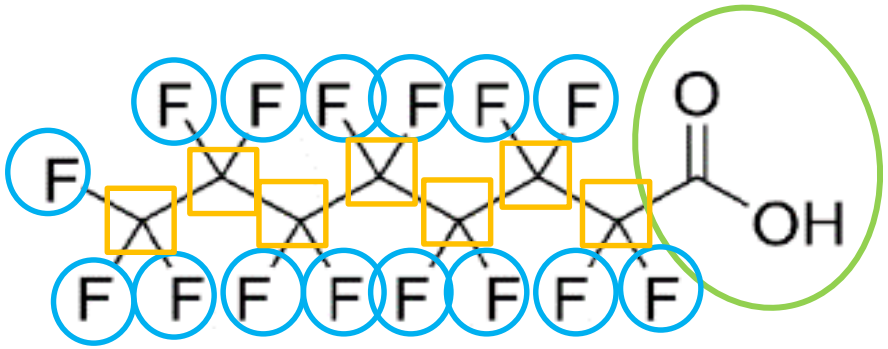
PFAS primer

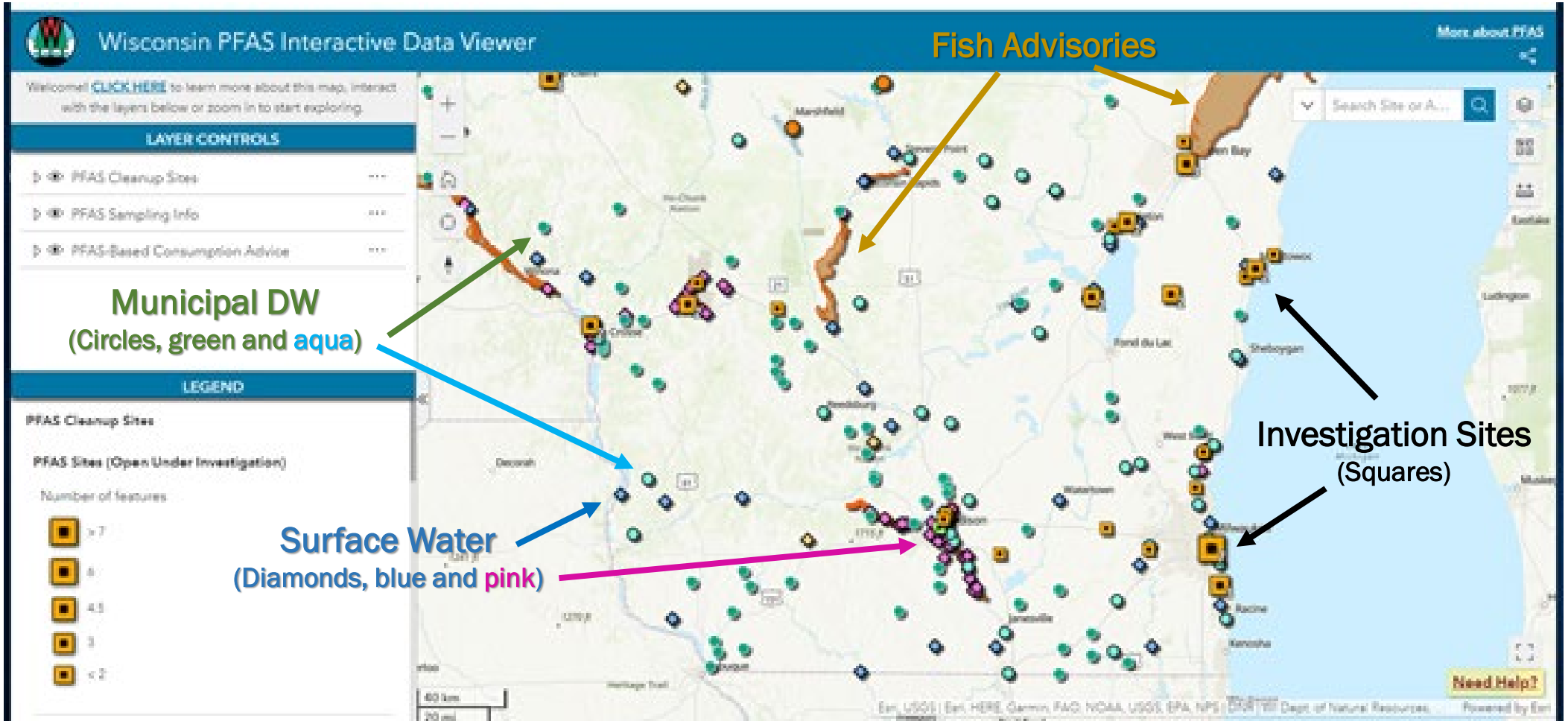
- **PFAS** = **Per-** and **Poly**-Fluorinated Alkyl Substances
  - Man-made organic compounds (>5000 known)
  - Chain of C atoms with multiple F attached (difficult to break C-F bond)
  - The fluorinated carbon chain (tail) attached to functional group (head)
- **Carboxylic Acids** (PFCAs), CO_2^- "Head"
  - **PFOA** (n=8 Carbons)
- **Sulfonic Acids** (PFSAs), SO_3^- "Head"
  - **PFOS** (n=8 Carbons)
- **Most toxicity data on PFOA and PFOS; PFOS bio-accumates**
- **Carboxylic and sulfonic acids can vary from C=4 to C=12 or more**
- **Other Compounds**, e.g., Fluorotelemers and Perfluoroalkane sulfonamide substances currently being assessed.

