Potomac Aquifer Recharge Monitoring Laboratory Update

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March 18, 2022

Highlights:

- Physical chemical monitoring by PARML
- PFAS and NDMA removal on GAC
- MCL and health advisory values versus SWIFT water concentrations
- Arsenic – Evaluation of mobilization/immobilization

PARML Monitoring

Analytical Capabilities

TOC, DOC, DO, pH, temperature, turbidity, specific conductance, UV absorbance, metals (As, Mn, Fe), synthetic organics by GC-MS (nitrosamines, 1,4 dioxane)

Monitoring Using Commercial Laboratories

PFAS, hydrogen and oxygen isotopes

Where We Monitor

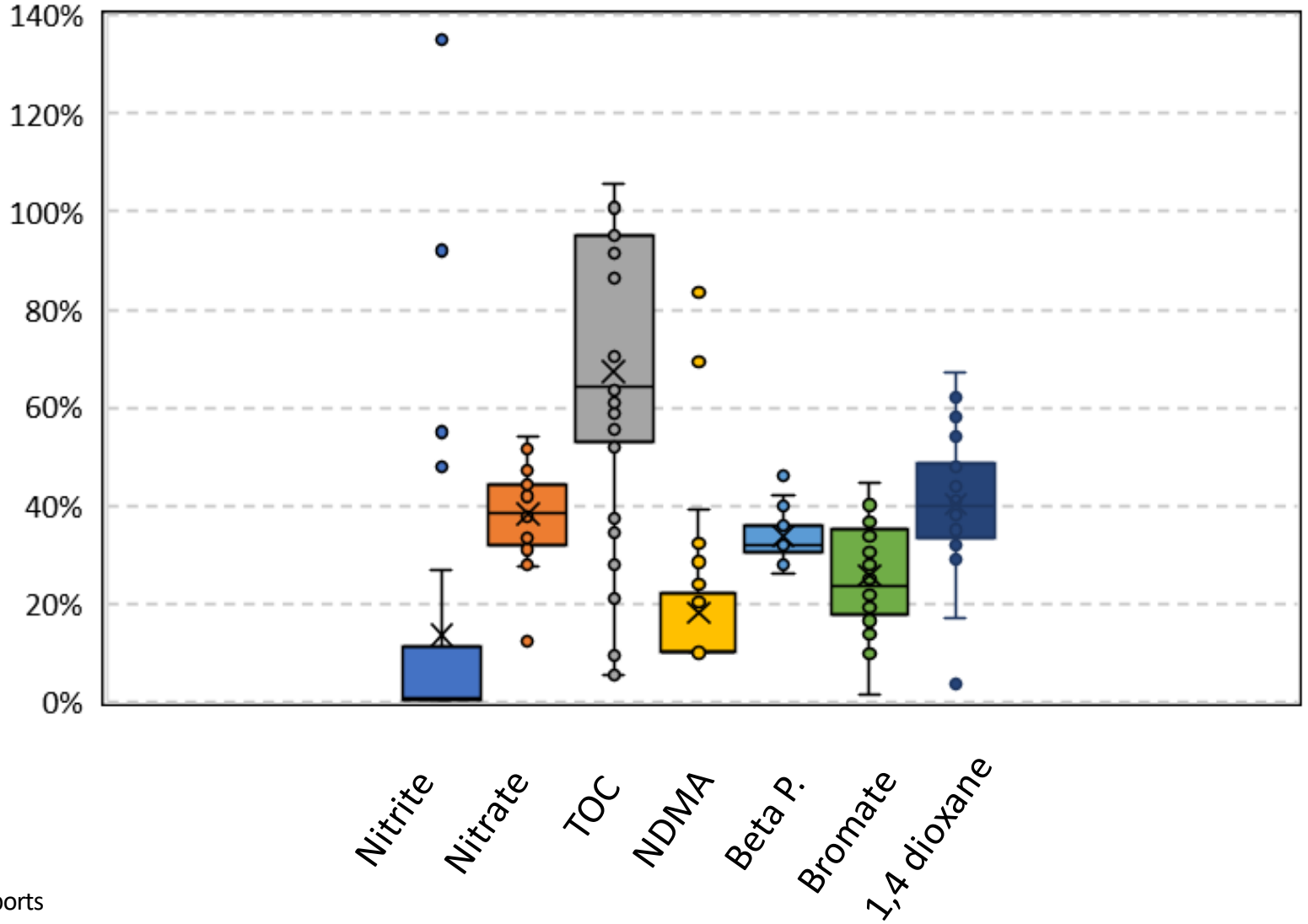
Before/after each unit process at SWIFT RC, MW-SAT wells, UPA, MPA, LPA

Newest Major Laboratory Acquisition

Solid Phase Extraction Instrument

Used for extracting and concentrating organic compounds from water followed by analysis by GC-MS (at PARML)

Statistical Distributions of Monitored Water Quality Parameters in SWIFT Water: 2018 - 2022



