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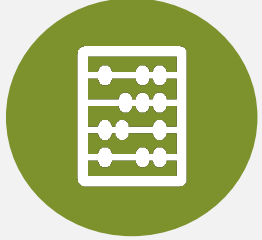
PFAS in Soil: Regional Investigation of the Air Deposition Pathway

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Project background



Several facilities within the region historically utilized PFAS containing materials in their manufacturing processes (~1950 to 2000)

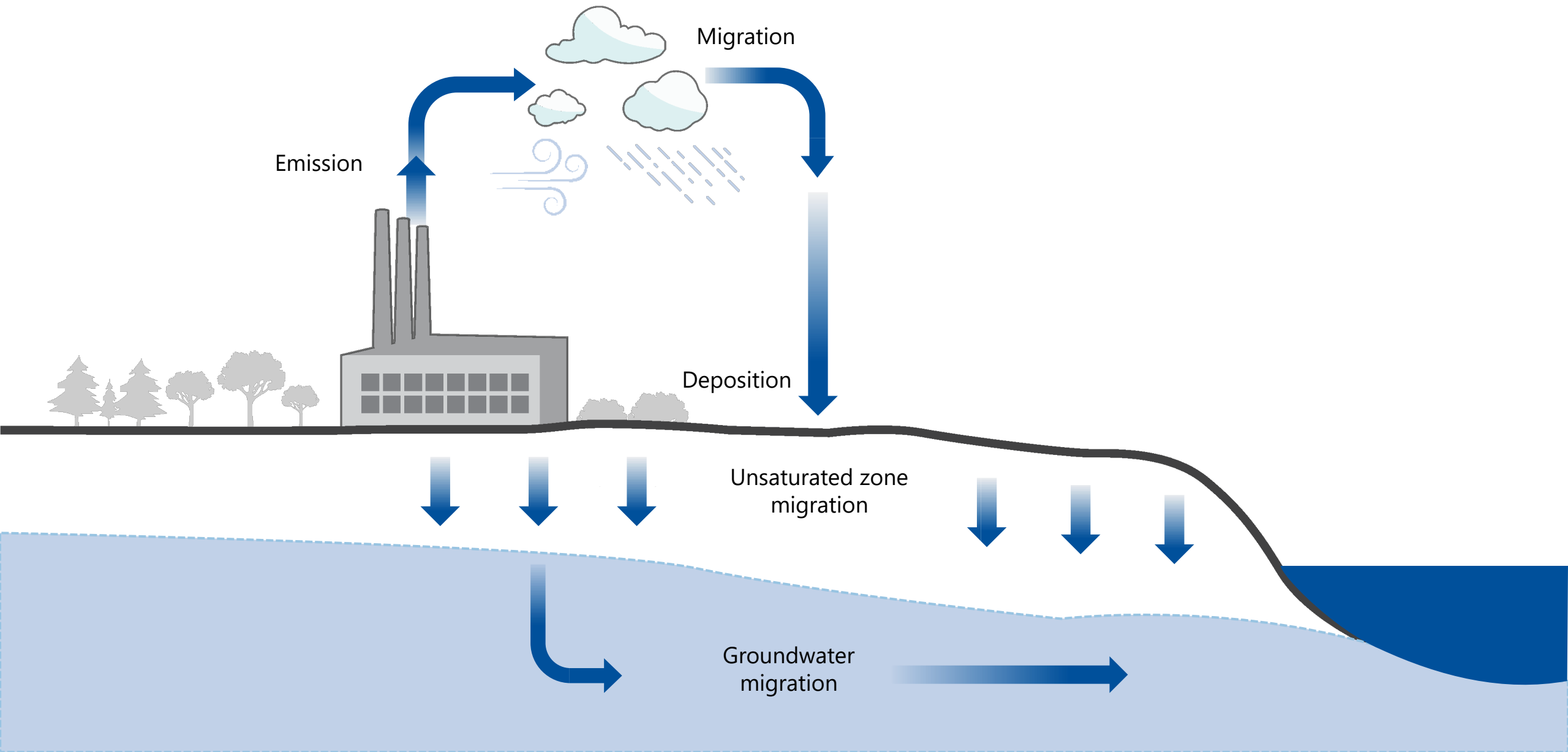


Potentially dispersed PFAS into the environment via atmospheric emissions and deposition

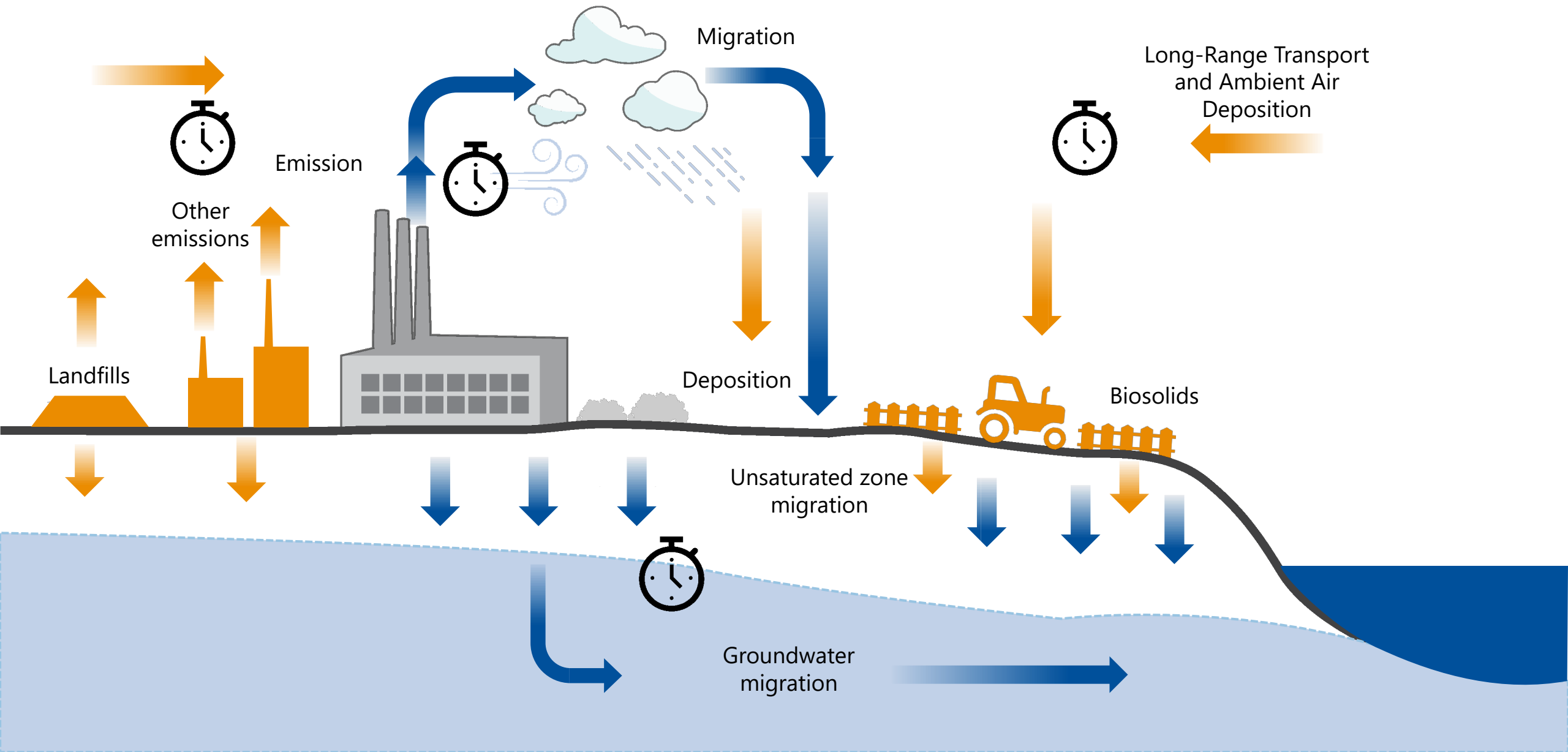


Regional-scale investigation, supporting multiple site investigations, designed to evaluate the air emission and deposition pathway was requested

Simplified conceptual model – single source



What about other sources, pathways and historical loading?



