Battelle
2019 Bioremediation Symposium | April 15-18 | Baltimore, Maryland

AECOM Imagine it. Delivered.

Are Wastewater Treatment Plants and Biosolids a significant source of PFAS in Michigan?

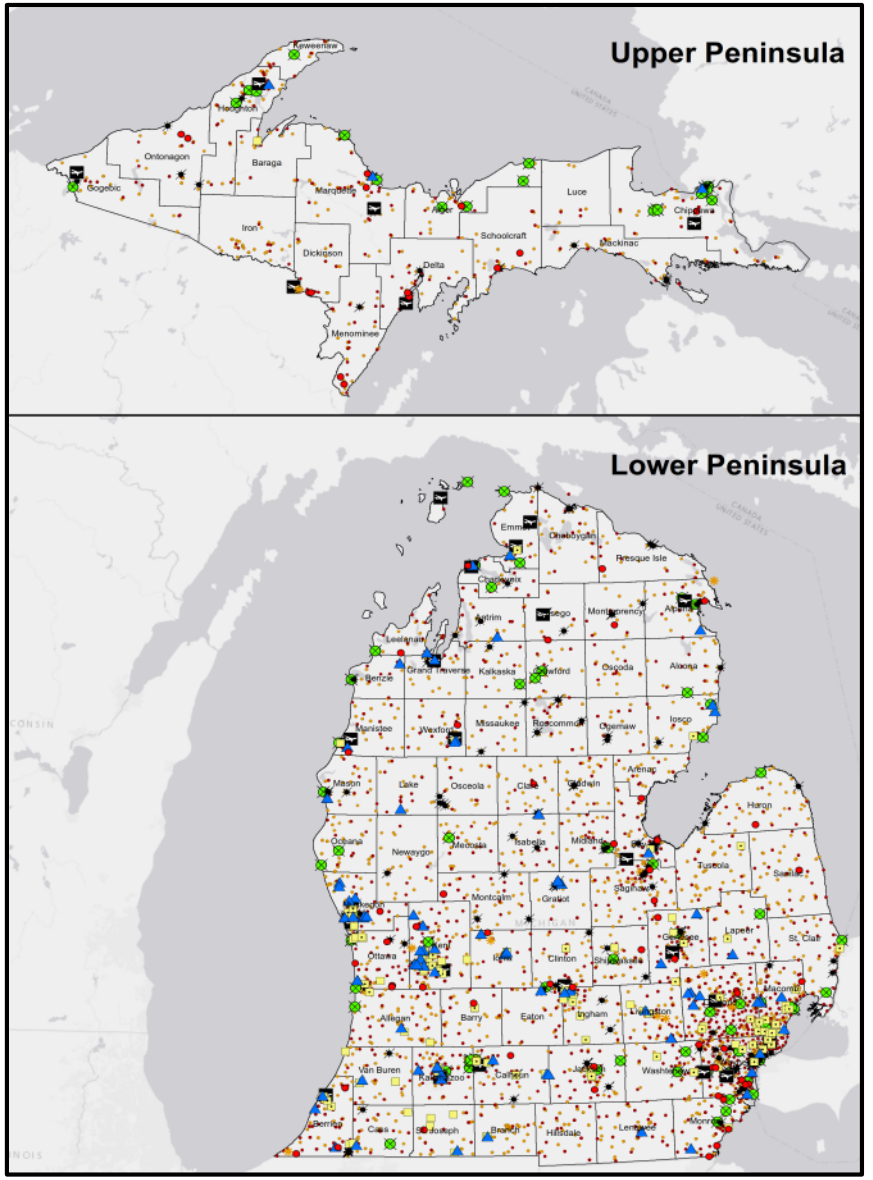
Dorin Bogdan, PhD

April, 17, 2019

Potential PFAS Sources

Legend

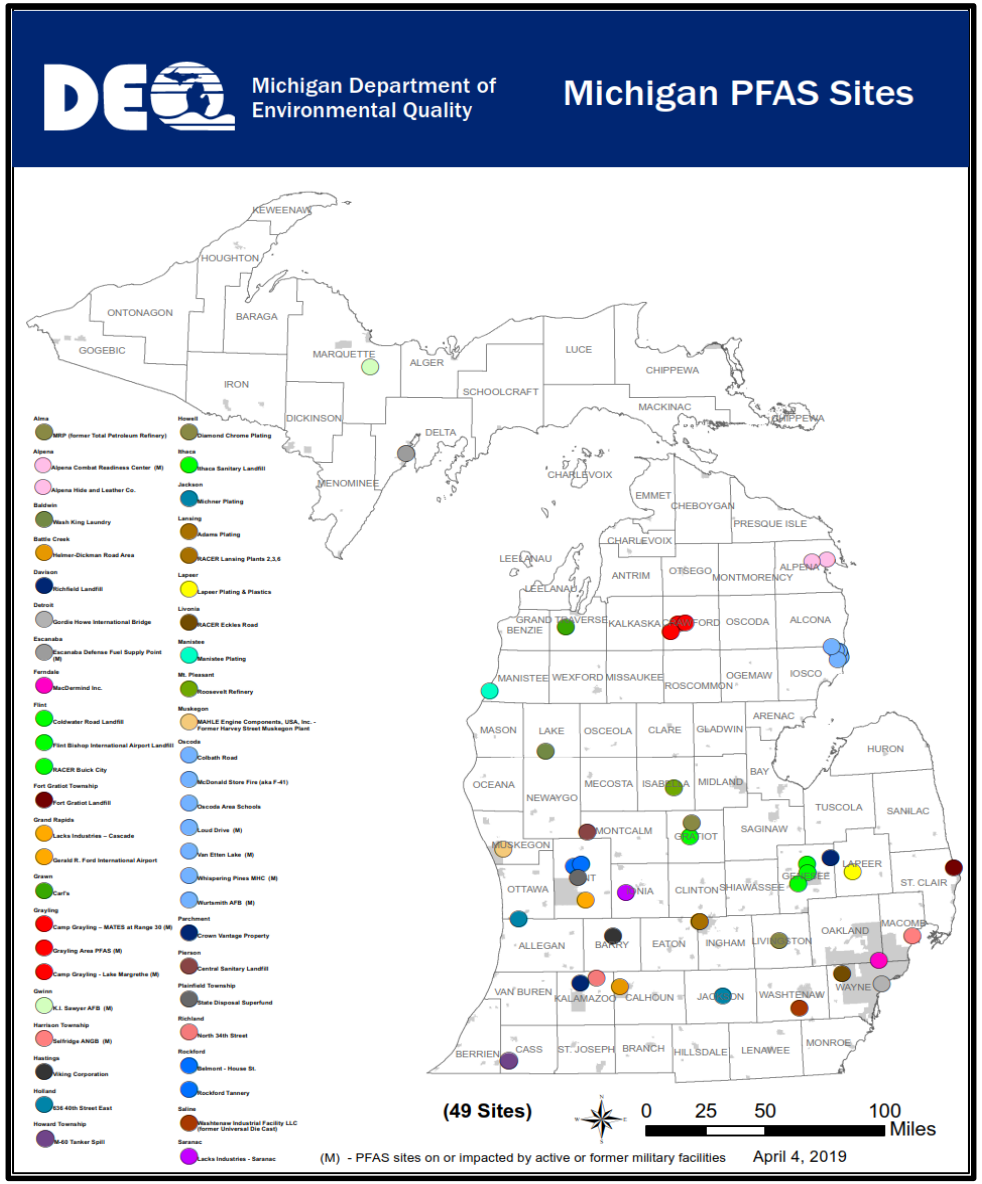
- Active Landfills
- Superfund Sites
- Electroplaters
- Plating and Polishing Sites
- Airports
- Petroleum Terminals
- Petroleum Bulk Stations
- Paints & Allied Products
- Military Sites
- Fire Stations
- Historic Landfills