Reference Concentrations

NO_2^-: 1 mg/L as N

NO_3^-: 10 mg/L as N

TOC: 4 mg/L as C

NDMA: 1 ug/L

Beta P. +: 50 pCi/L

Bromate: 10 ug/L

1,4 dioxane: 1 ug/L

All values from Quarterly Reports

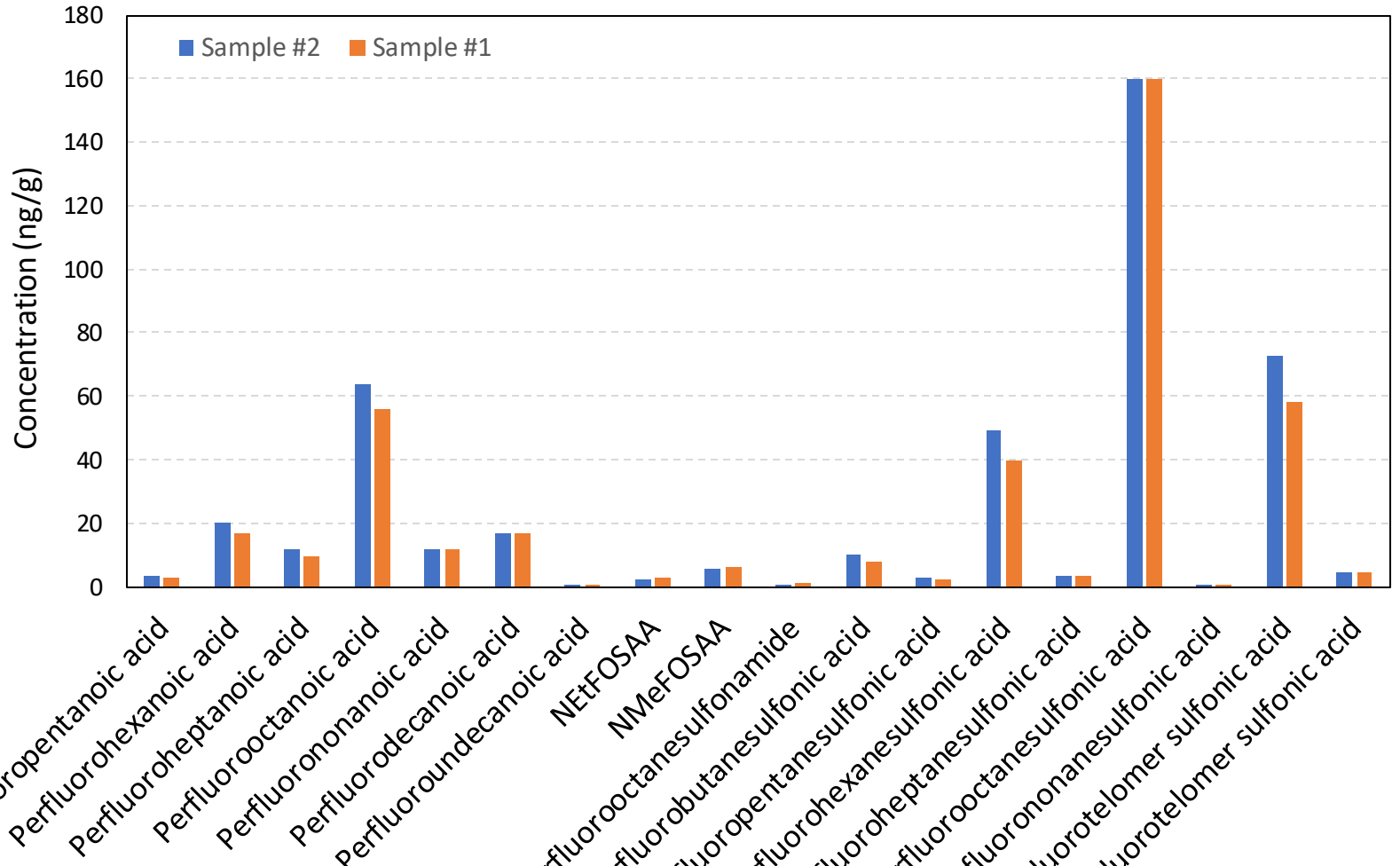
Replacement of Granular Activated Carbon in GAC2 on September 27, 2021, after 26,600 Bed Volumes of Treatment

- Analysis of NDMA and PFAS on <u>two</u> samples collected during removal of spent GAC;
- One sample from the top and the other while GAC was being pumped from the vessel from the bottom
- In the last PAROC meeting we reported on one sample and only NDMA compounds

PFAS Removed on Granular Activated Carbon at SWIFT RC

- Two samples sent to Eurofins where GAC extractions and PFAS analyses were conducted

PFAS Concentrations in Extract from SWIFT Research Center GAC2 Samples



Both extraction of GAC and analysis of PFAS conducted by Eurofins

Calculated Apparent PFAS Removal by GAC2

Evaluated apparent PFAS removal by taking the mass PFAS/gram GAC extracted and converted this to average ng/L removed from water treated based on total mass of GAC and total volume of water treated