Objectives



Determine if PFAS impacts from air deposition were observable in representative **soils**



Determine if PFAS distribution in soils is **consistent** with an air deposition conceptual site model (CSM) for sources within the study area

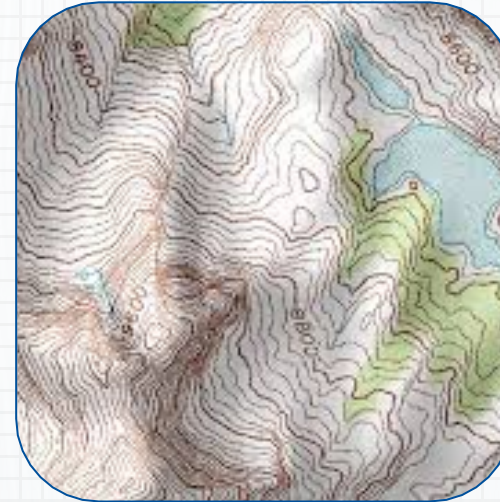
Historical Aerial Imagery



Tax Records

NAME	LOCATION OR FROM WHICH TAKEN	AMOUNT	DATE	REMARKS	DATE	REMARKS
James A. Hill	St. Louis	100	1870			
James A. Hill	St. Louis	100	1870			
James A. Hill	St. Louis	100	1870			
James A. Hill	St. Louis	100	1870			
James A. Hill	St. Louis	100	1870			
James A. Hill	St. Louis	100	1870			
James A. Hill	St. Louis	100	1870			
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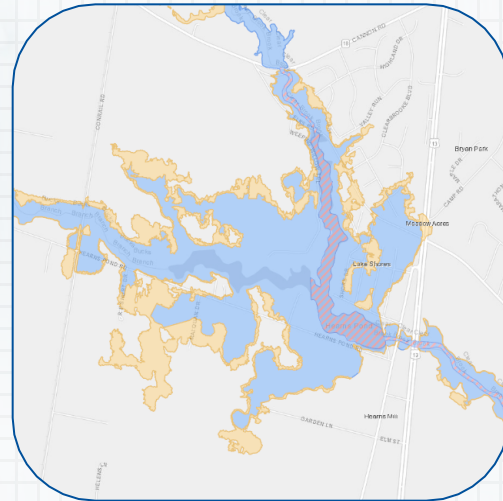
Topographic Maps



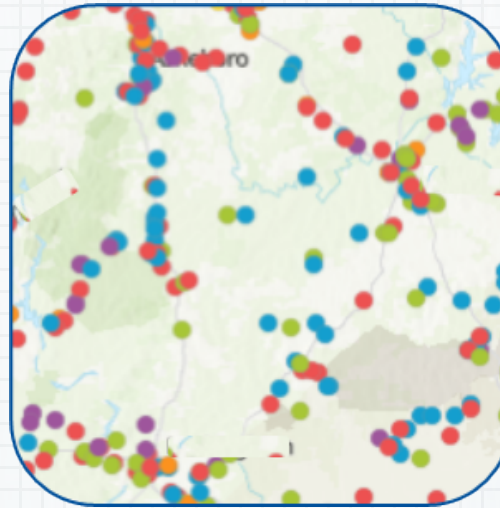
Geologic Maps



Wetland/Floodplain Maps



Regulatory Review

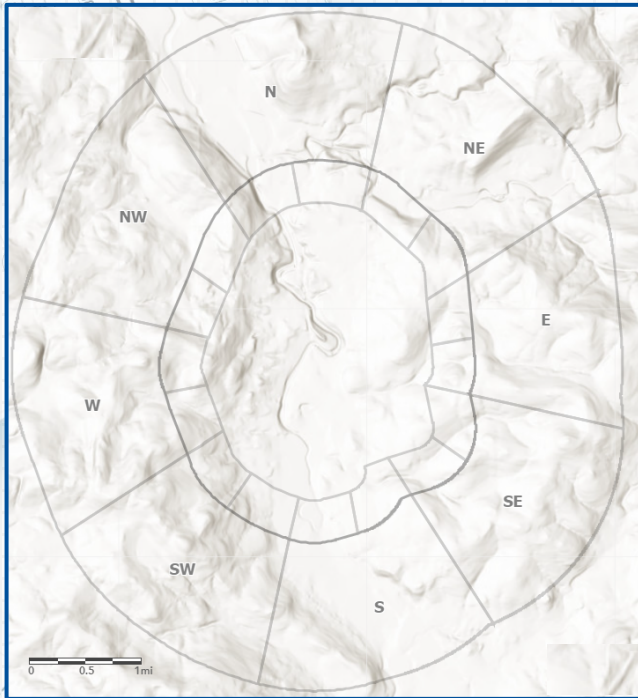


Investigation Design

Sampling Location Criteria

- Undisturbed for past 60 years;
- No indication of nearby source;
- Outside of wetland and floodplain;
- Sufficient soil thickness;
- Clear land ownership and ability to obtain access; and
- Inward-facing slope.

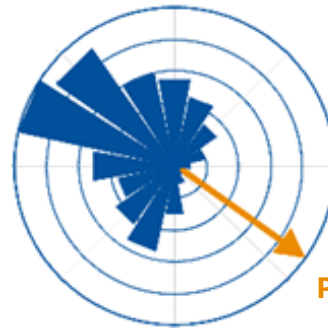
Radial Grid 1k to 10K feet Step-out



Site-Specific Meteorological Data



Met station:
installed to continuously
gather meteorological
data (> 4 years of data)



**Predominant
downwind
direction**

Wind Rose:
demonstrates
predominant winds
blowing from NW to SE

Investigation Design

- Access sought at more than 148 properties as potential sampling locations
- Mostly private properties, all wooded
- Goal of distribution with distance and direction