AECOM

Michigan PFAS Sites

- Department of Defense (DoD)
- Former Refineries
- Fuel Supply
- Shoe Manufacturing
- Wastewater Treatment Plants
- Landfills
- Plastic Manufactures
- Chrome Platers



Industrial Pretreatment Programs (IPPs)

RICK SNYDER
GOVERNOR

STATE OF MICHIGAN
DEPARTMENT OF ENVIRONMENTAL QUALITY
LANSING DISTRICT OFFICE

C. HEIDI GRETHER
DIRECTOR

February 20, 2018

SUBJECT: PFAS Source Evaluation and Reduction Requirements

You may have heard news recently about perfluoroalkyl and polyfluoroalkyl substances (PFAS, also referred to as PFCs), especially the specific chemicals PFOS (perfluorooctane sulfonate) and PFOA (perfluorooctanoic acid). The Department of Environmental Quality (DEQ), Water Resources Division (WRD), is requiring Wastewater Treatment Plants (WWTP) with Industrial Pretreatment Programs (IPPs) to evaluate potential sources of PFAS, investigate probable sources, reduce/eliminate the sources found, and take other actions to protect surface water quality as needed.

AECOM

Michigan IPP Initiative

IPP PFAS Initiative Status

Update 1-31-2019

95 POTWs with IPPs:

- **93** IRs* Submitted
- **1** IRs not yet due
- **1** IR Overdue

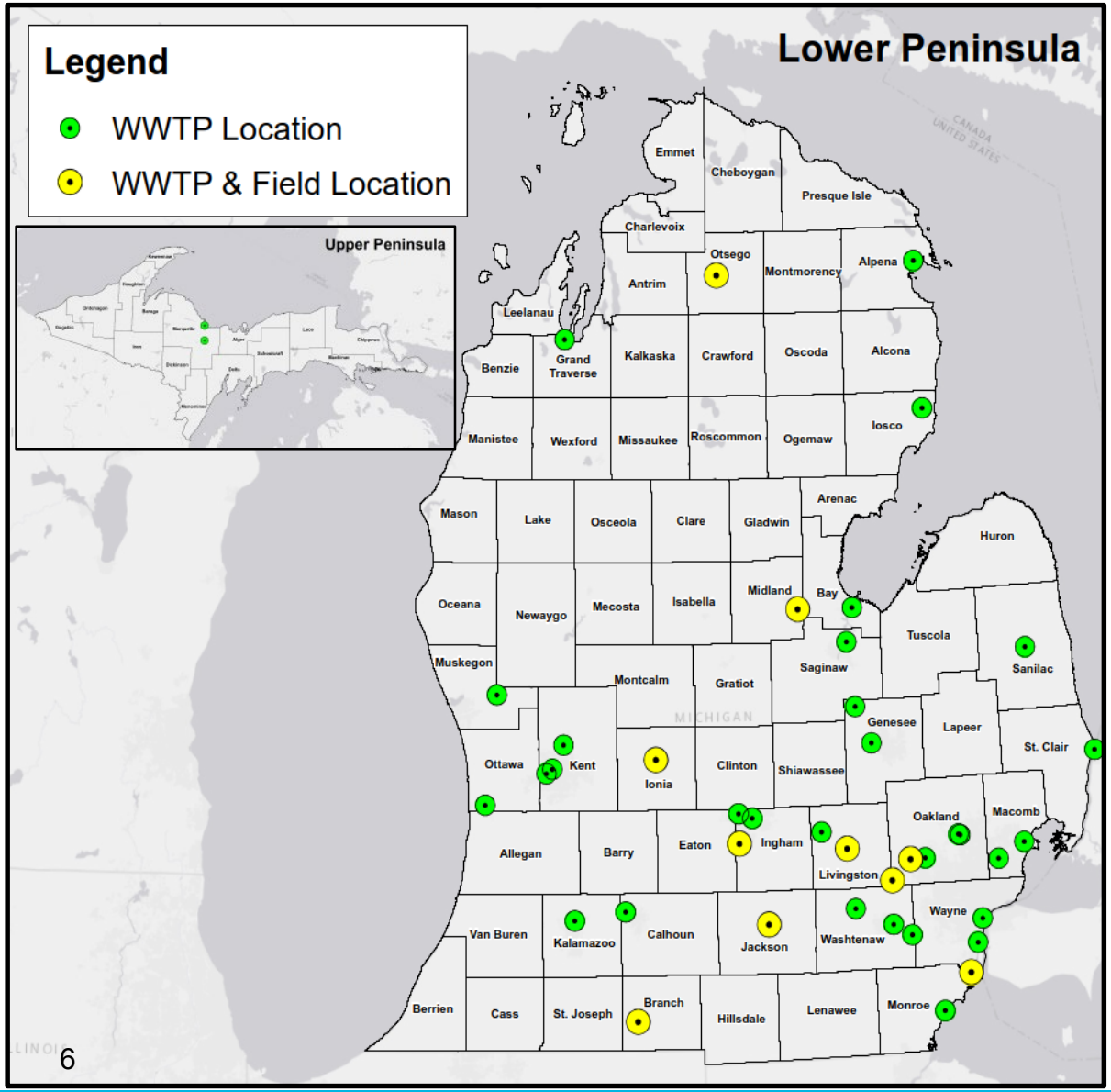
*IR = Interim Report

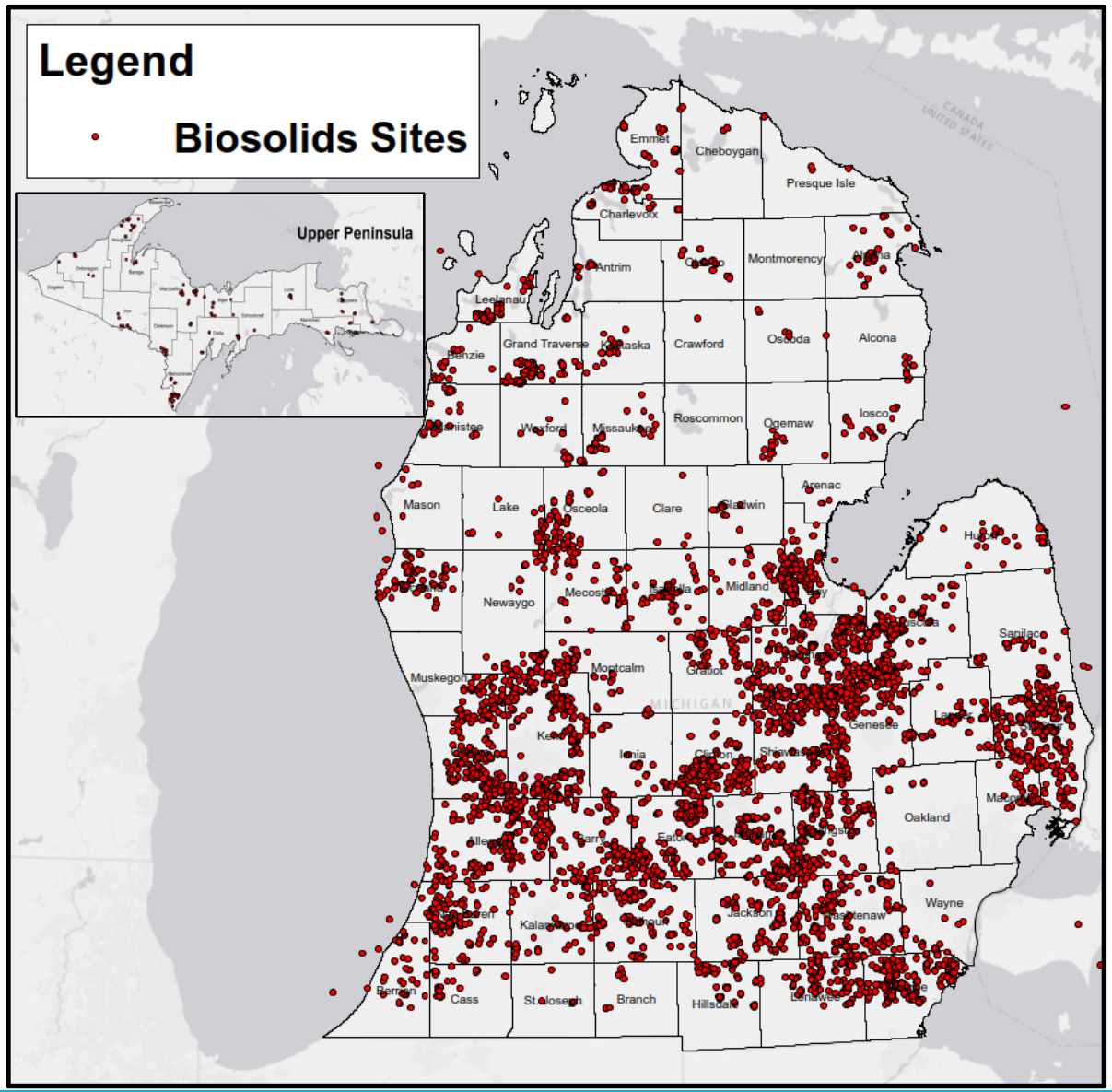
Bin 1: 33
No sources
PFOS/PFOA found

Bin 2: 19
Sources found but
POTW Effluent
≤WQS[1]

Bin 3: 22
Sources found and
POTW Effluent
>WQS[1]