PFOA:



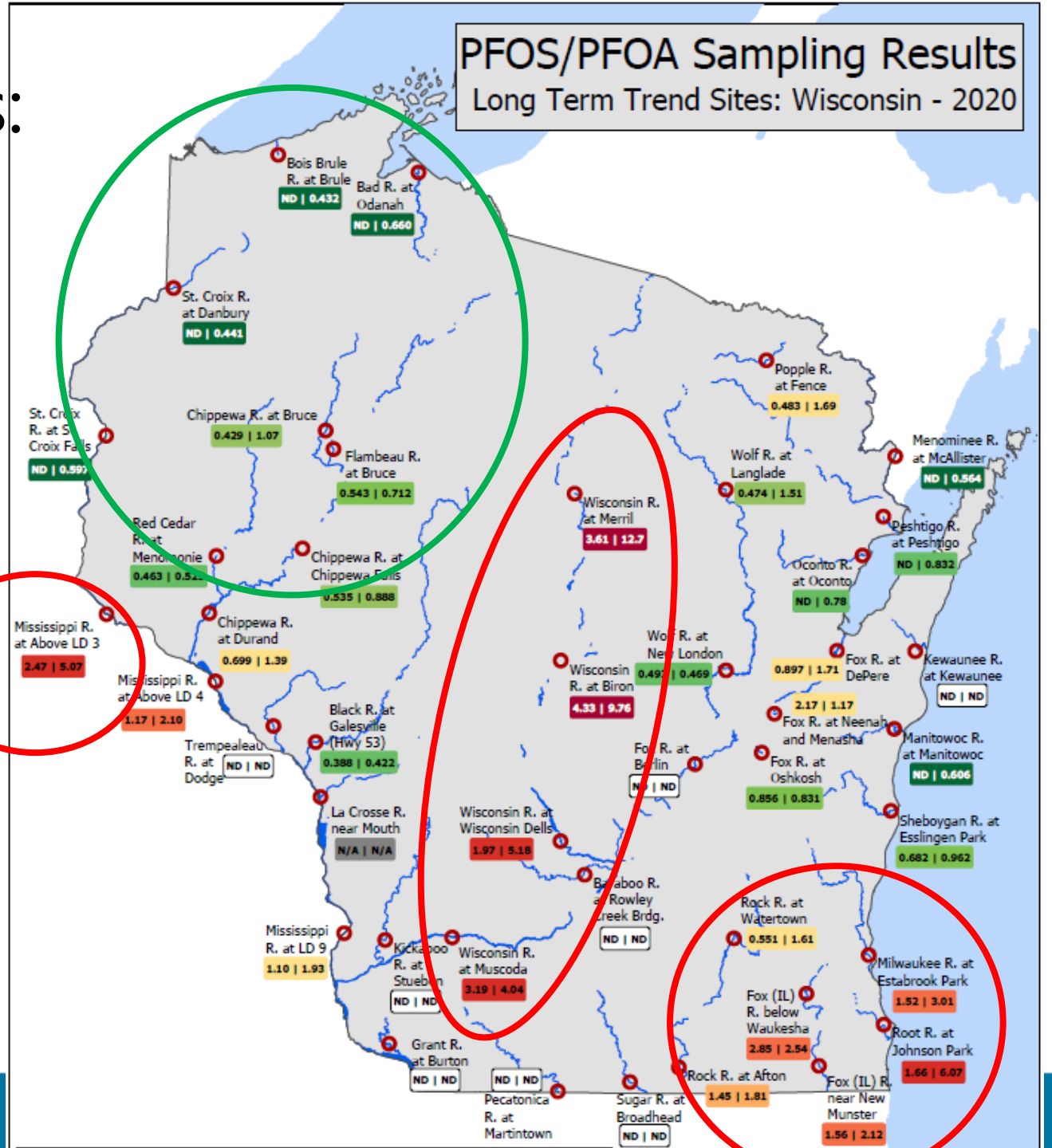
WDNR PFAS Interactive Data Viewer, new 10/22

https://dnr.wisconsin.gov/topic/PFAS/DataViewer



Long Term Trends Results:

- **Sampled 43 LTT river sites state-wide:**
  - Covers 80% of the watersheds in state
  - Major representative geographic regions
- **PFOS and PFOA often non-detectable (ND)**
  - 37% PFOS = ND
  - 19% PFOA = ND
- **When detectable:**
  - PFOS < 5.0 ng/L, Avg =1.4 ng/L
  - PFOA < 10 ng/L, Avg = 2.2 ng/L
- **Higher** relative **PFAS** concentrations were in the **Wisconsin and Mississippi Rivers and** the **Southeastern** part of the state
- **Northwestern rivers** were relatively **lower, or non-detectable.**