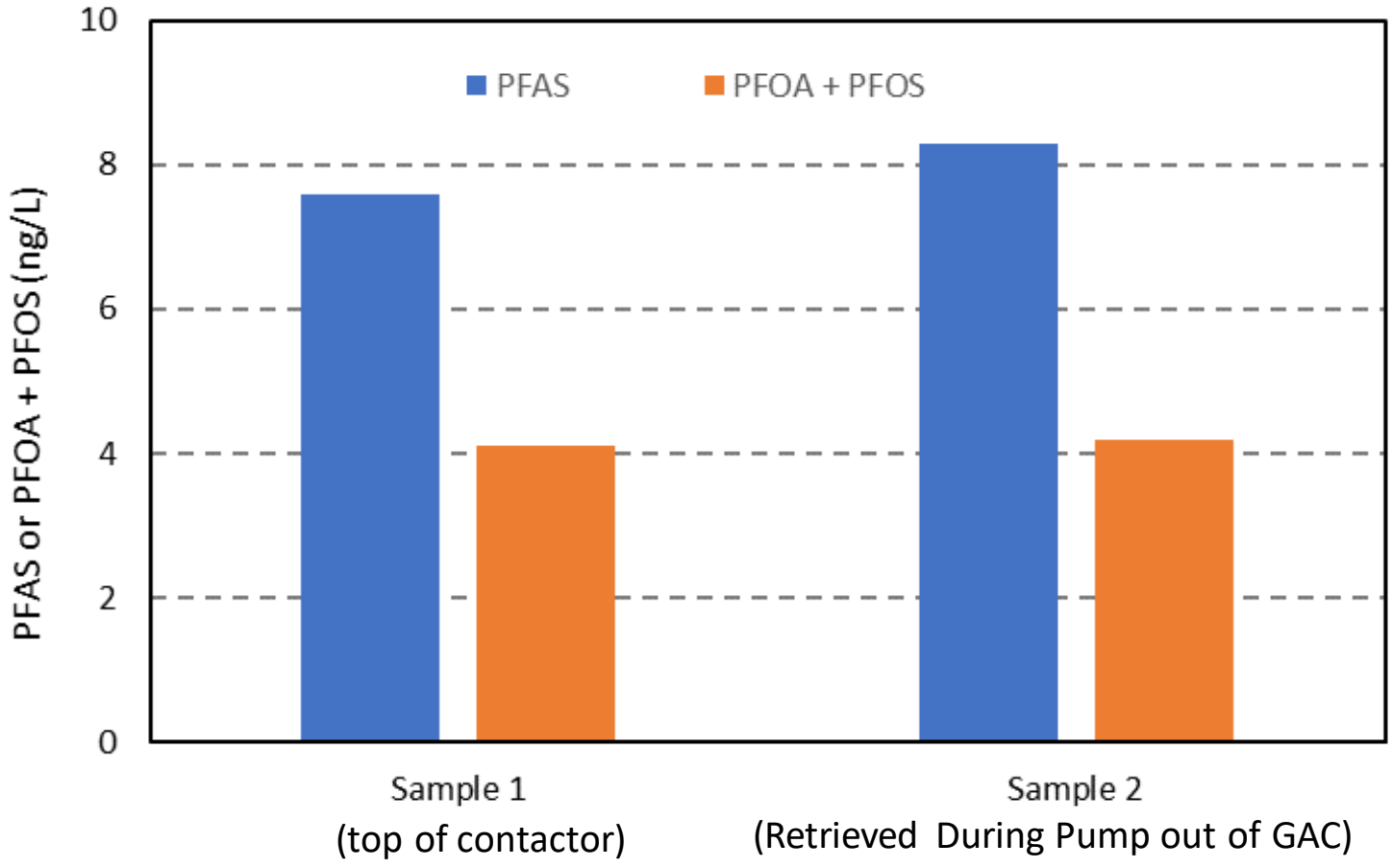
$$Average\ PFAS\ Removal = \left(\frac{ng\ PFAS\ measured}{gram\ GAC\ extracted}\right)\left(\frac{total\ mass\ of\ GAC}{1}\right)\left(\frac{1}{total\ volume\ water\ treated}\right)$$

Total mass of GAC = 40,000 lbs in GAC2

Total Volume of Water = 26,600 bed volumes treated (requires conversion of GAC mass to volume occupied by GAC)

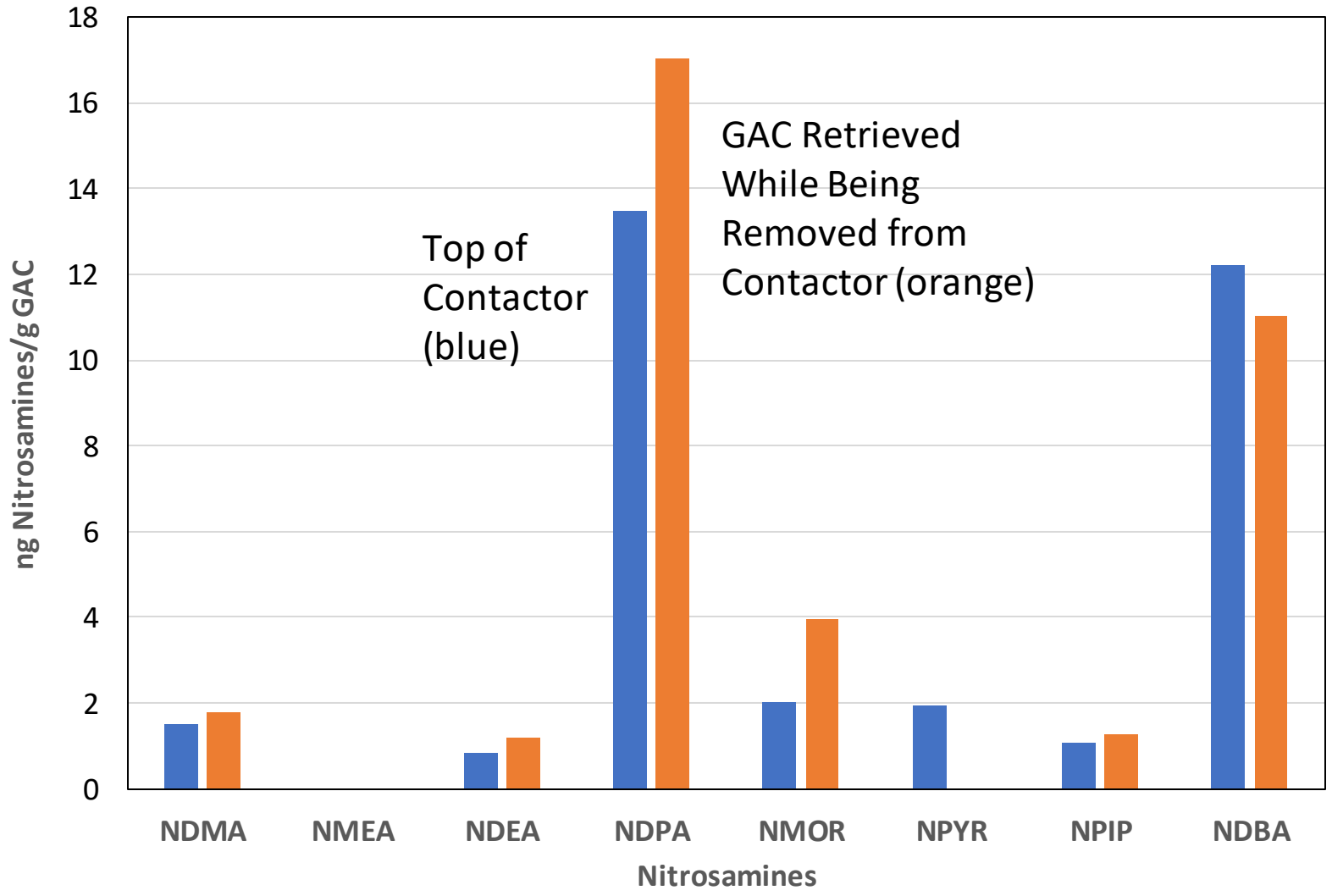
Calgon F-400 apparent density = 0.50 g GAC/cm^3 or 2.0 cm^3/gram GAC