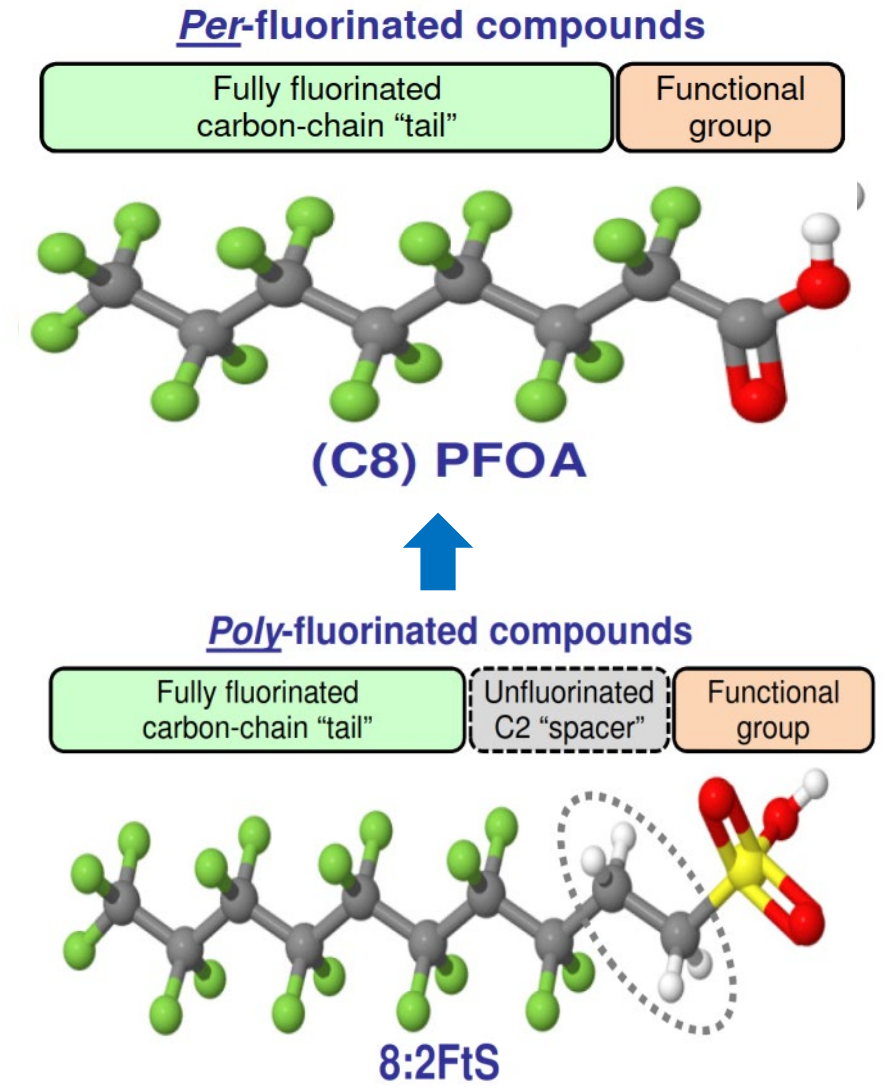
Michigan WWTP and Biosolids Sites



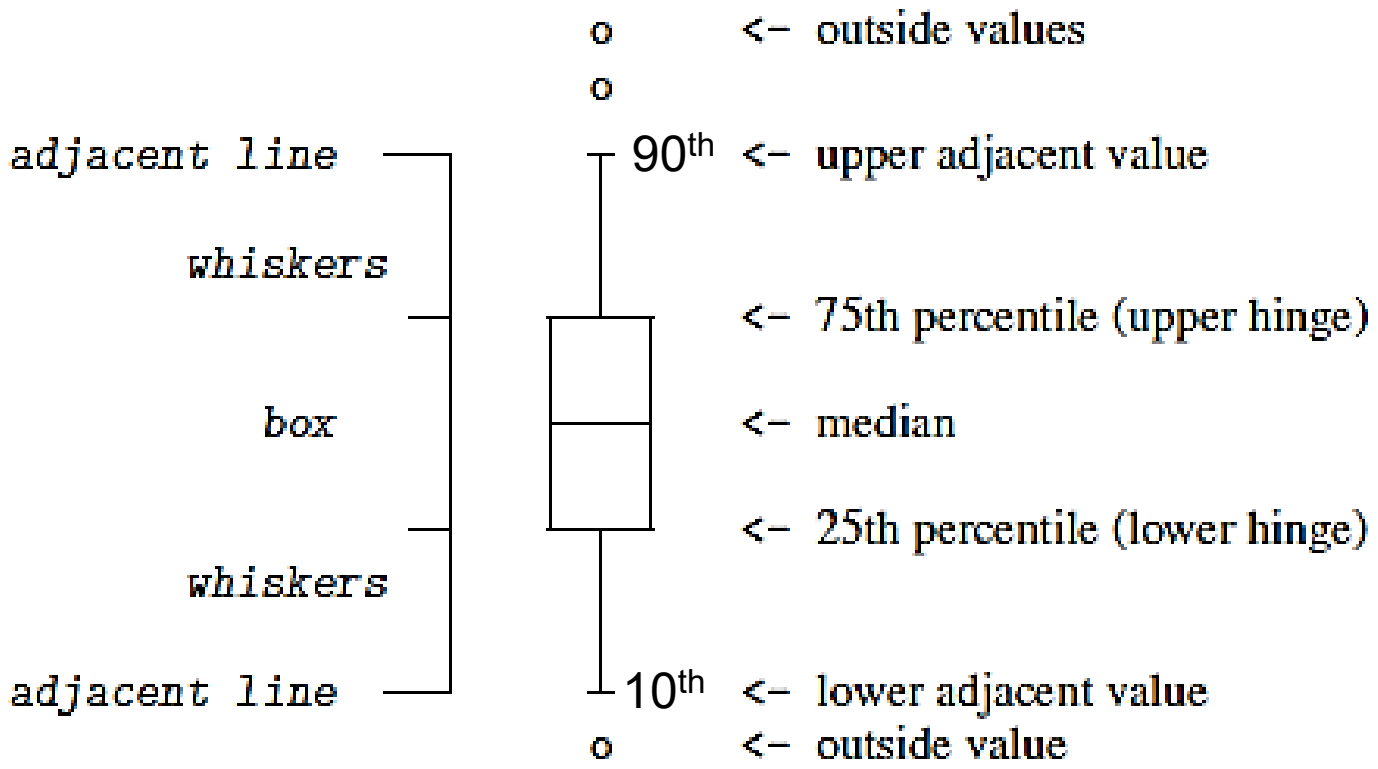


MDEQ Minimum 24 PFAS Analysis List

PFAS Substance	Acronym	Carbon Chain Length
Perfluorobutanoic Acid	PFBA	C_4
Perfluoropentanoic Acid	PFPeA	C_5
Perfluorohexanoic Acid	PFHxA	C_6
Perfluoroheptanoic Acid	PFHpA	C_7
Perfluorooctanoic Acid	PFOA	C_8
Perfluorononanoic Acid	PFNA	C_9
Perfluorodecanoic Acid	PFDA	C_{10}
Perfluoroundecanoic Acid	PFUnDA	C_{11}
Perfluorododecanoic Acid	PFDoDA	C_{12}
Perfluorotridecanoic Acid	PFTrDA	C_{13}
Perfluorotetradecanoic Acid	PFTeDA	C_{14}
Perfluorobutane Sulfonic acid	PFBS	C_4
Perfluoropentane sulfonic acid	PFPeS	C_5
Perfluorohexane Sulfonic acid	PFHxS	C_6
Perfluoroheptane Sulfonic acid	PFHpS	C_7
Perfluorooctane Sulfonic acid	PFOS	C_8
Perfluorononane sulfonic acid	PFNS	C_9
Perfluorodecane Sulfonic acid	PFDS	C_{10}
Perfluorooctane sulfonamide	FOSA	C_8
4:2 Fluorotelomer sulfonic acid	4:2 FTSA	C_4
6:2 Fluorotelomer sulfonic acid	6:2 FTSA	C_6
8:2 Fluorotelomer sulfonic acid	8:2 FTSA	C_8
N-Ethyl perfluorooctane sulfonamidoacetic acid	EtFOSAA	C_8
N-Methyl perfluorooctane sulfonamidoacetic acid	MeFOSAA	C_8