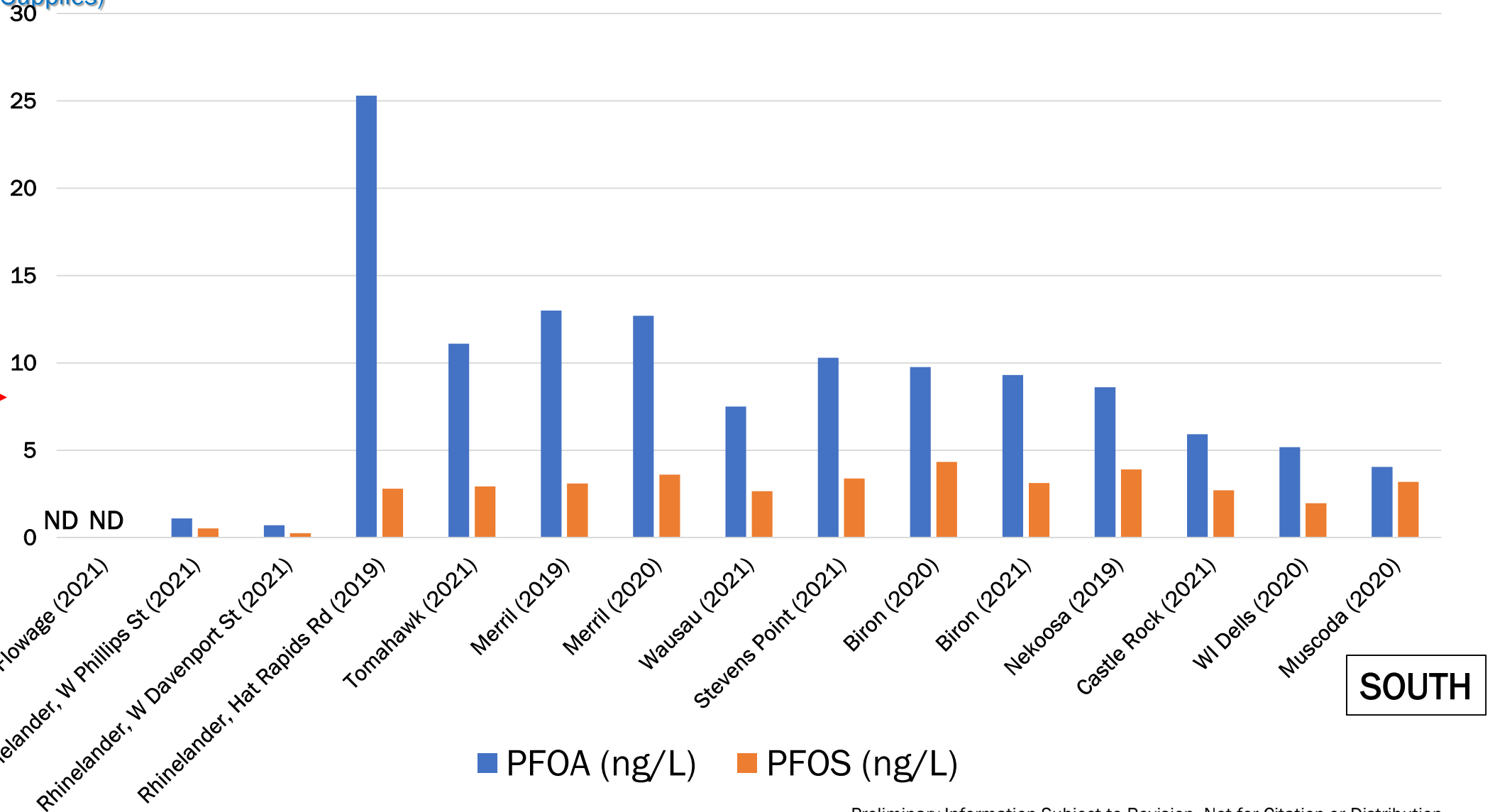


Wisconsin River PFAS SW Results: 2019-2021

PFOA = 95 ng/L →
(20 ng/L for Public Water Supplies)