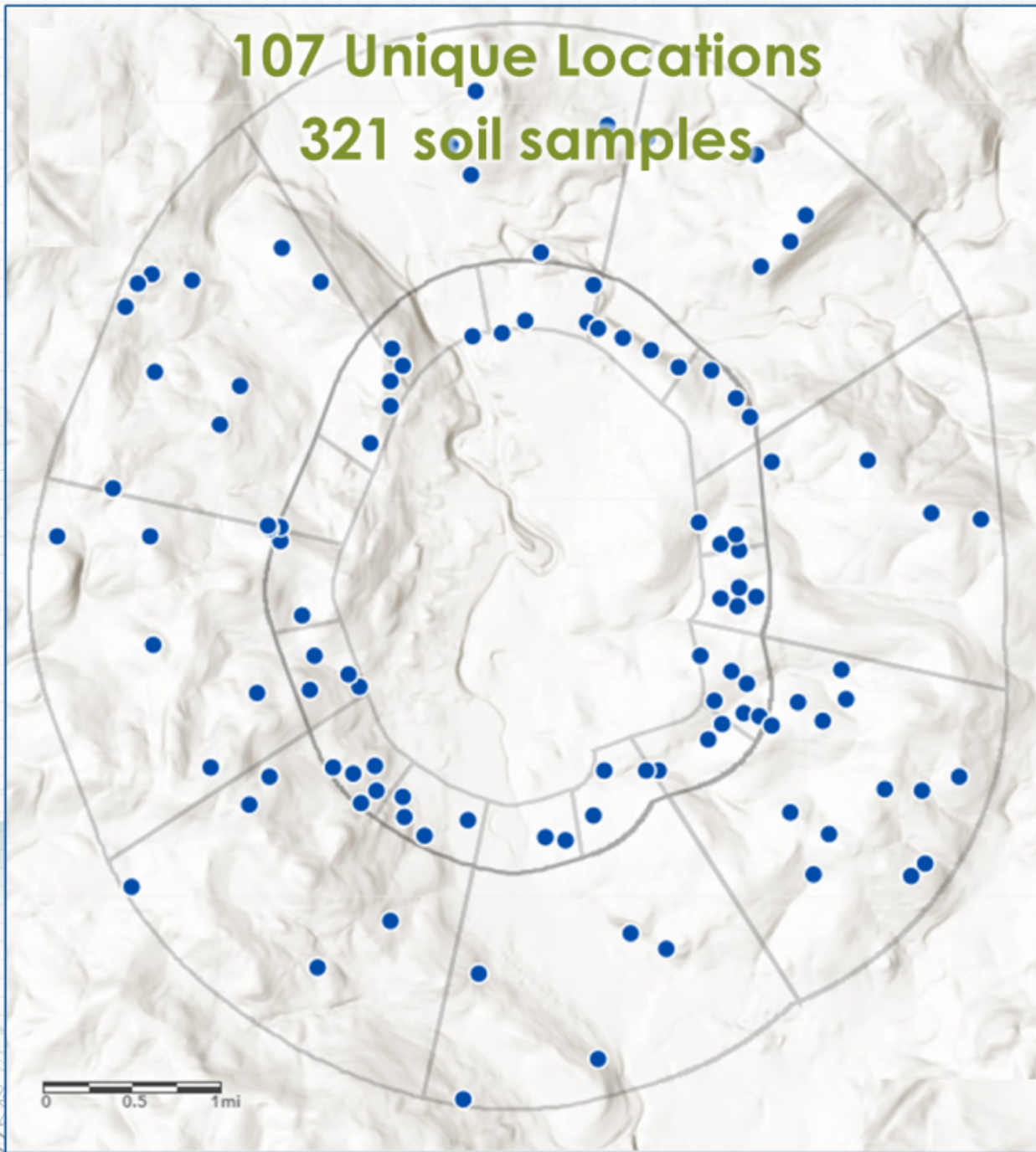
Investigation Design

Field Vetting and Sampling

- No evidence of dumping or disturbance;
- Avoid low lying/settling/wet areas;
- Type of tree and diameter;
- Mid-slope where possible;
- Oversight/agreement with agency on each location;
- Telescopic interval sampling (avoid sloughing); and
- Careful homogenization.



107 Unique Locations
321 soil samples.

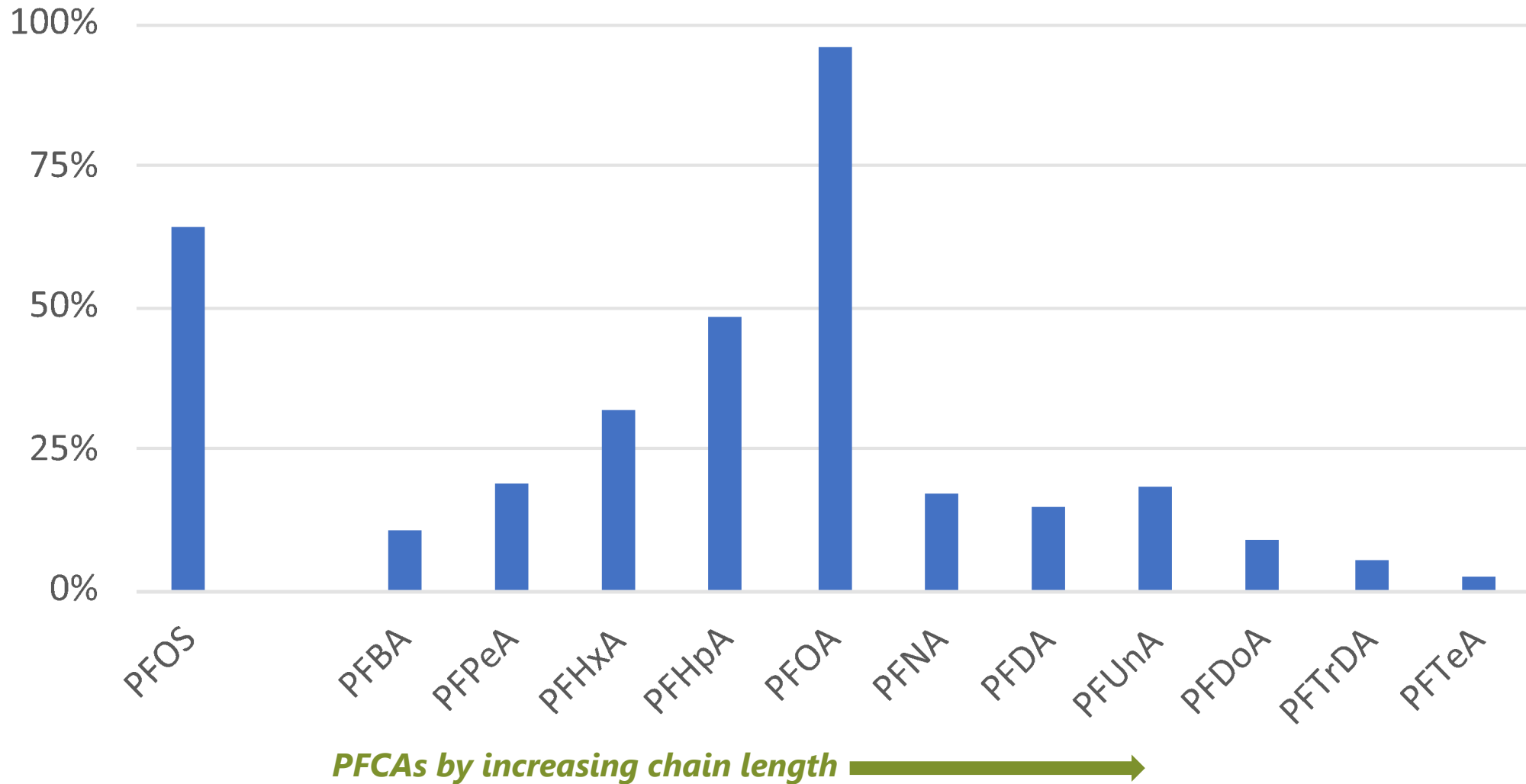


The Dataset

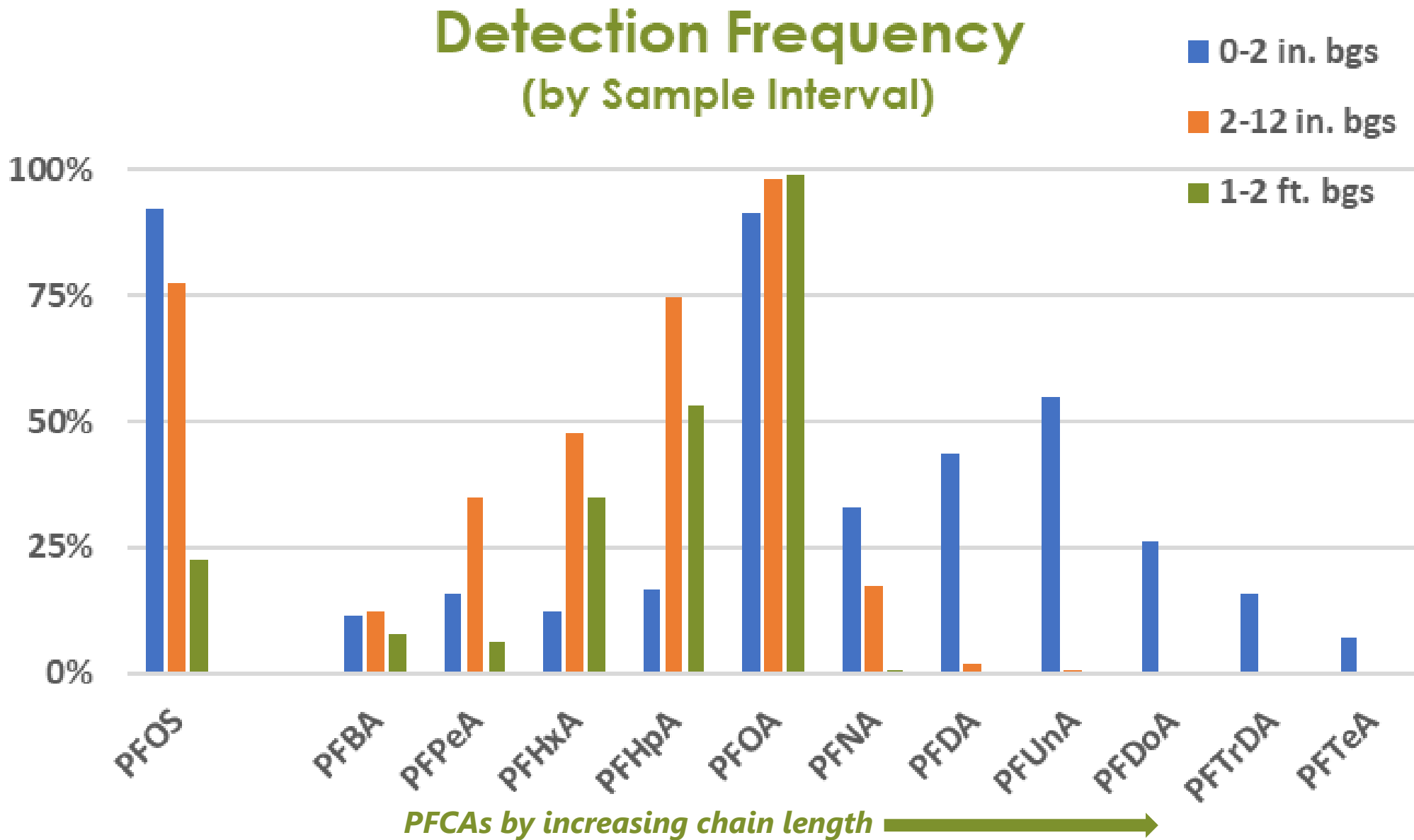
- Analytical Data
 - PFAS
 - Total Organic Carbon
 - pH
 - SPLP (limited subset)
- Field data
 - Tree cover
 - Soil classification
 - Elevation
 - Distance and direction
 - Slope position