Estimated* Average PFAS and PFOA+PFOS Removed From Water Passing Through GAC2

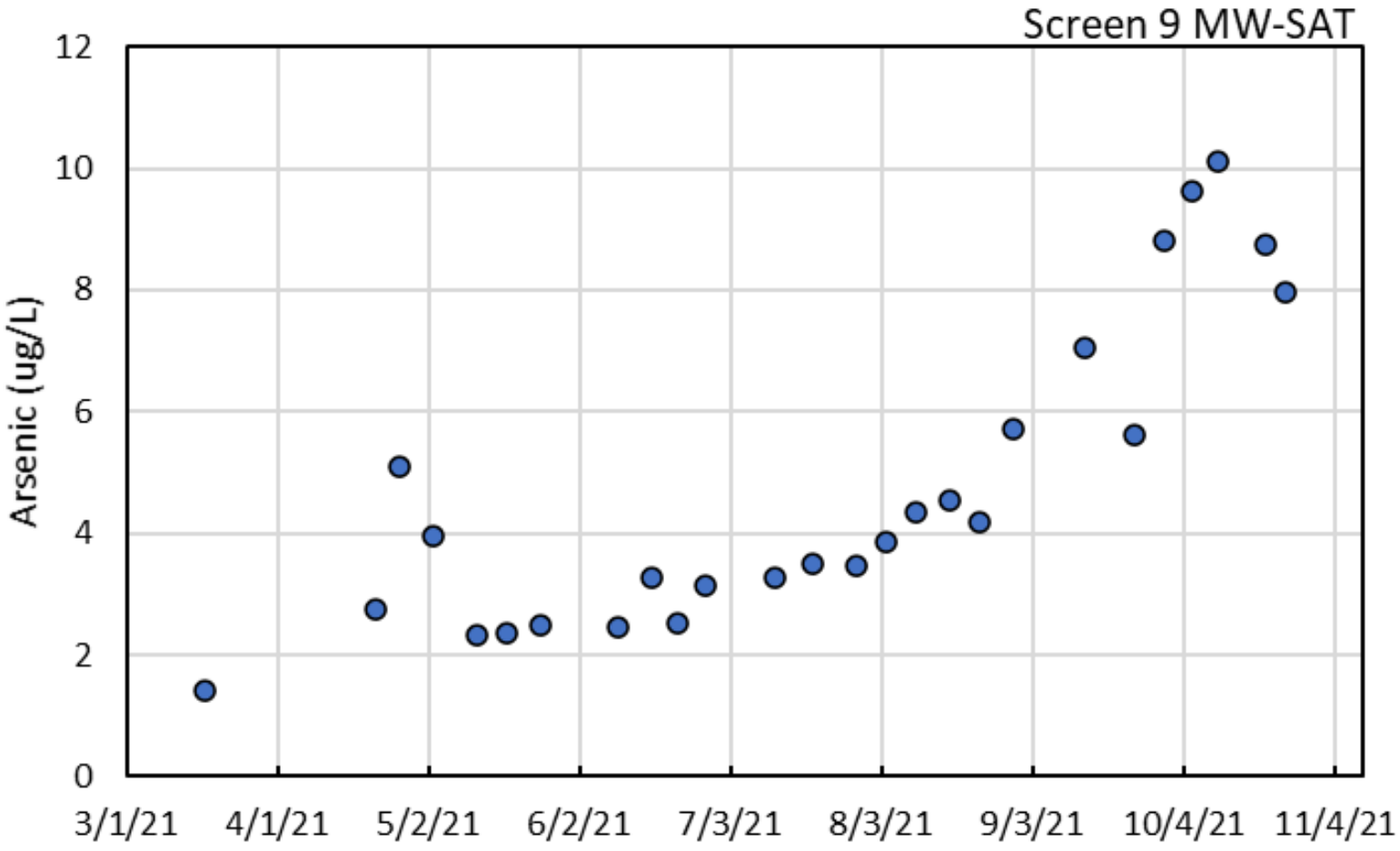


* Does not account for the efficiency of extraction that may vary among the individual compounds.