Surface Water Standards

PFOS = 8 ng/L →

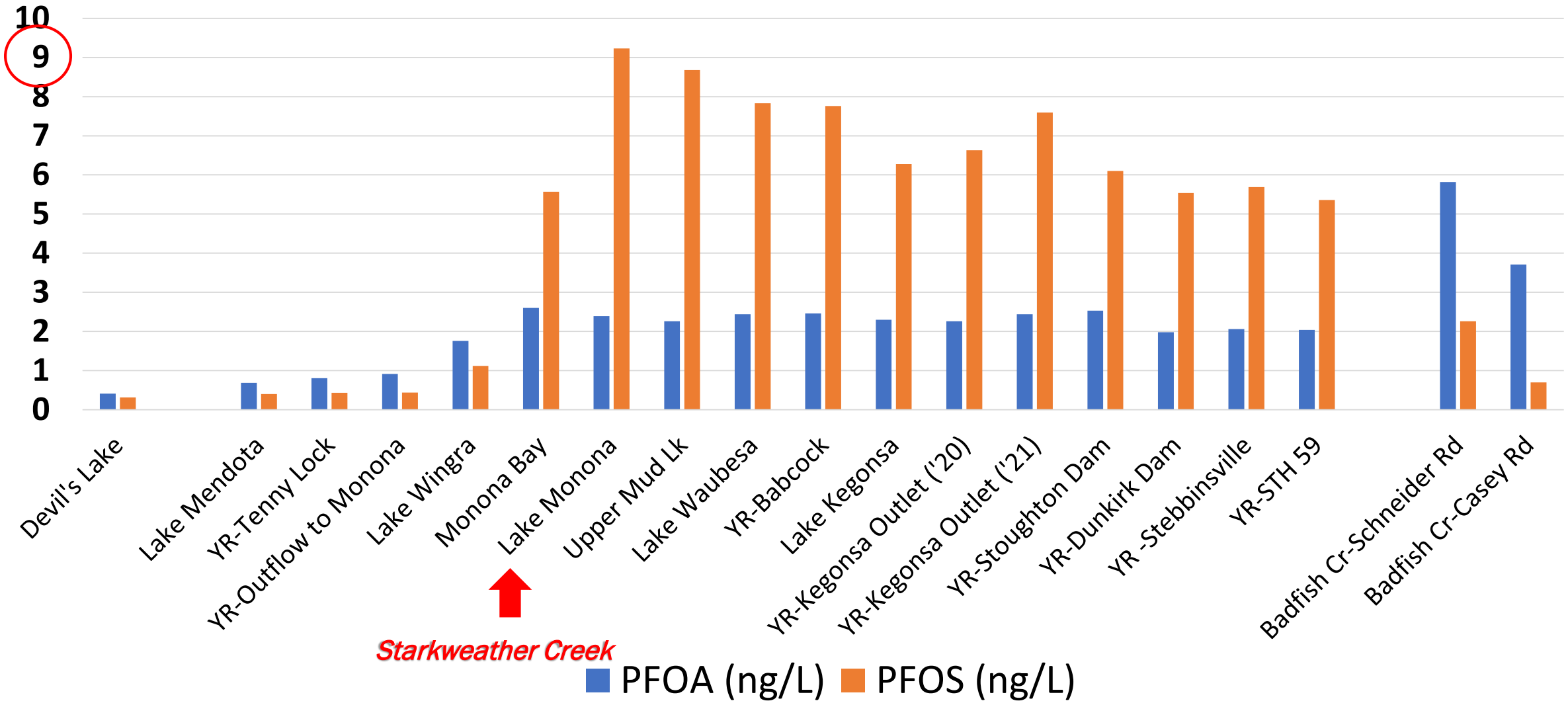


NORTH

SOUTH

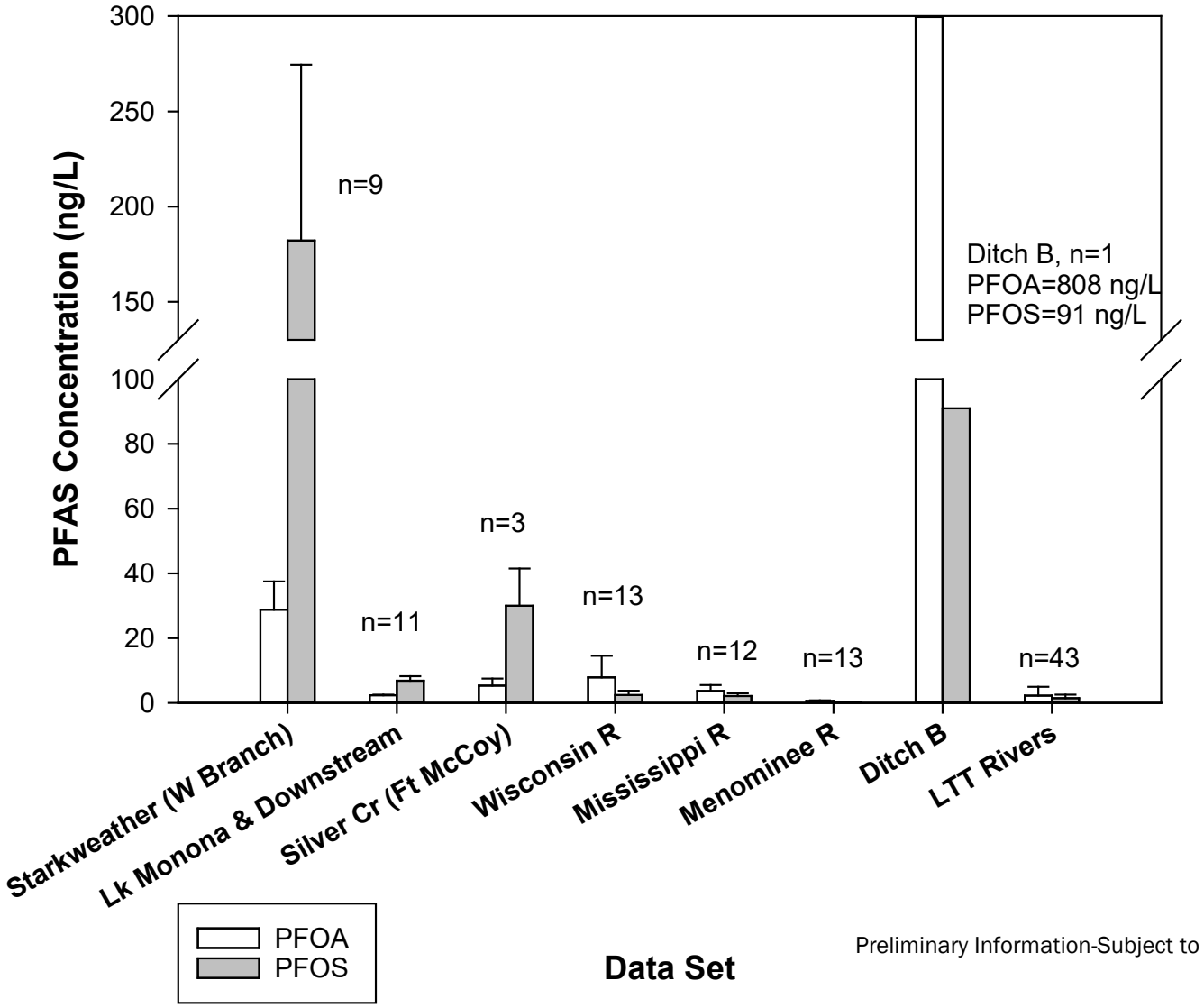
Preliminary Information-Subject to Revision. Not for Citation or Distribution.