Data Legend



PFBA PFPeA PFHxA PFHpA PFOA PFNA PFDA PFUnDA PFDoDA PFTrDA PFTeDA

PFBS PFPeS PFHxS PFHpS PFOS PFNS PFDS

FOSA

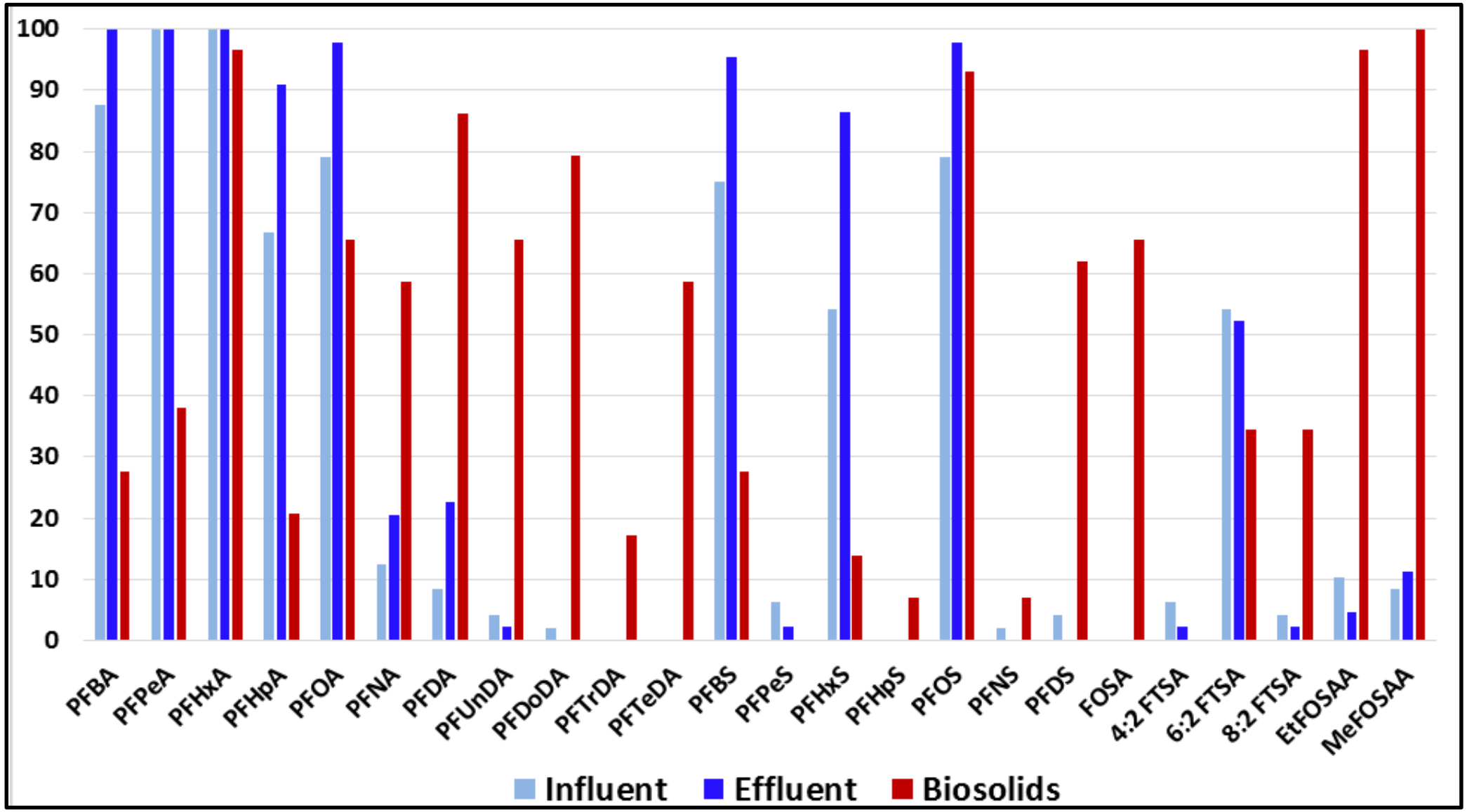
4:2 FTSA 6:2 FTSA 8:2 FTSA

EtFOSAA

MeFOSAA

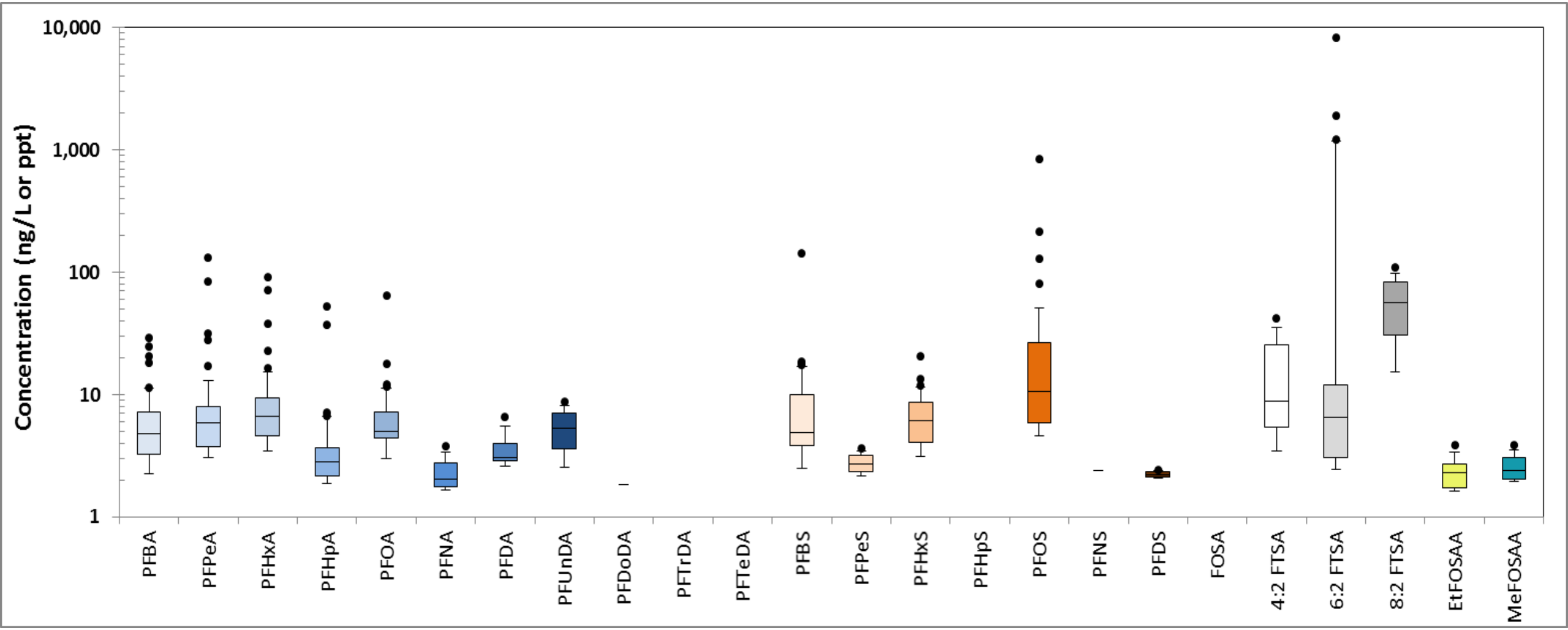
AECOM

PFAS Detection Frequency – WWTP Study



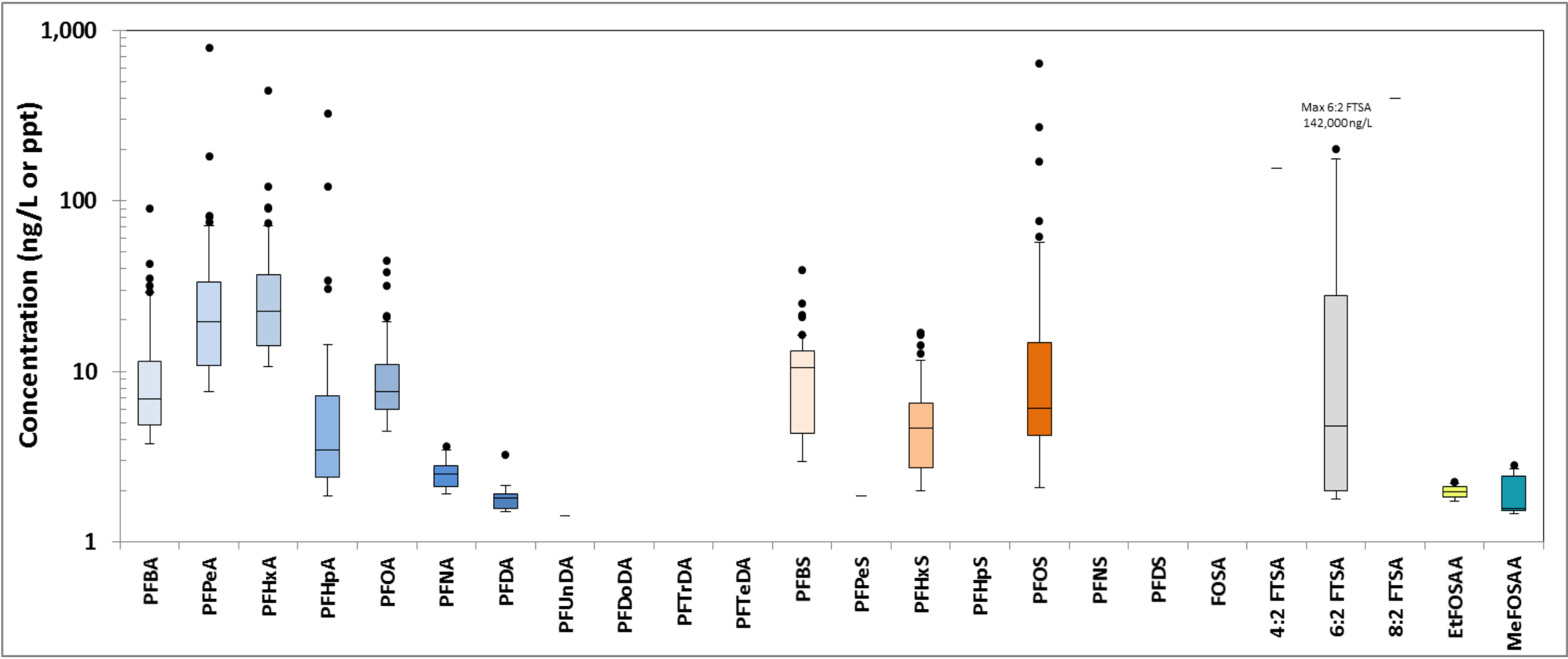
AECOM

WWTP Influent PFAS Concentrations