Nitrosamines Extracted from GAC2



Temporal Variation in Arsenic at MW-SAT Screen 9

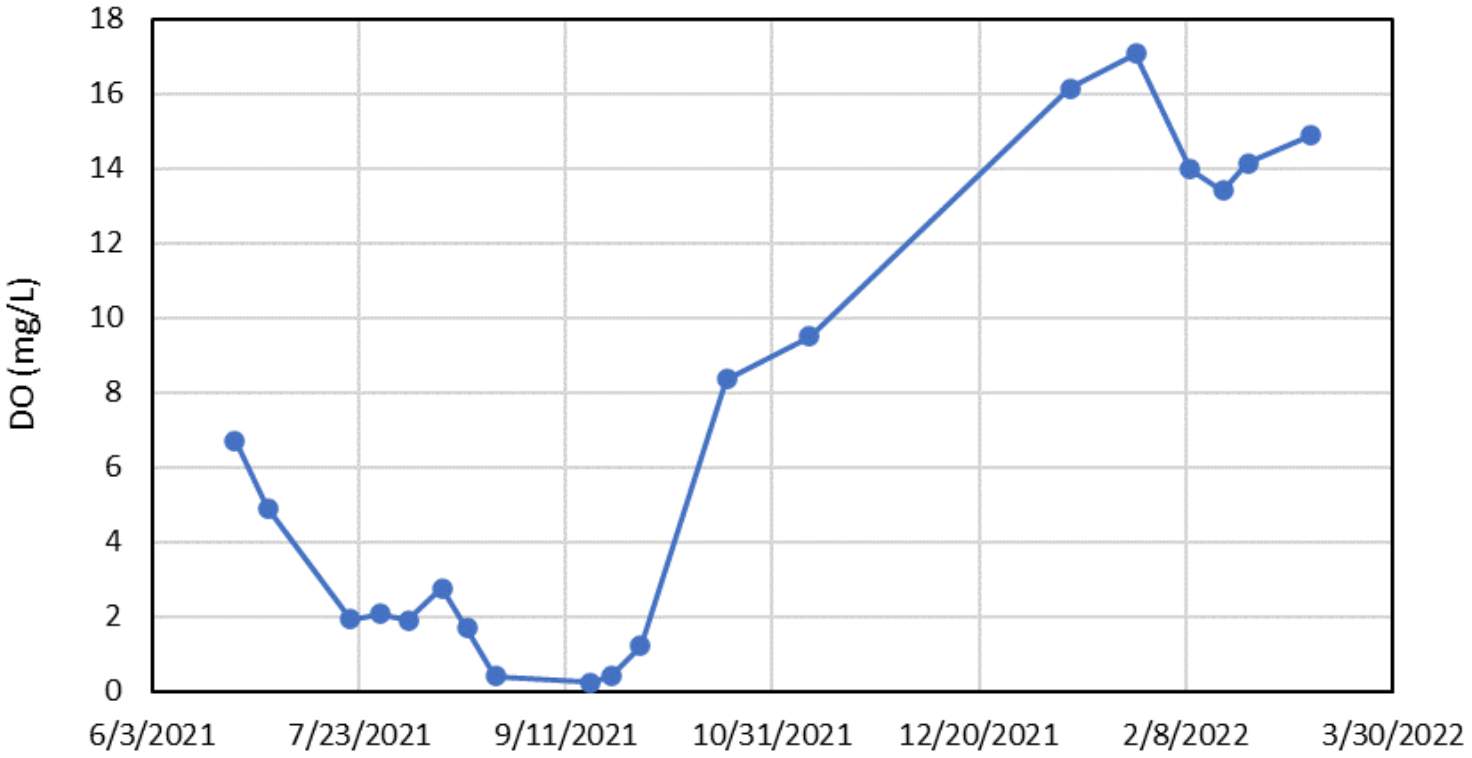


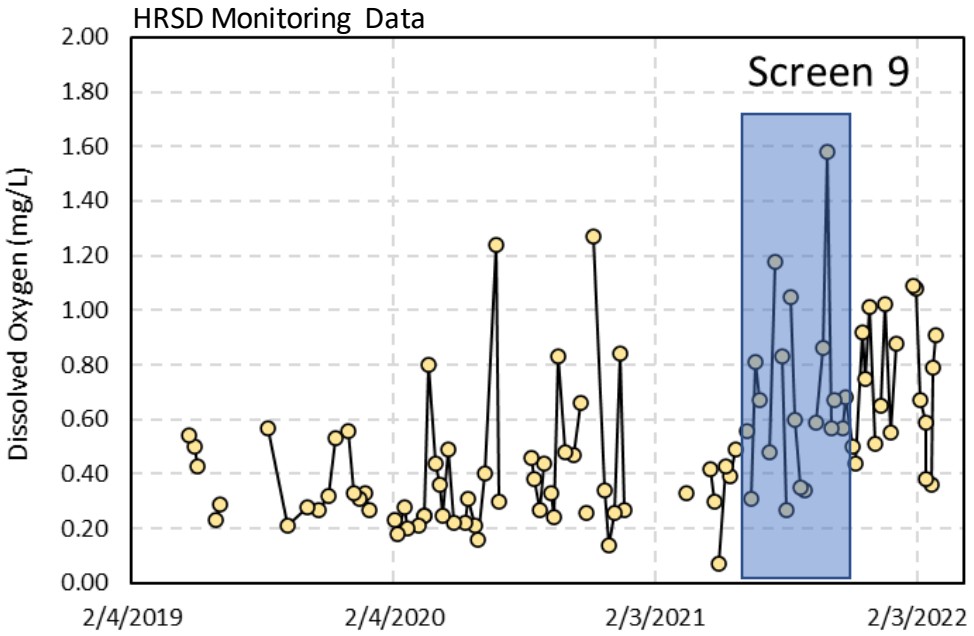
What is the Cause of the Mobilization of Arsenic