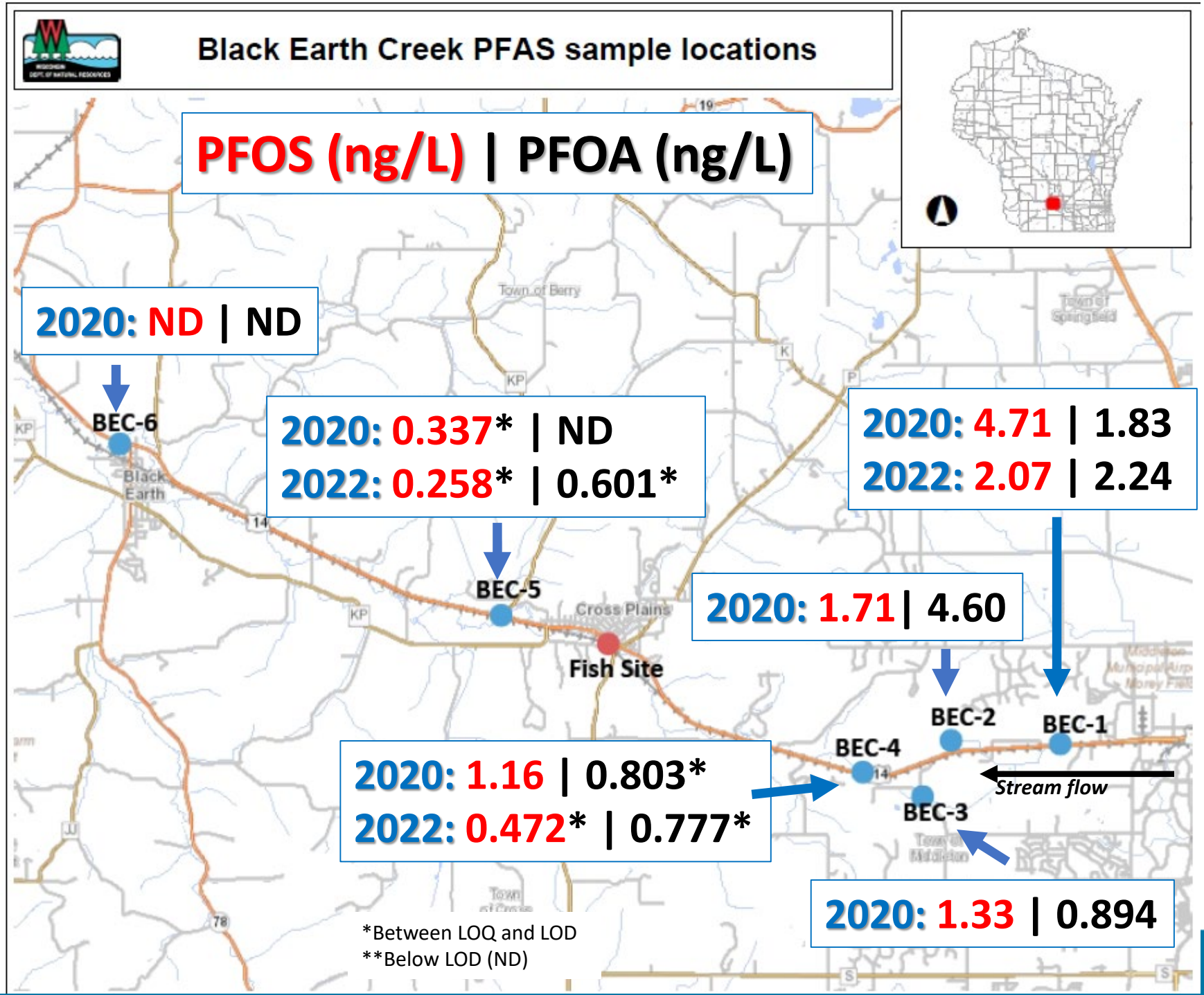
PFAS Results for Madison Lakes, Yahara River (YR) and Badfish Creek



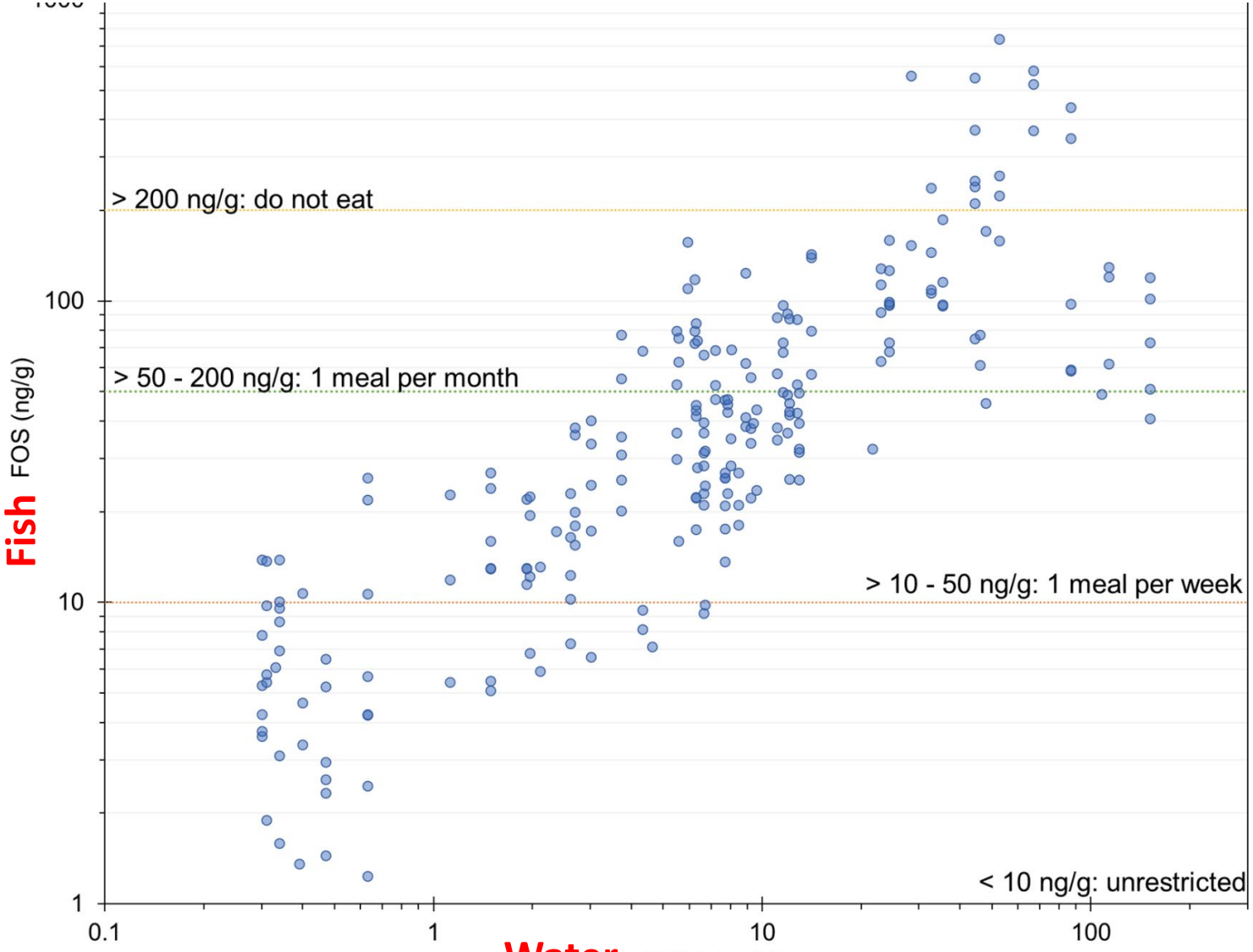
Preliminary Information-Subject to Revision. Not for Citation or Distribution.