PFOA and PFOS were most frequently detected

Detection Frequency (All Sample Intervals)

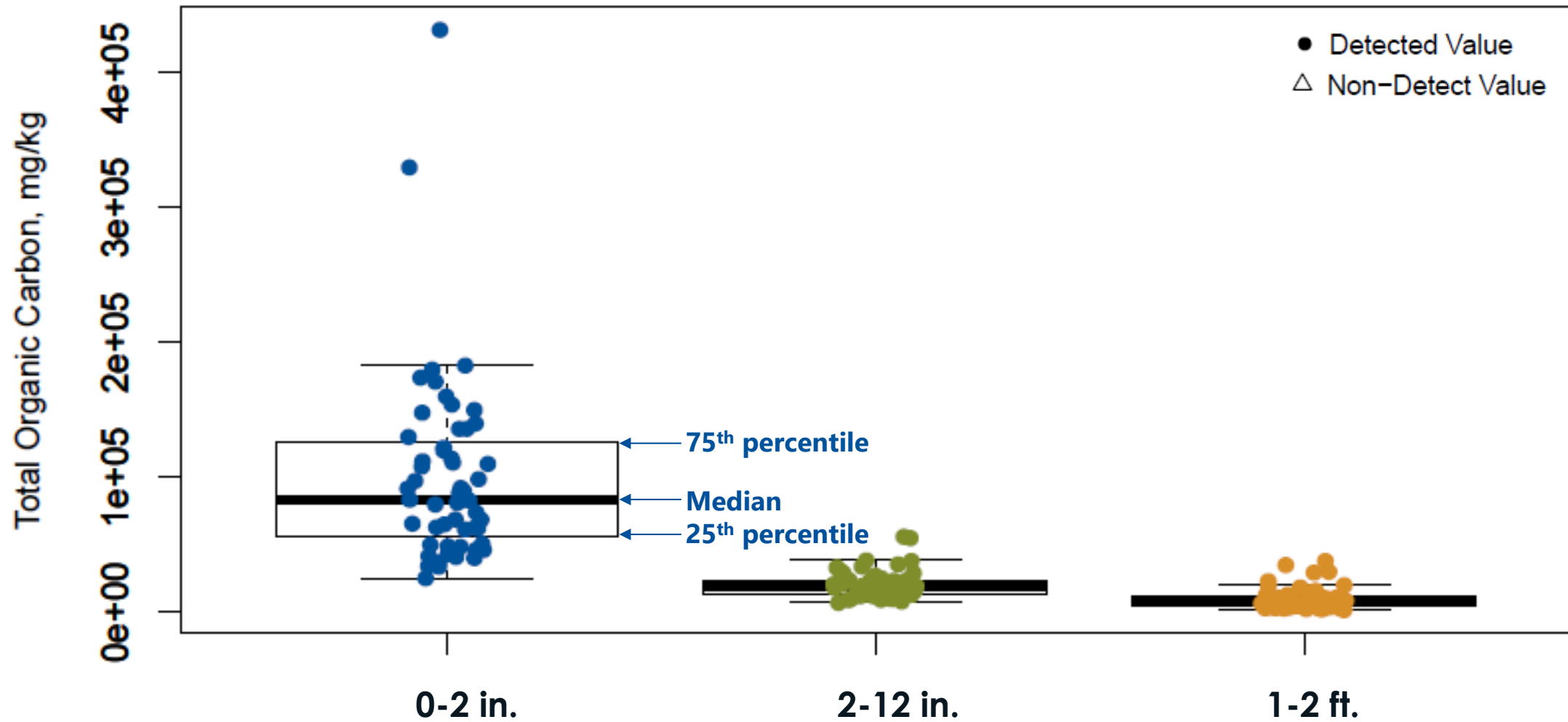


Significant differences in detection frequency by sampling interval



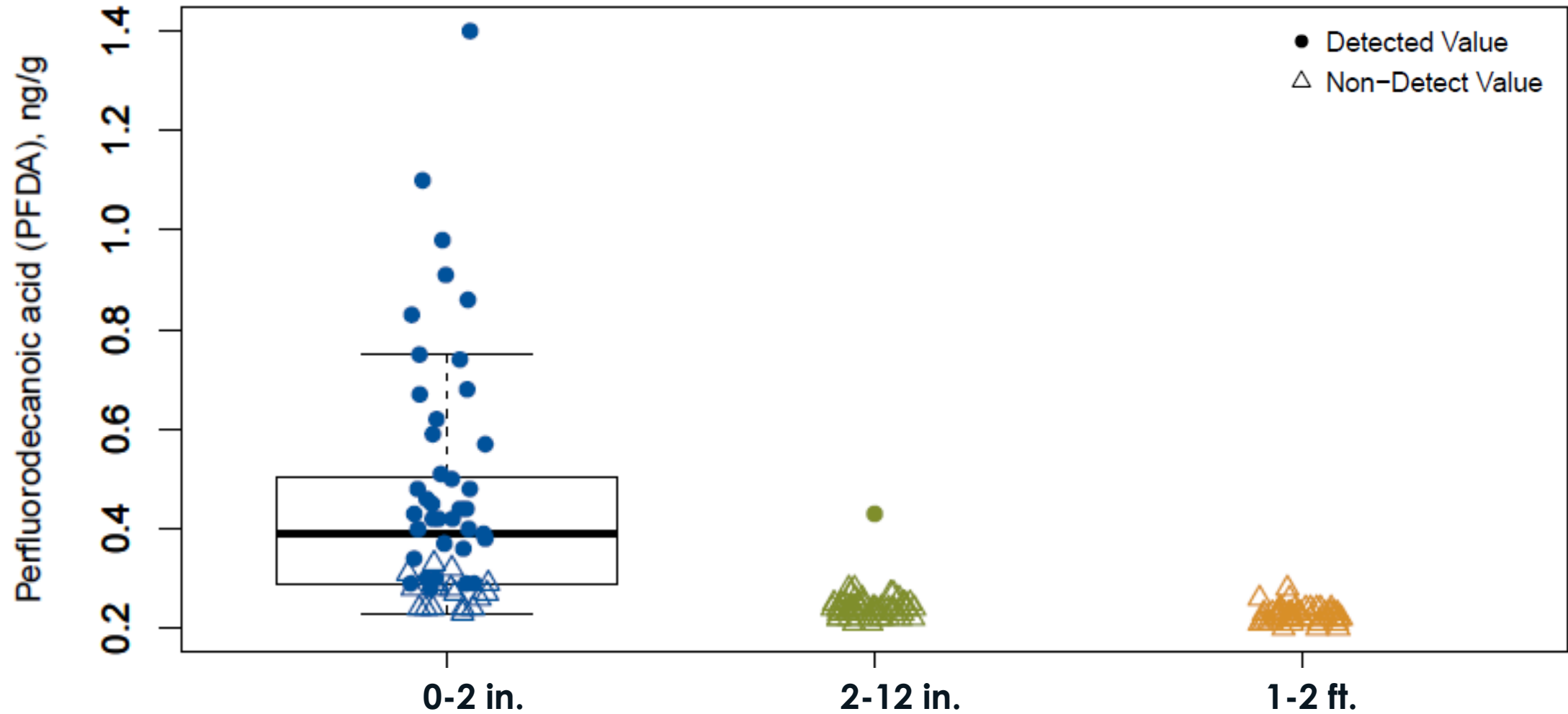
Significant differences in concentration by sampling interval