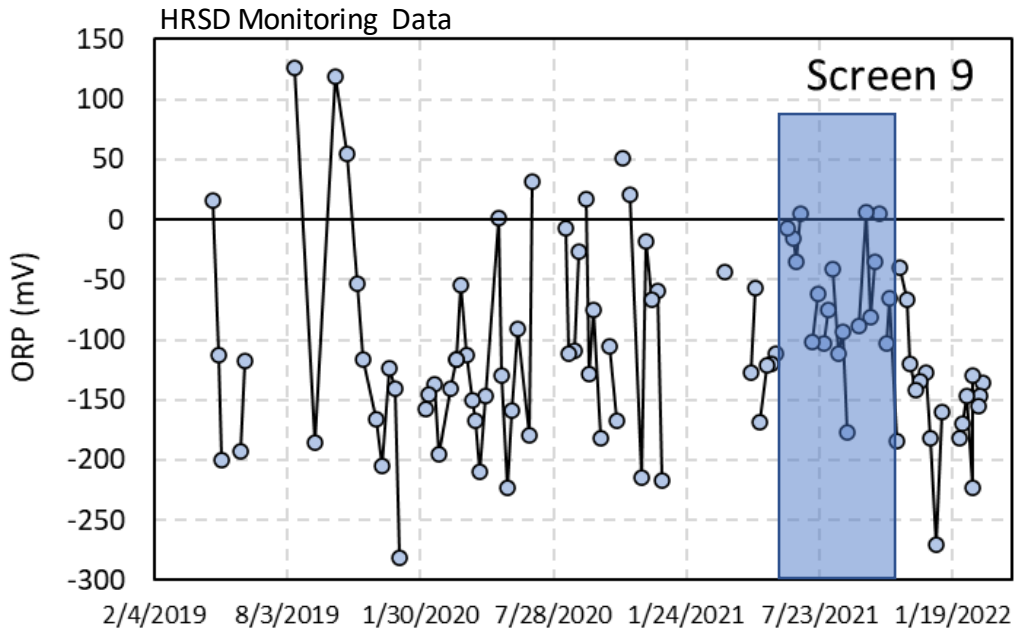
Change in groundwater:

- Dissolved oxygen/redox conditions?
- Ionic strength?
- Organic substrate?
- pH?
- Inorganic carbon?