2019-2022 PFAS Surface Water Results

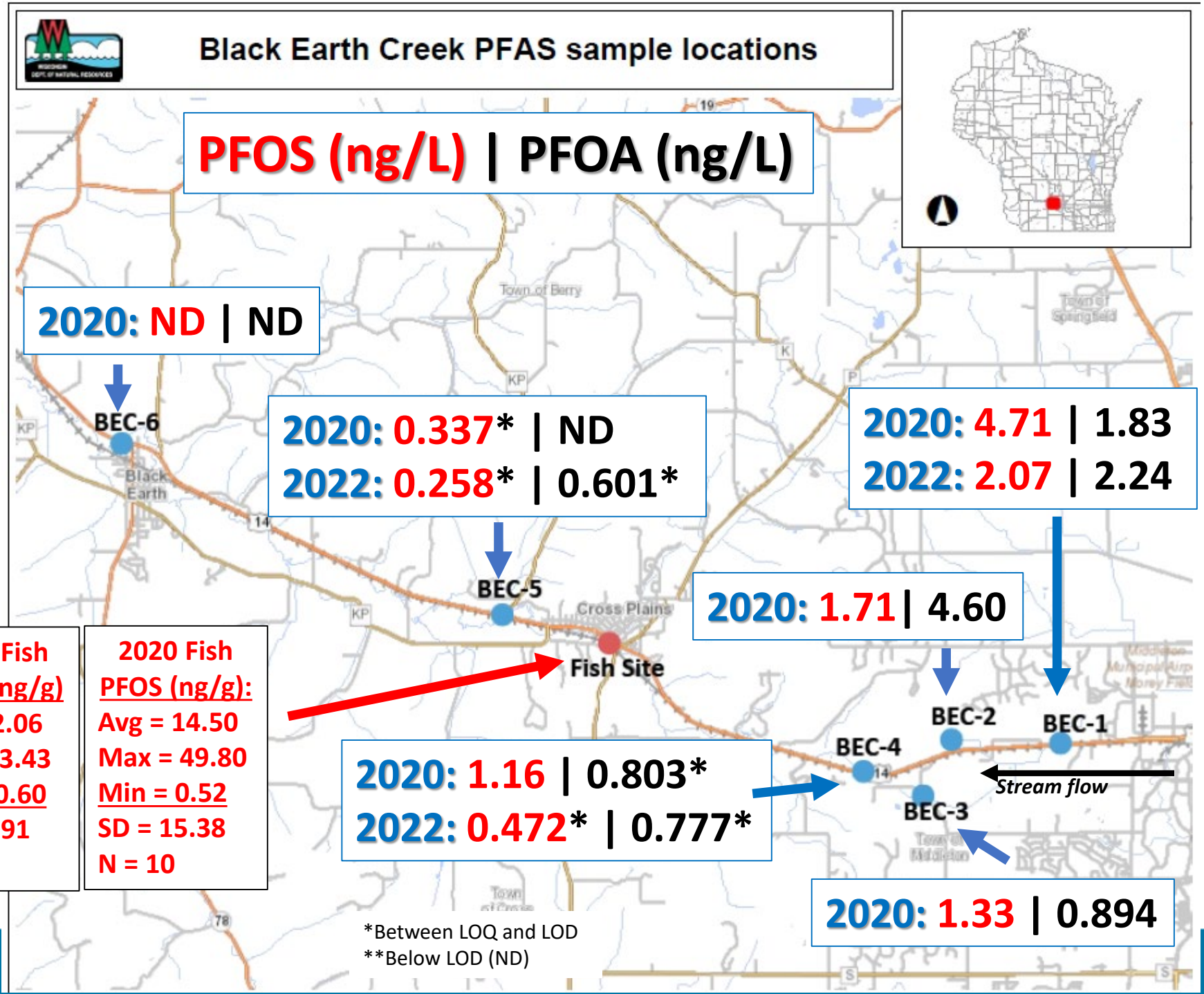



Black Earth Creek PFAS sample locations
PFOS (ng/L) | PFOA (ng/L)
2020: ND | ND
BEC-6
2020: 0.337* | ND
2022: 0.258* | 0.601*
BEC-5
Fish Site
2020: 4.71 | 1.83
2022: 2.07 | 2.24
2020: 1.71 | 4.60
BEC-2
BEC-1
BEC-4
Stream flow
2020: 1.16 | 0.803*
2022: 0.472* | 0.777*
BEC-3
2020: 1.33 | 0.894
*Between LOQ and LOD
**Below LOD (ND)

Correlation between PFOS in Water and Fish



Williams et al., unpublished WI and MN data

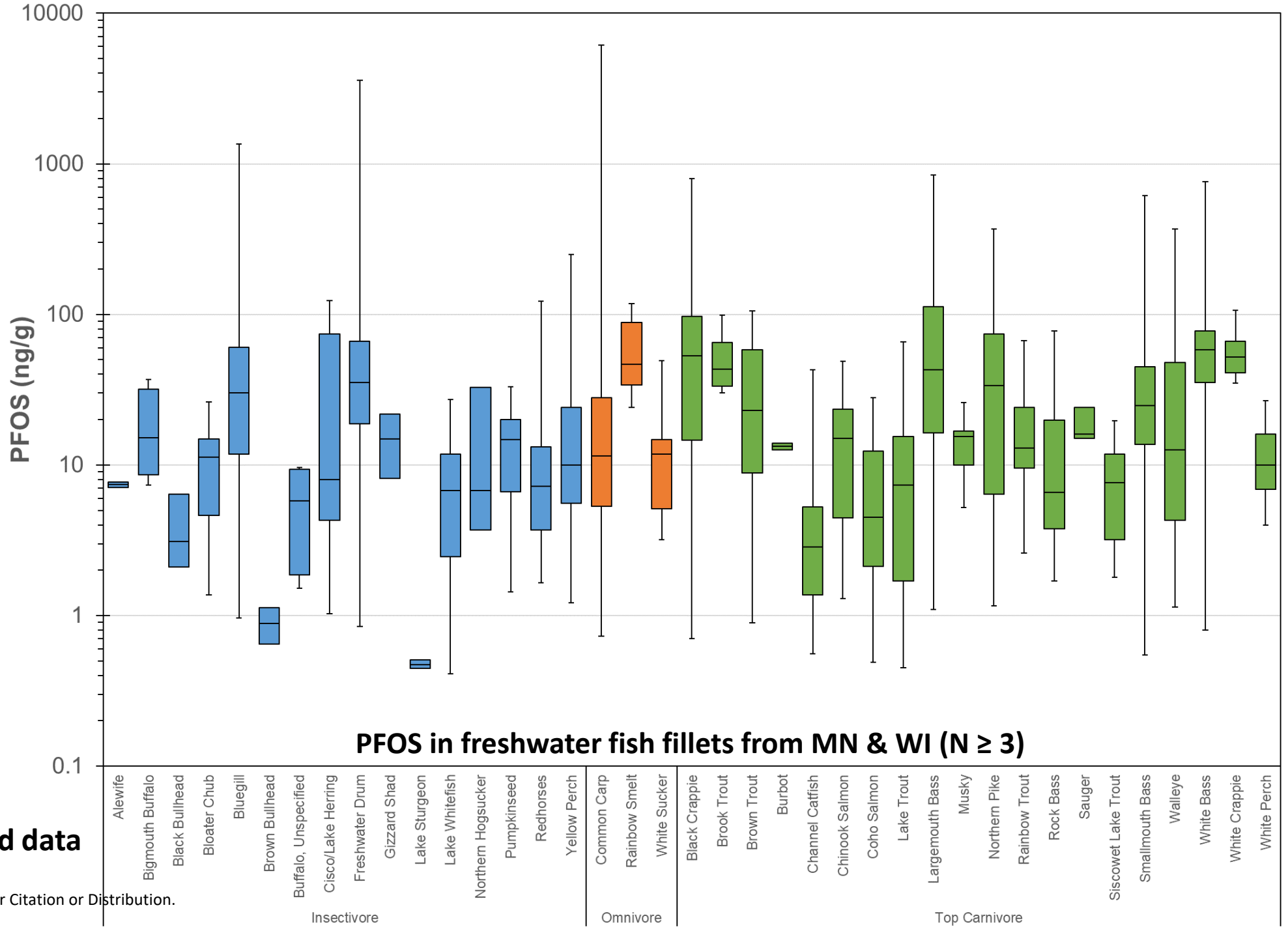


2022 Fish ???

2021 Fish PFOS (ng/g)
Avg = 2.06
Max = 3.43
Min = 0.60
SD = 0.91
N = 10

2020 Fish PFOS (ng/g):
Avg = 14.50
Max = 49.80
Min = 0.52
SD = 15.38
N = 10

PFOS accumulation in fish species is often unpredictable



Williams et al., unpublished data

Conclusions:

- Compared to statewide PFAS surface water concentrations, BEC is relatively very low, particularly in Cross Plains and Black Earth.
- All BEC PFOS and PFOA are lower than Surface Water Standards.
- Based on water concentrations at Cross Plains (fish collection site), we would not expect fish advisories.
- 2020 Fish Concentrations:
  - High variability and average > 10 ng/g
  - Lowest tier advisory (1 meal/week) was issued to be protective of Human Health.
  - 2021 Fish Concentrations were consistent and lower than advisory.
- 2022: Fish have been sampled and submitted for analysis.