Total Organic Carbon (TOC)



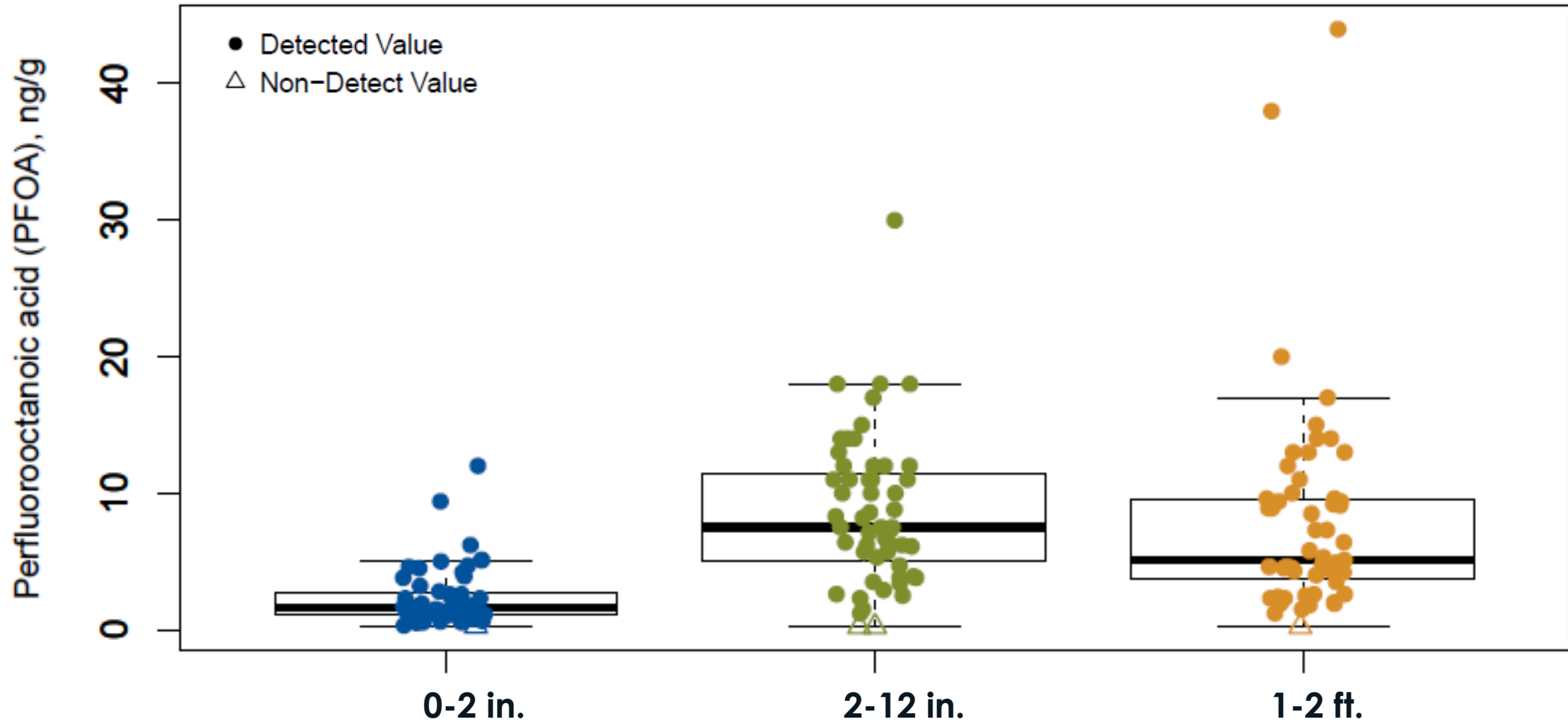
Significant differences in concentration by sampling interval

PFDA

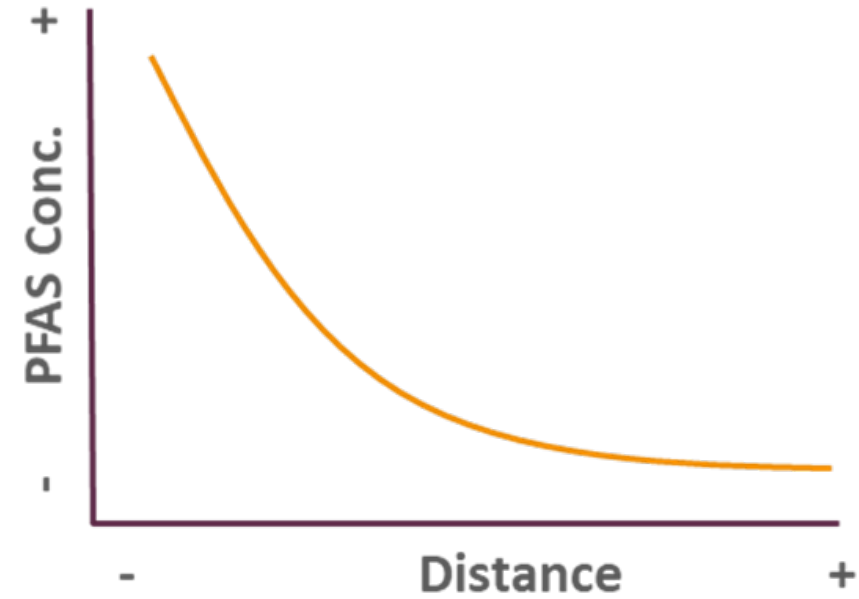


Significant differences in concentration by sampling interval

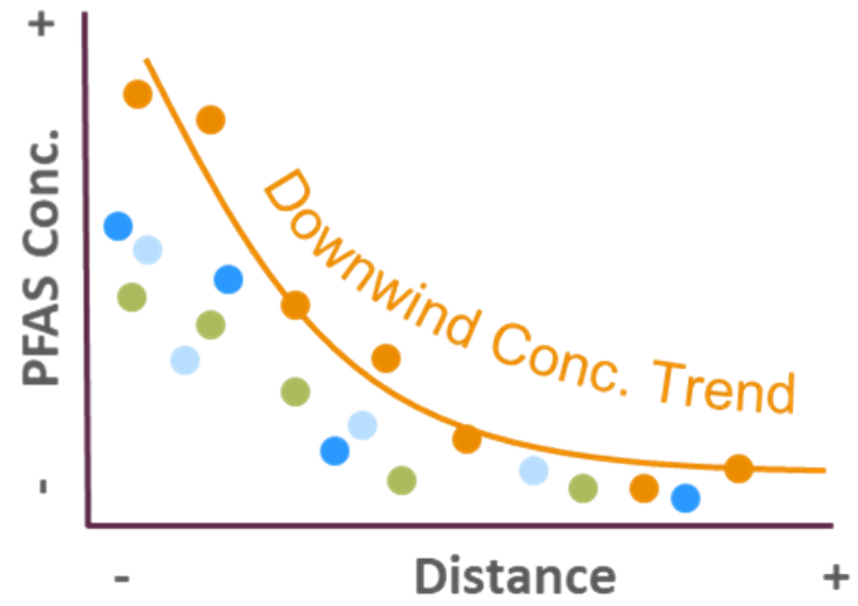
PFOA



PFAS concentrations consistent with source(s) within study area were anticipated to demonstrate:

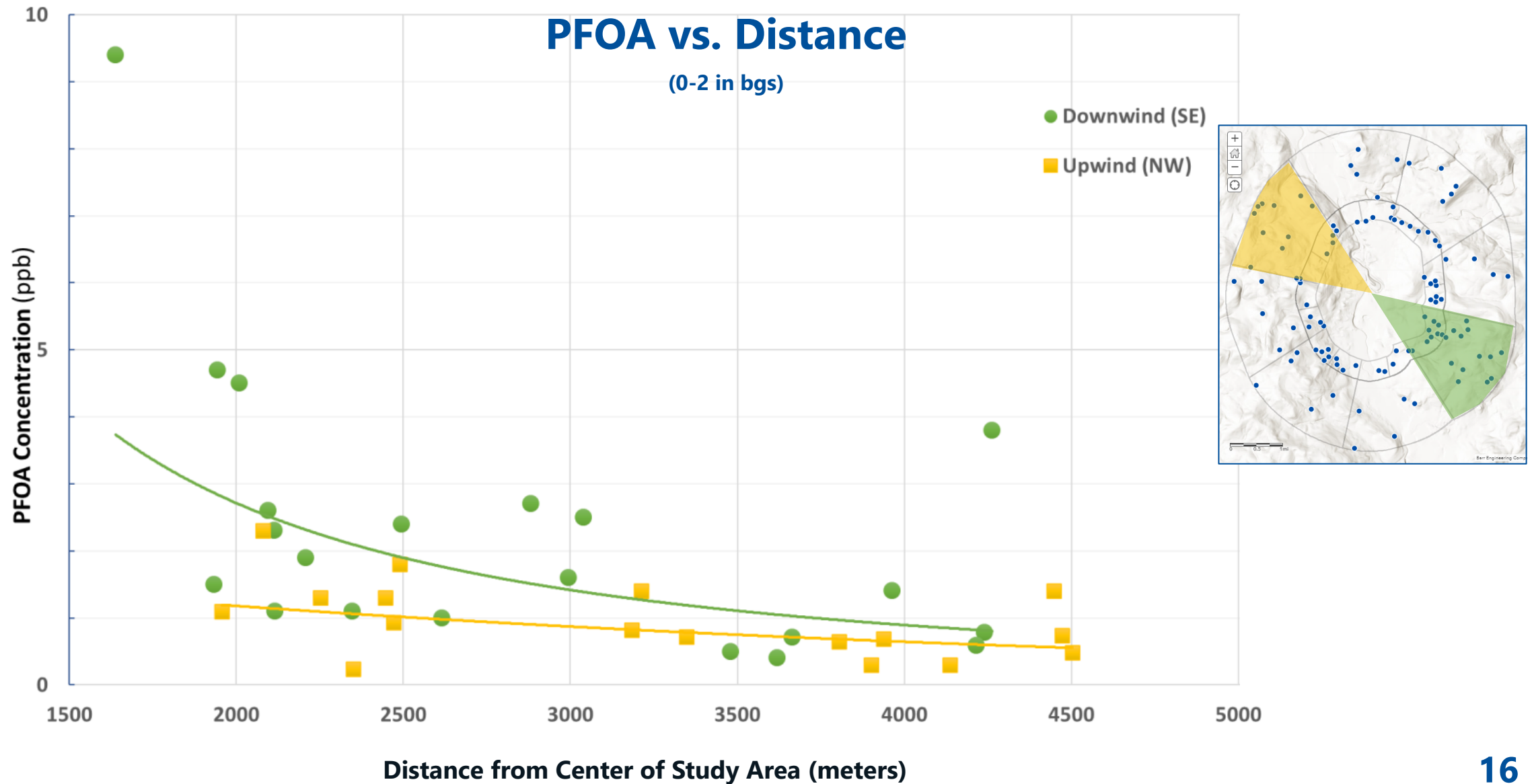


Decreasing with distance in all directions

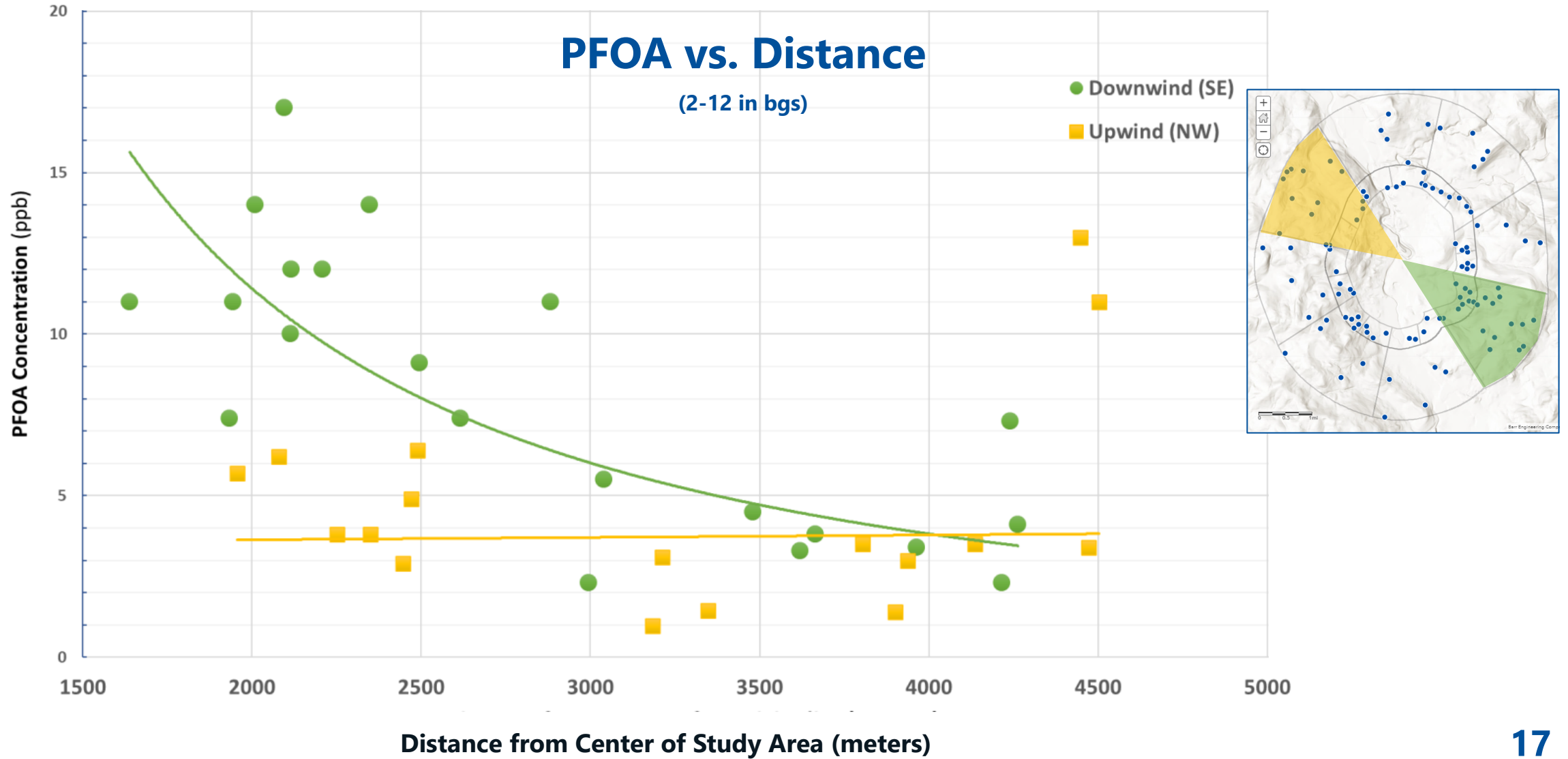


Highest in predominant downwind direction

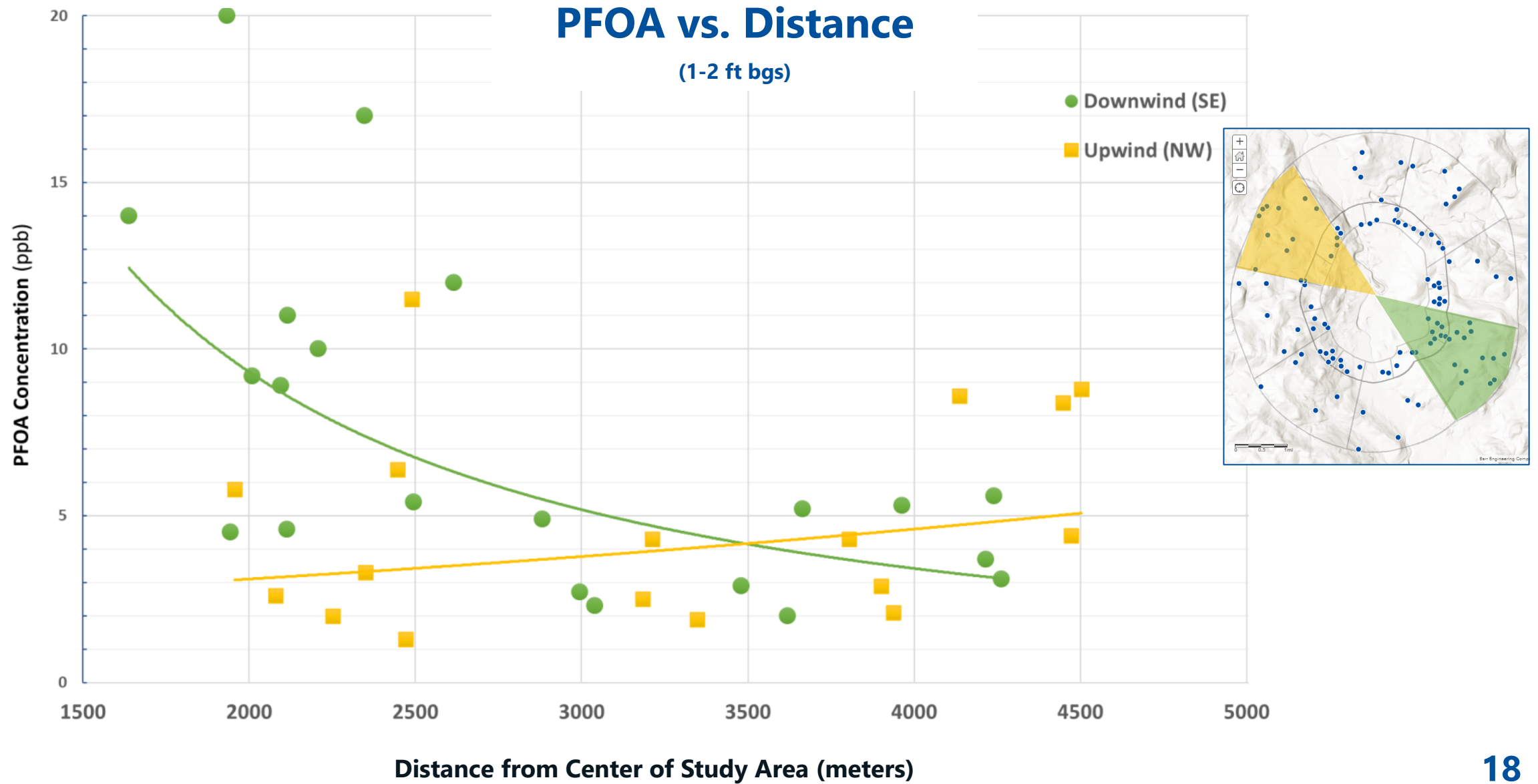
Decreasing trend with distance (upwind and downwind)