Dissolved Oxygen Concentrations in SWIFT Water

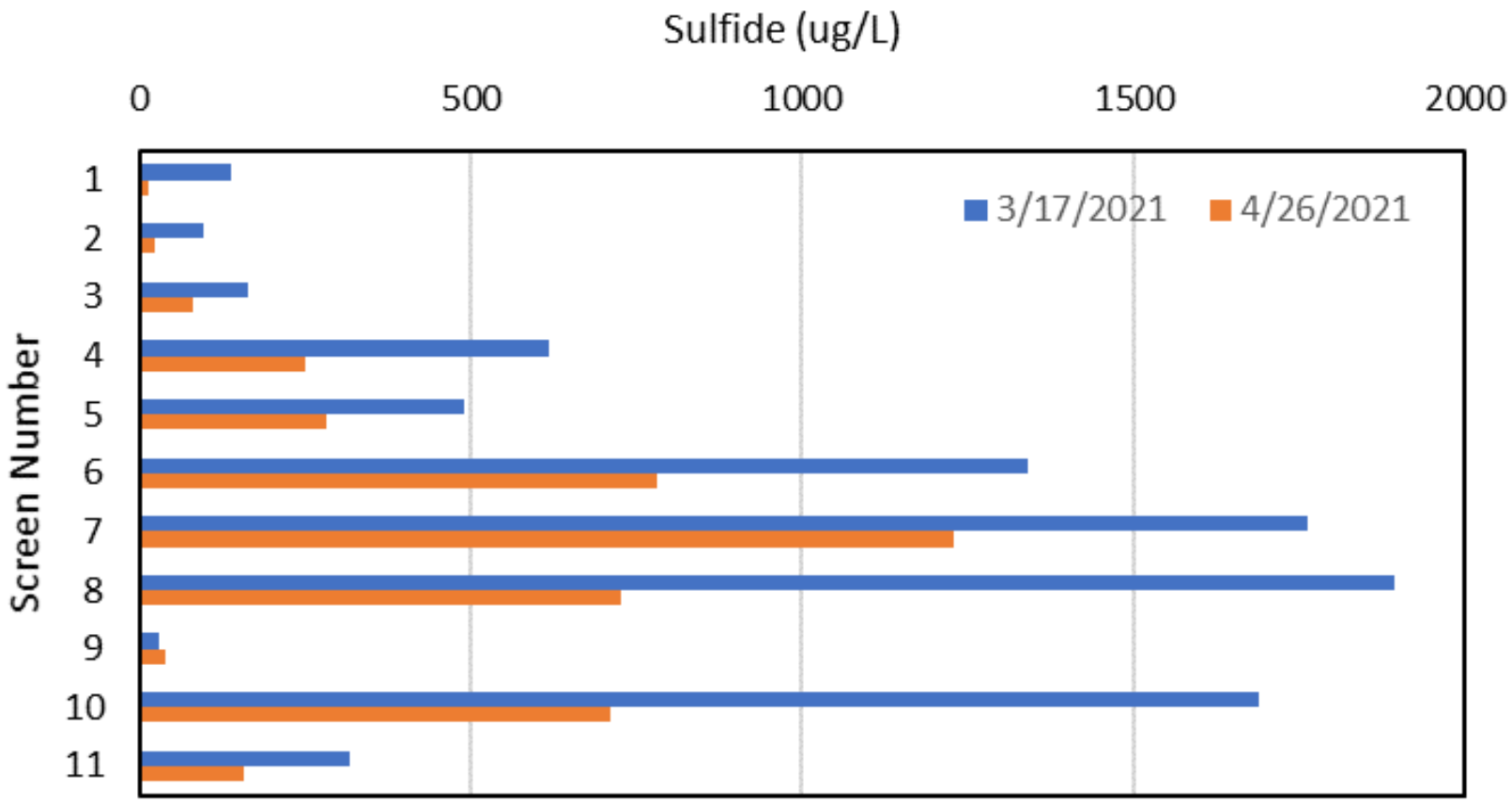




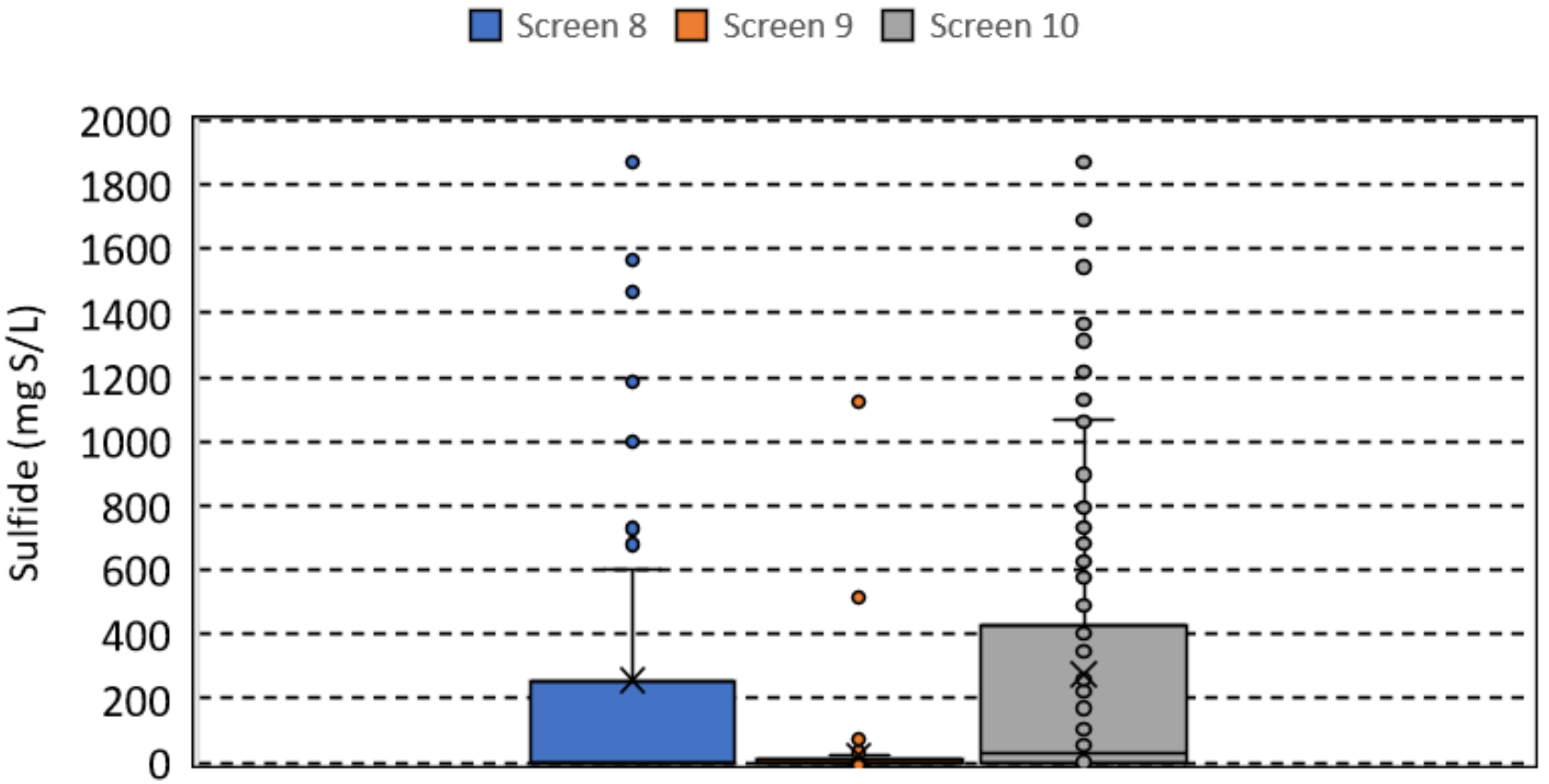


Blue-shaded area = June 1, 2021 to November 1, 2021

Variation in Sulfide Concentration in the Potomac Aquifer at MW-SAT Well