Lake Monona PFAS Partitioning and Distribution

Why Lake Monona?

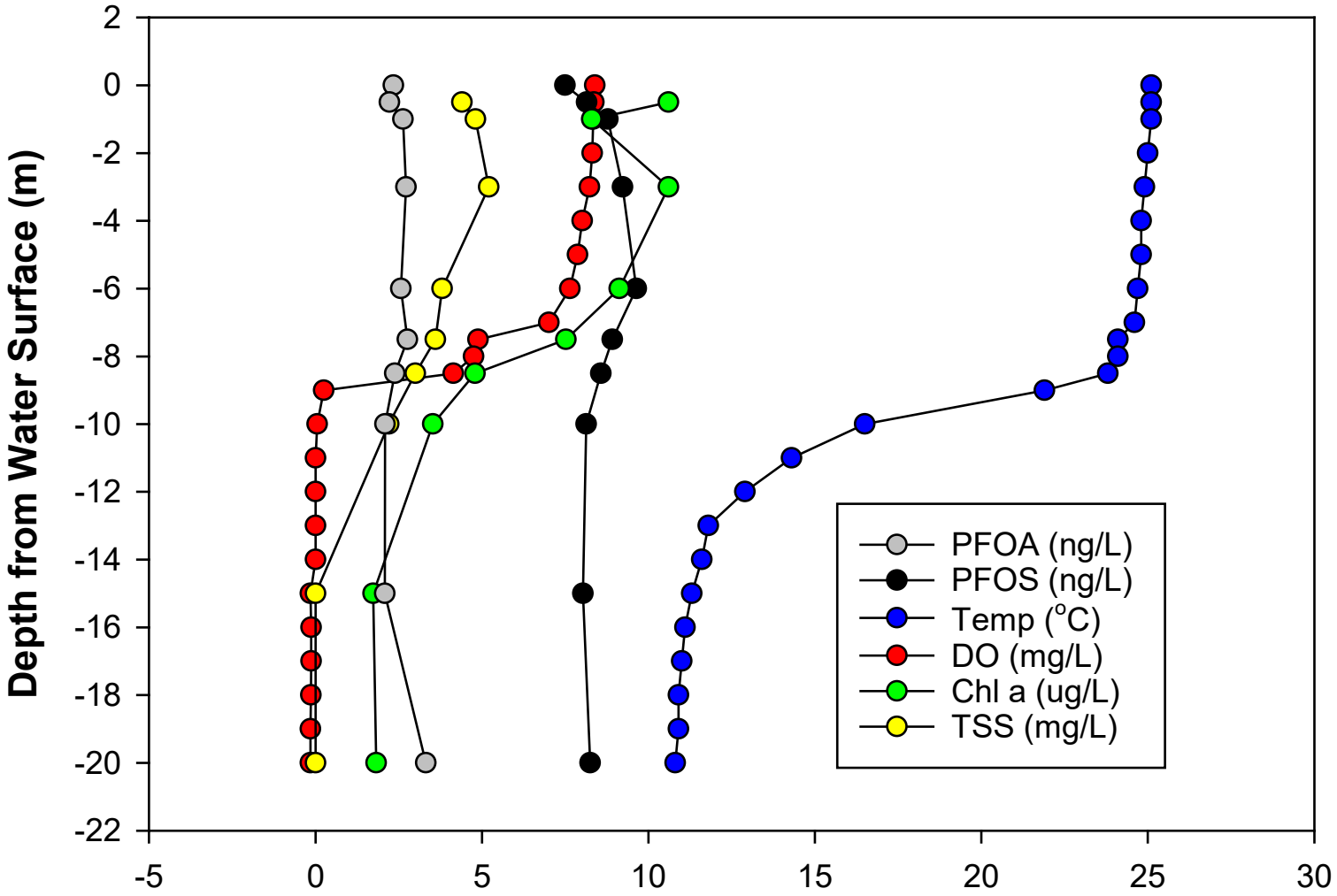
- Starkweather Cr. has the one of highest PFOS conc. in WI (~200 ng/L range).
- Consistently has 8-10 ng/L PFOS in the surface water.
- Fish consumption advisories on Monona and downstream chain of lakes
- Convenient location – near multiple DNR field/office locations and WSLH

Lake Monona PFAS Partitioning and Distribution

How does this relate to PFAS monitoring?

- Are we missing anything by only monitoring “total” PFAS sample @ 6” below surface?
  - Sample the lake horizontally and vertically during lake stratification
  - Develop water method to analyze both filtered (”dissolved”) and particulate PFAS
- How is PFAS partitioning to other components in the lake and non-sport fish biota to better understand PFAS mass-balance and bioaccumulation?
  - Sample: sediments, zooplankton, algae, macrophytes, macroinverts (amphipods, mayflies, damselflies), snails, zebra mussels, and YOY BG, LMB and brook silversides

Lake Monona Water Column Profile: August 4, 2022



- Sampled with PFAS-clean Niskin Go-Flow sampler.
- Lake was well-stratified with anoxic hypolimnion.
- Algae bloom in epilimnion, as well as most TSS.
- PFAS is “mixed,” or not stratified.
- Both PFOA and PFOS were within +/- 1 to 2 ng/L top to bottom.
- Further analysis shows PFOS is mainly (~80%) in the “dissolved” phase at this time.

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OFF THE RECORD"