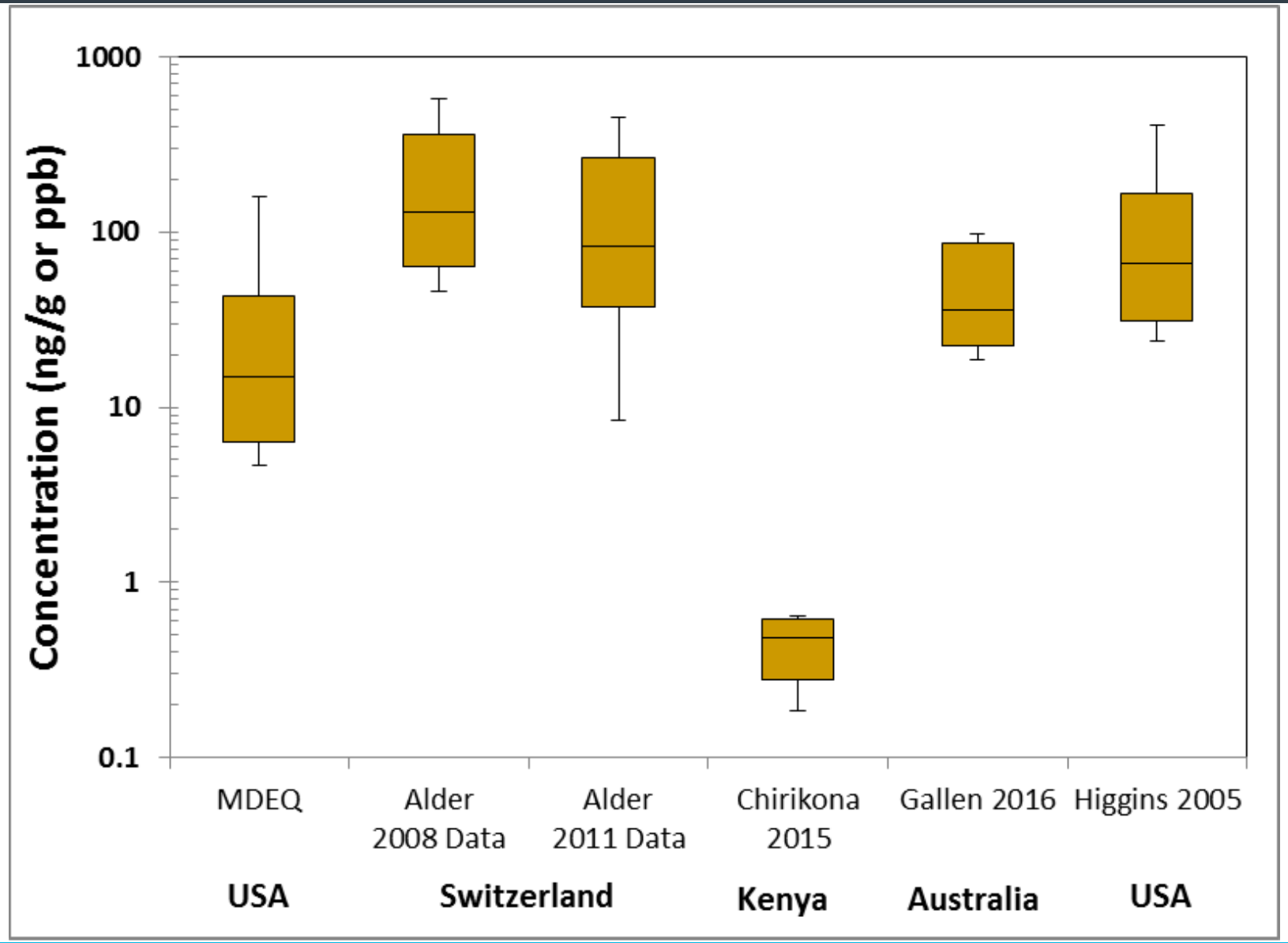
AECOM

WWTP Effluent PFAS Concentrations



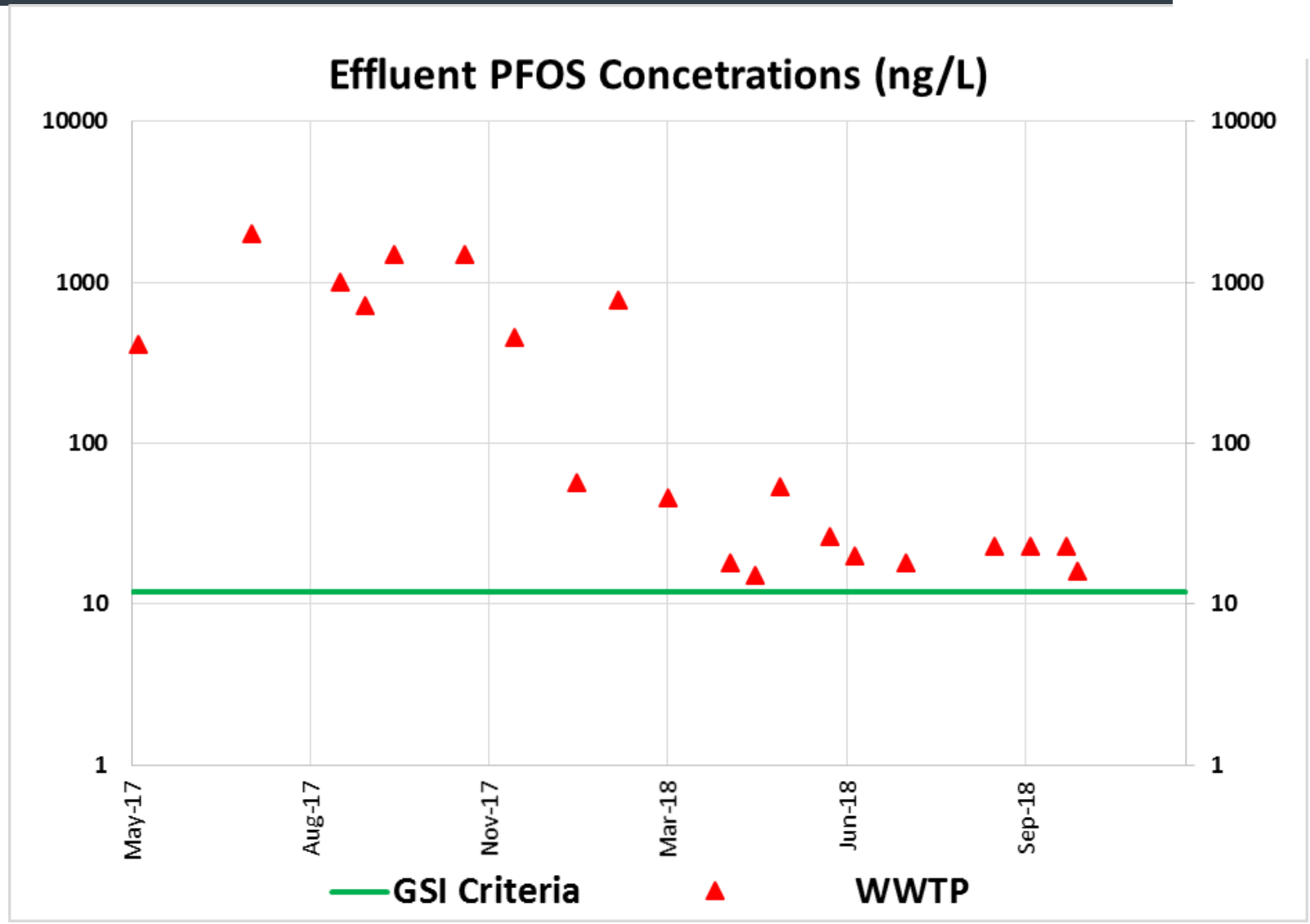
AECOM

MDEQ vs. Published Biosolids Studies



AECOM

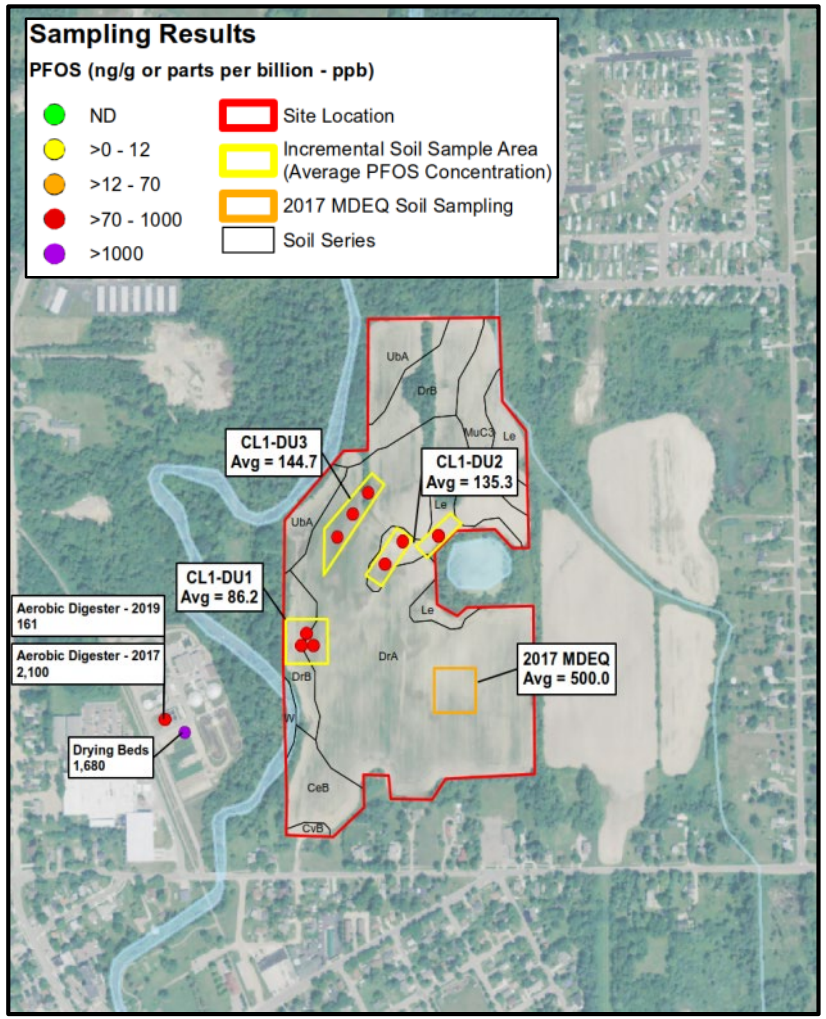
WWTP PFOS Concentrations



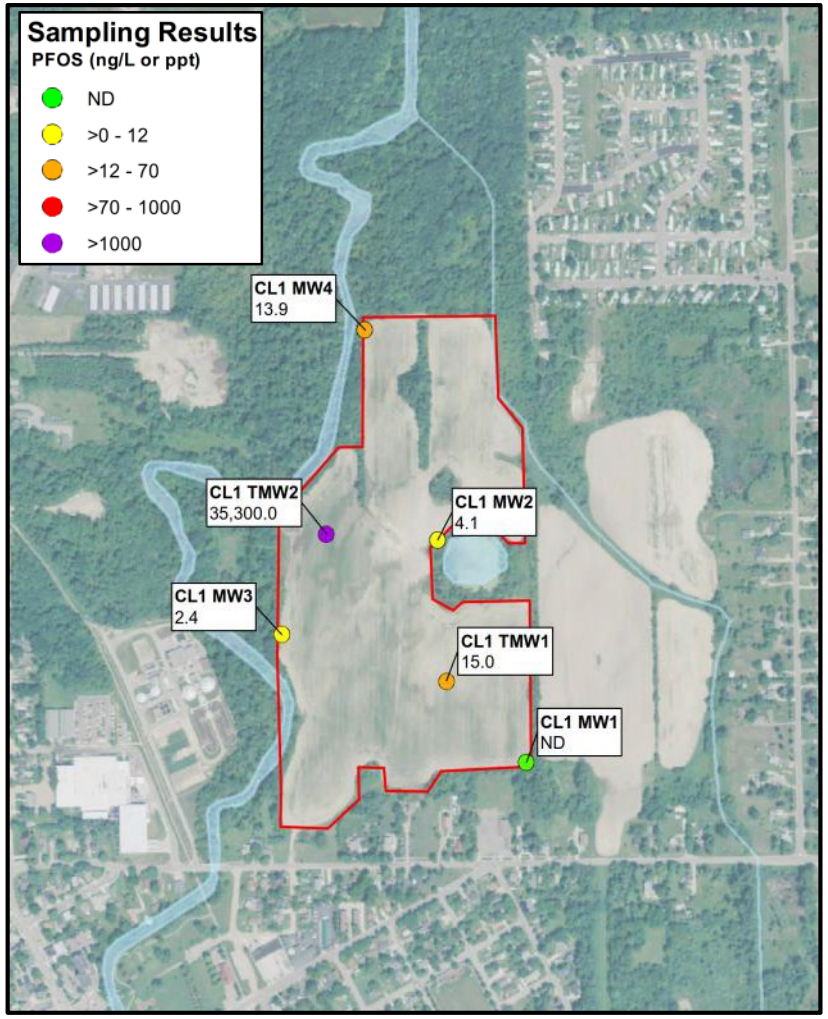
AECOM

Biosolids - Application Site Evaluation

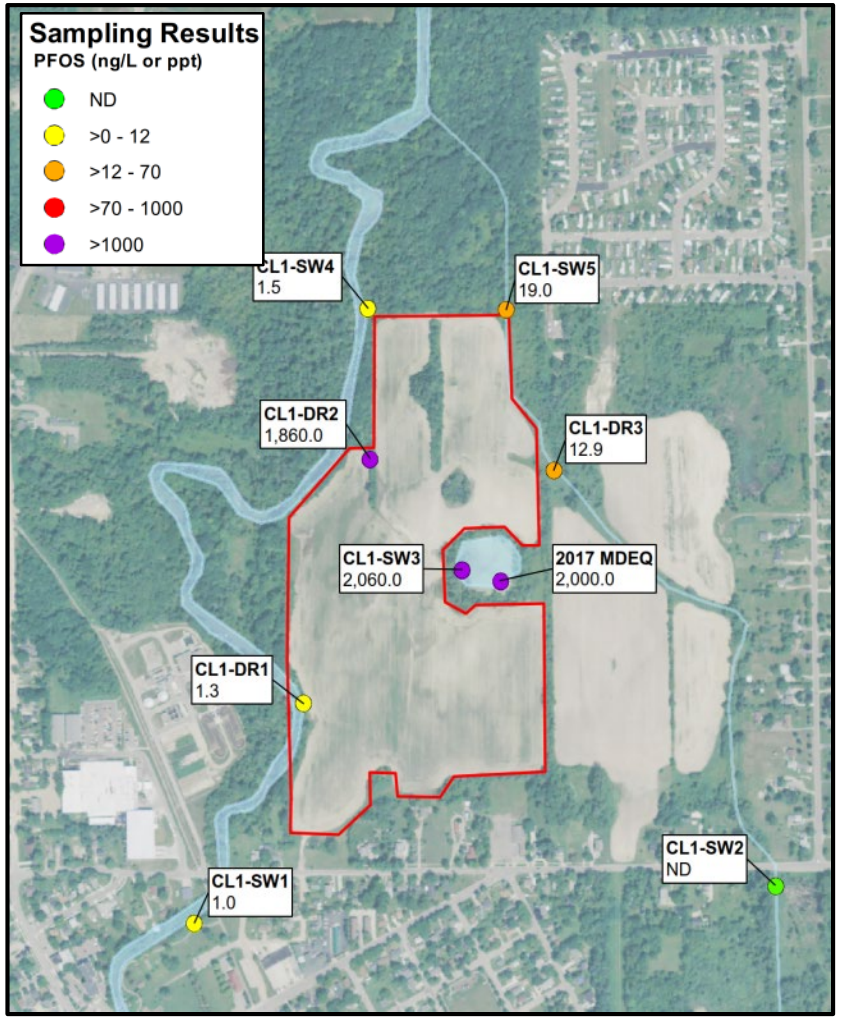