Trends intersect at distance

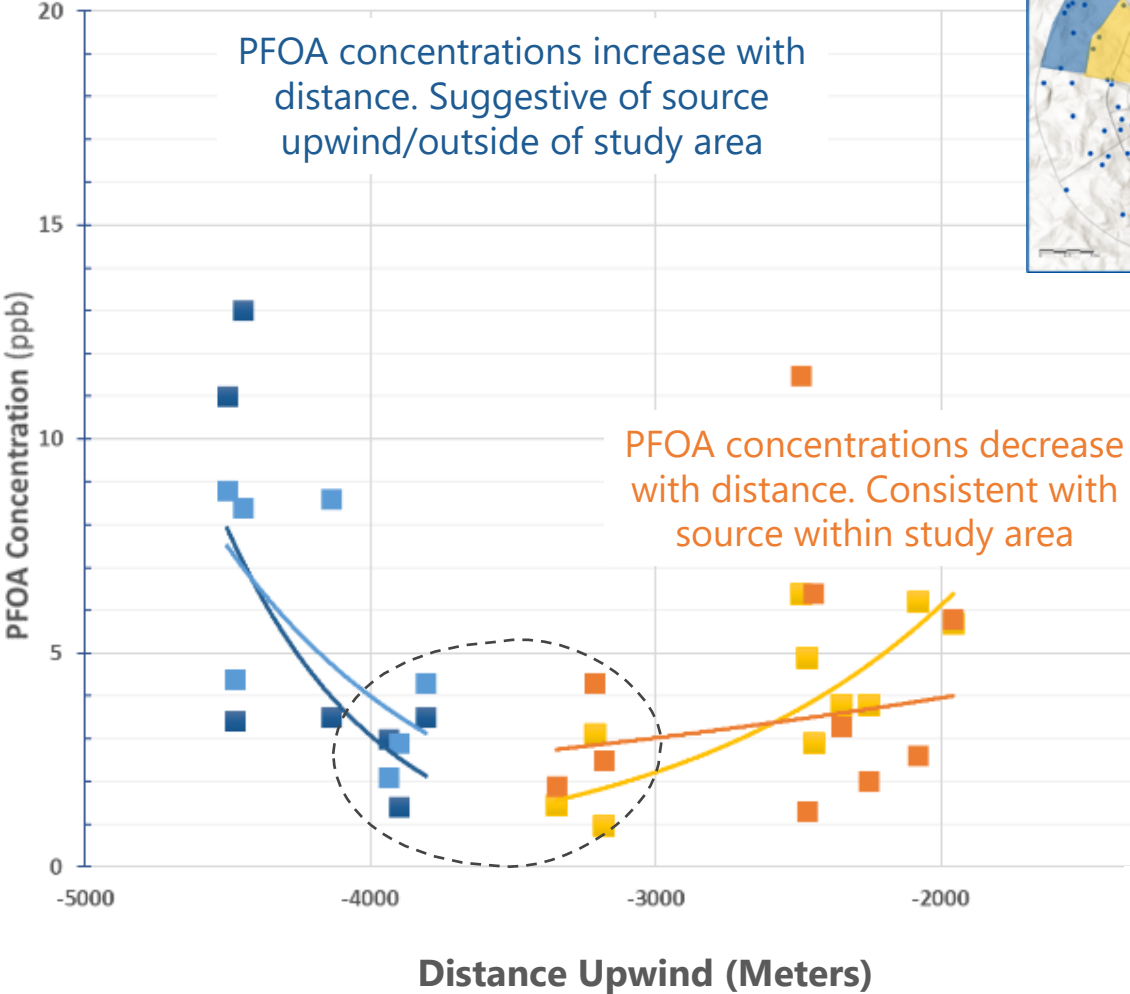


Concentrations higher upwind at distance

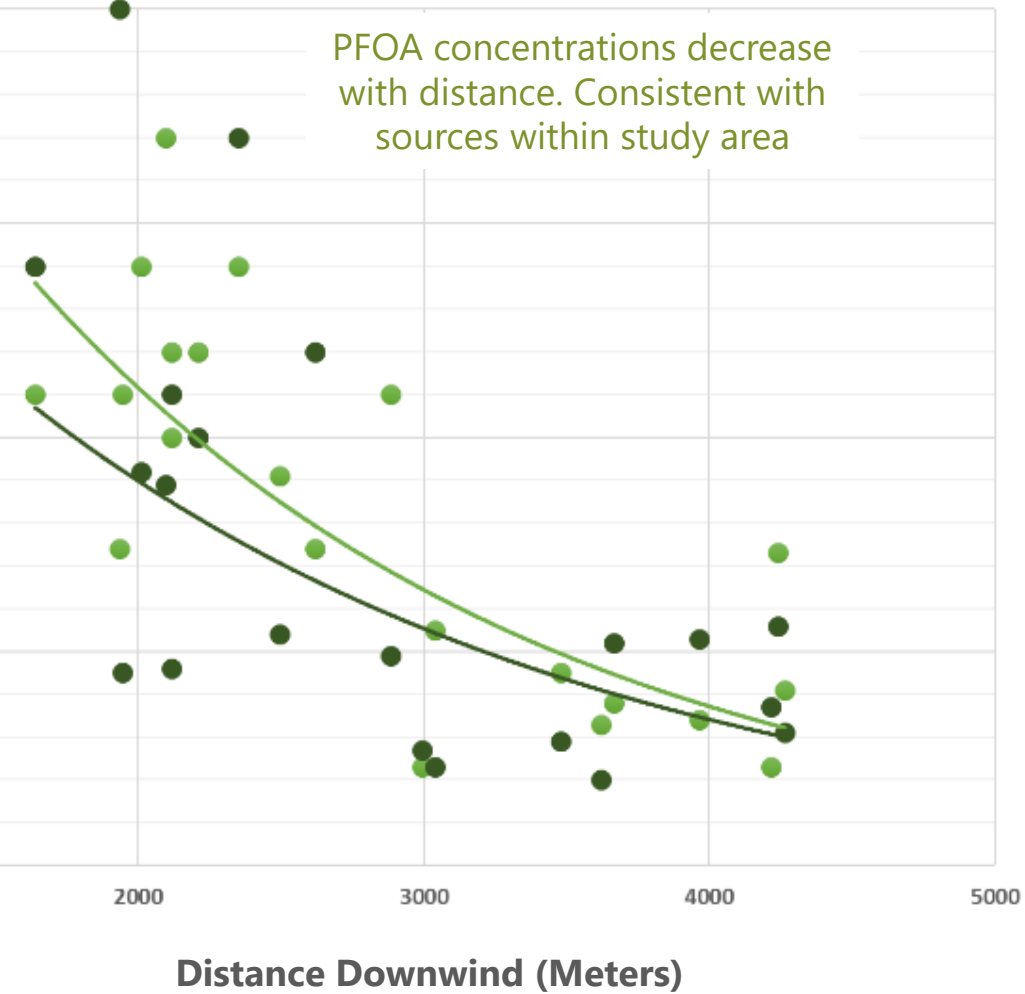


Upwind sources indicated

Upwind

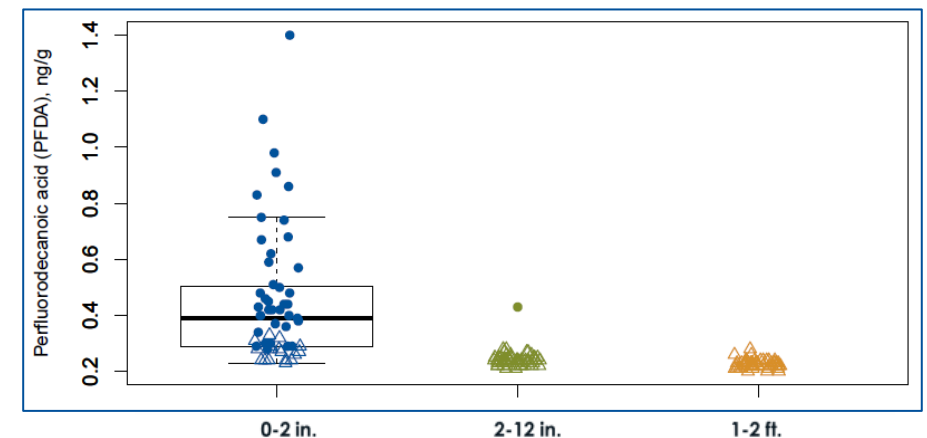
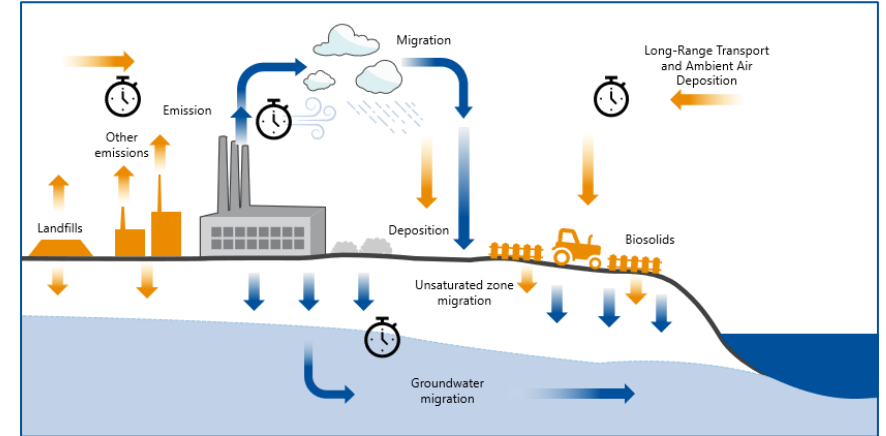


Downwind



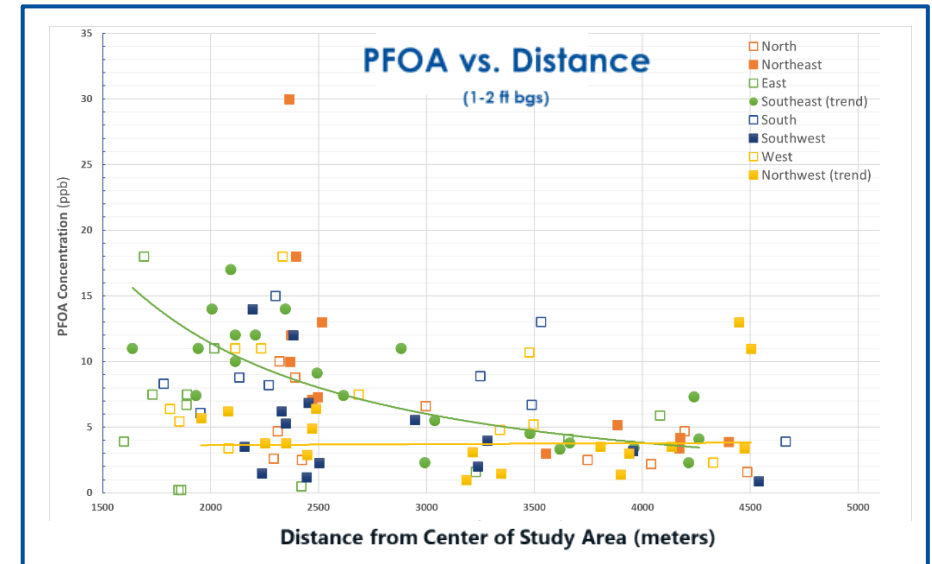
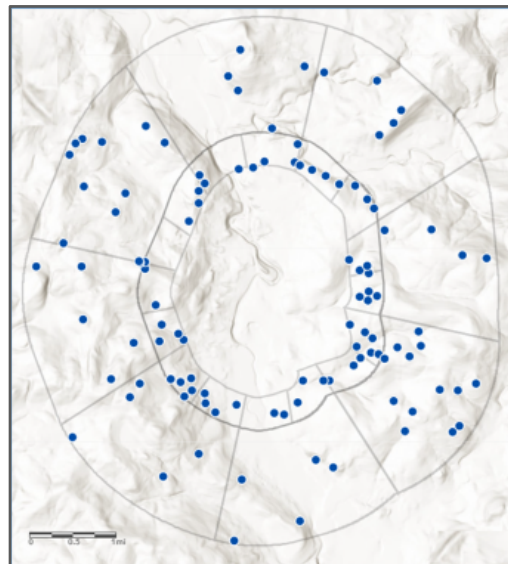
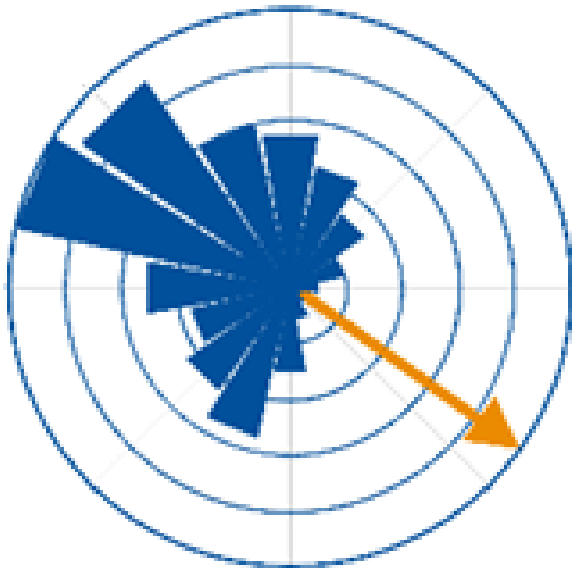
Key Take-Aways

- Sample location vetting and selection were key
 - Reduces potential influence from potential sources/pathways
 - Confidence in representativeness
- Undisturbed soils may serve as a record of historical PFAS deposition
 - Important consideration for characterizing background conditions
 - Important considerations for disturbed soils
- Sample interval considerations
 - Wide intervals may “dilute” detections in surface soils
 - Caution in comparing samples with different intervals



Key Take-Aways

- Delineation is possible.....
 - CSM-focused investigation design
 - Large datasets likely needed
 - Expect other sources/background



Thank you

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