Soil / Biosolids



Groundwater

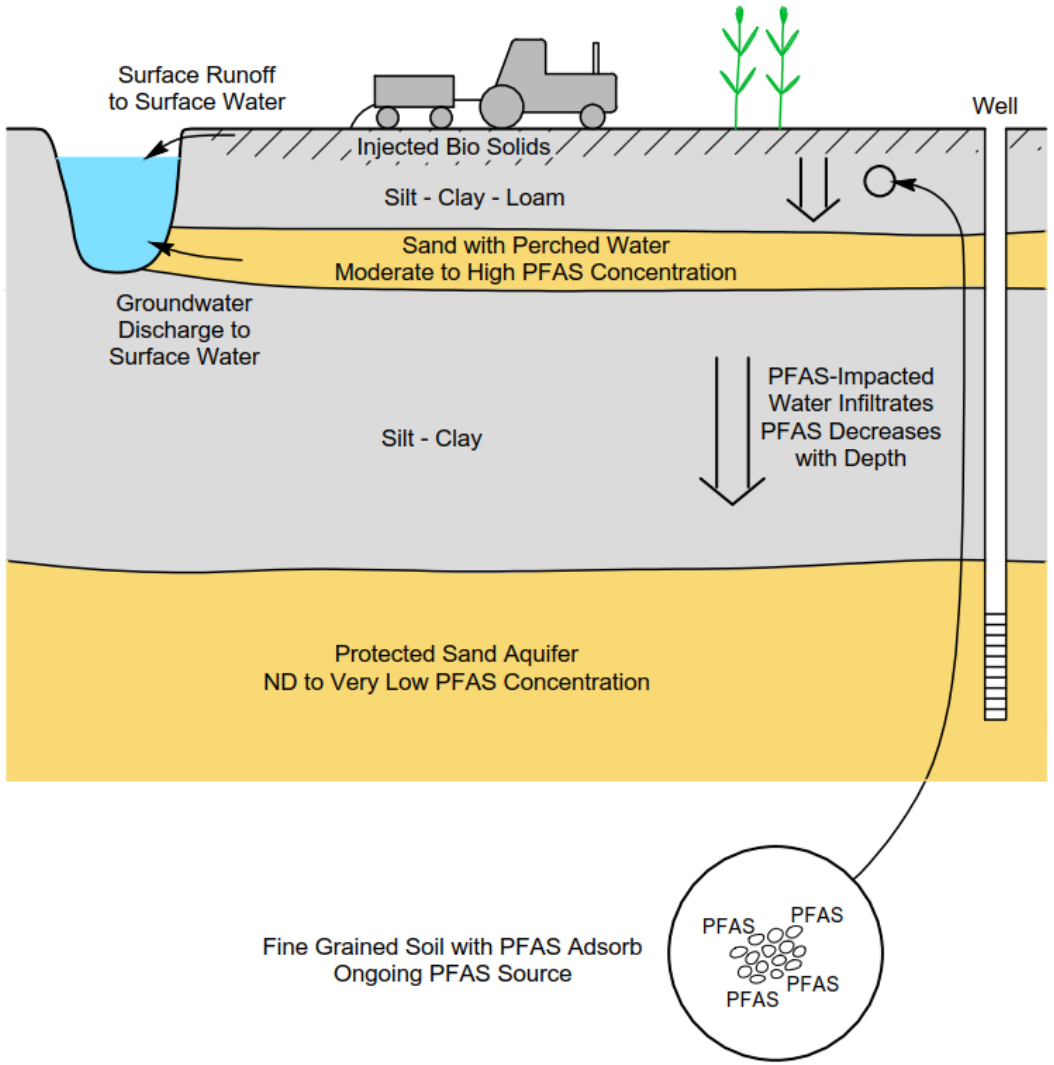


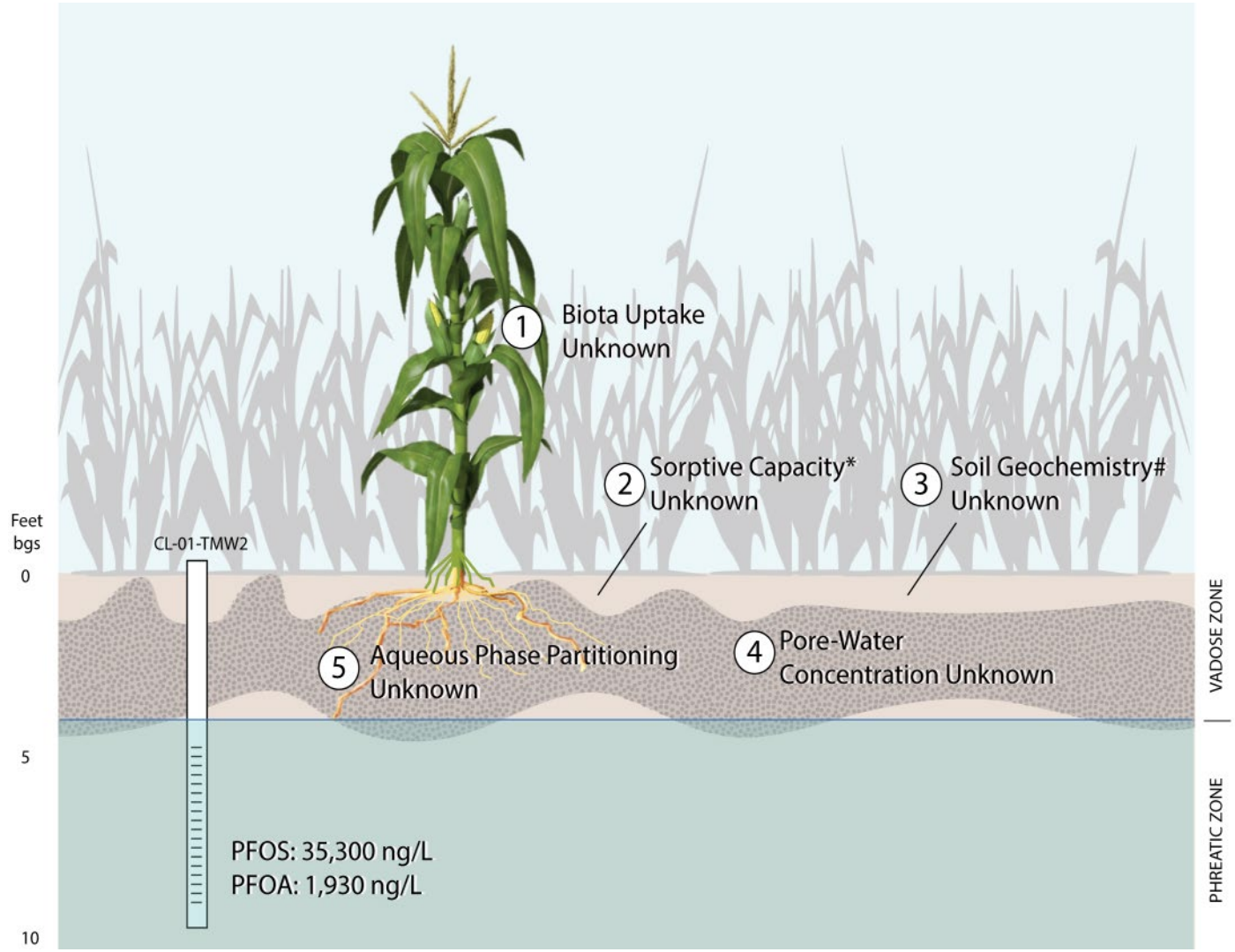
Surface Water / Tile Drain



AECOM

Biosolids Exposure Conceptual Model





AECOM

Conclusions

- Industrial effluent from Chrome platers, metal finishers, landfills were found to have the most frequent PFAS detections
- PFAS source reduction in the industrial effluents are having a significant impact on the biosolids and WWTP effluents
- Higher PFAS concentrations identified in stabilized sludges/biosolids compared to Secondary and Primary Treatments
- Long-chain PFAS has a higher affinity to the sludge/biosolids
- Biosolids correlation to potential impact to soils, groundwater, surface water, and plant uptake is on-going.
- WWTP associated with industrial users are more likely to have higher PFAS concentrations.
- Some industries have changed to short-chain (C6) chemistry resulting in 6:2 FTS being detected at highest concentration in the WWTP influents and effluents.
- 6:2 FTS was not found to accumulate as much as PFOS and other long-chain PFAS in the sludges and biosolids.

Thank You!

T 616-516-5995
E Dorin.Bogdan@aecom.com