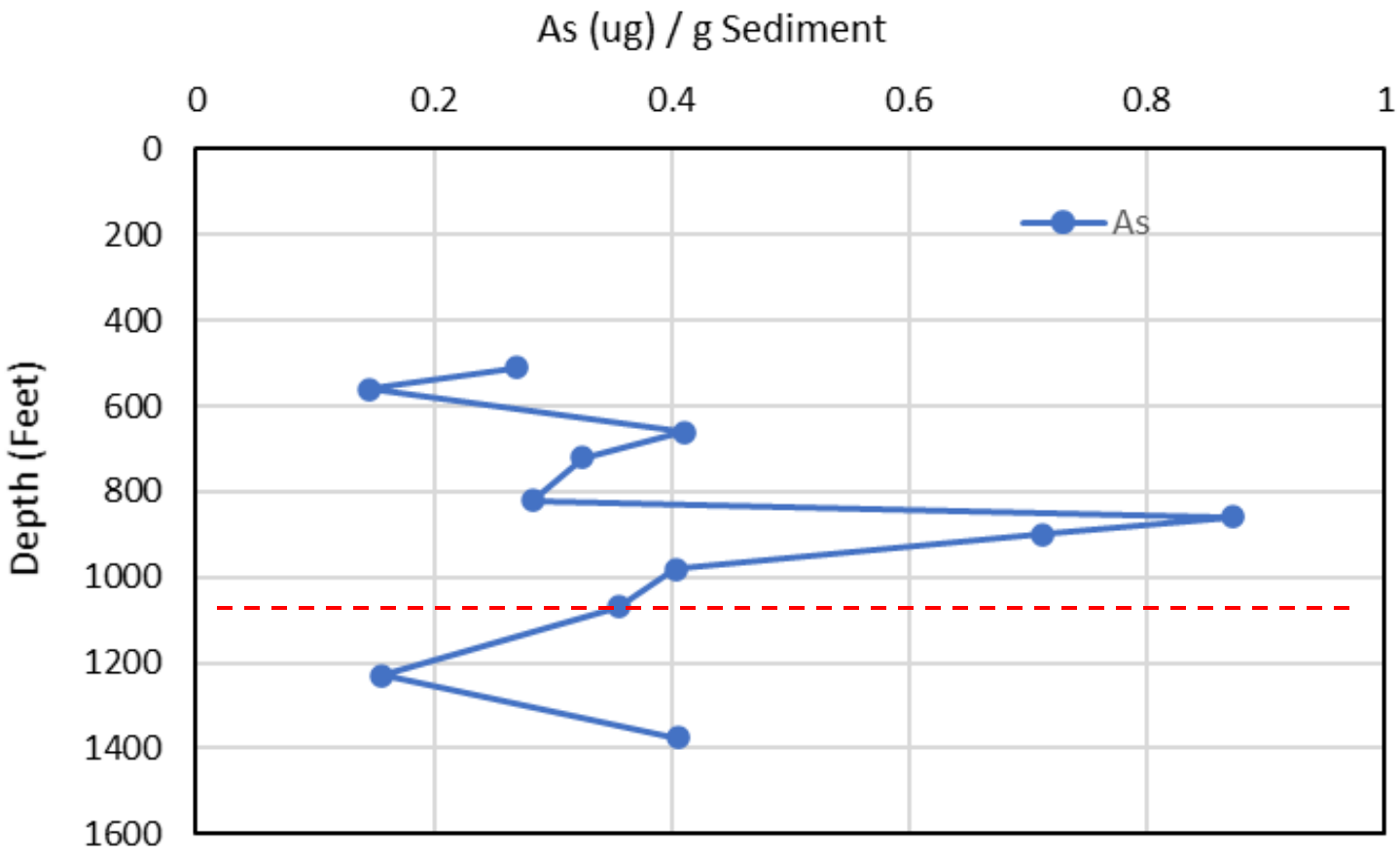


Distribution of Sulfide Concentrations For Indicated Screens: April 25, 2019 – October 11, 2021

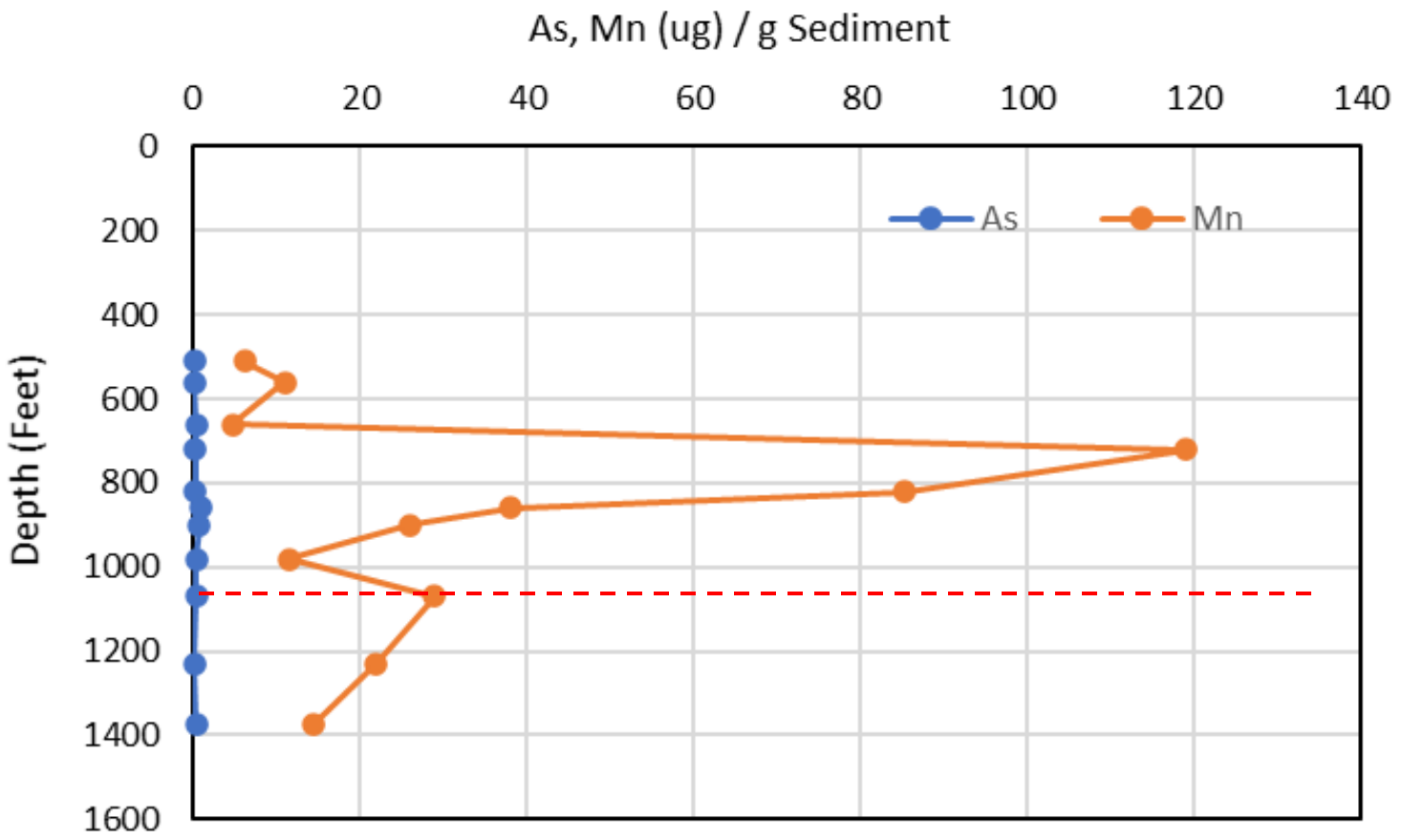


Analysis of Arsenic in Potomac Aquifer Sediments

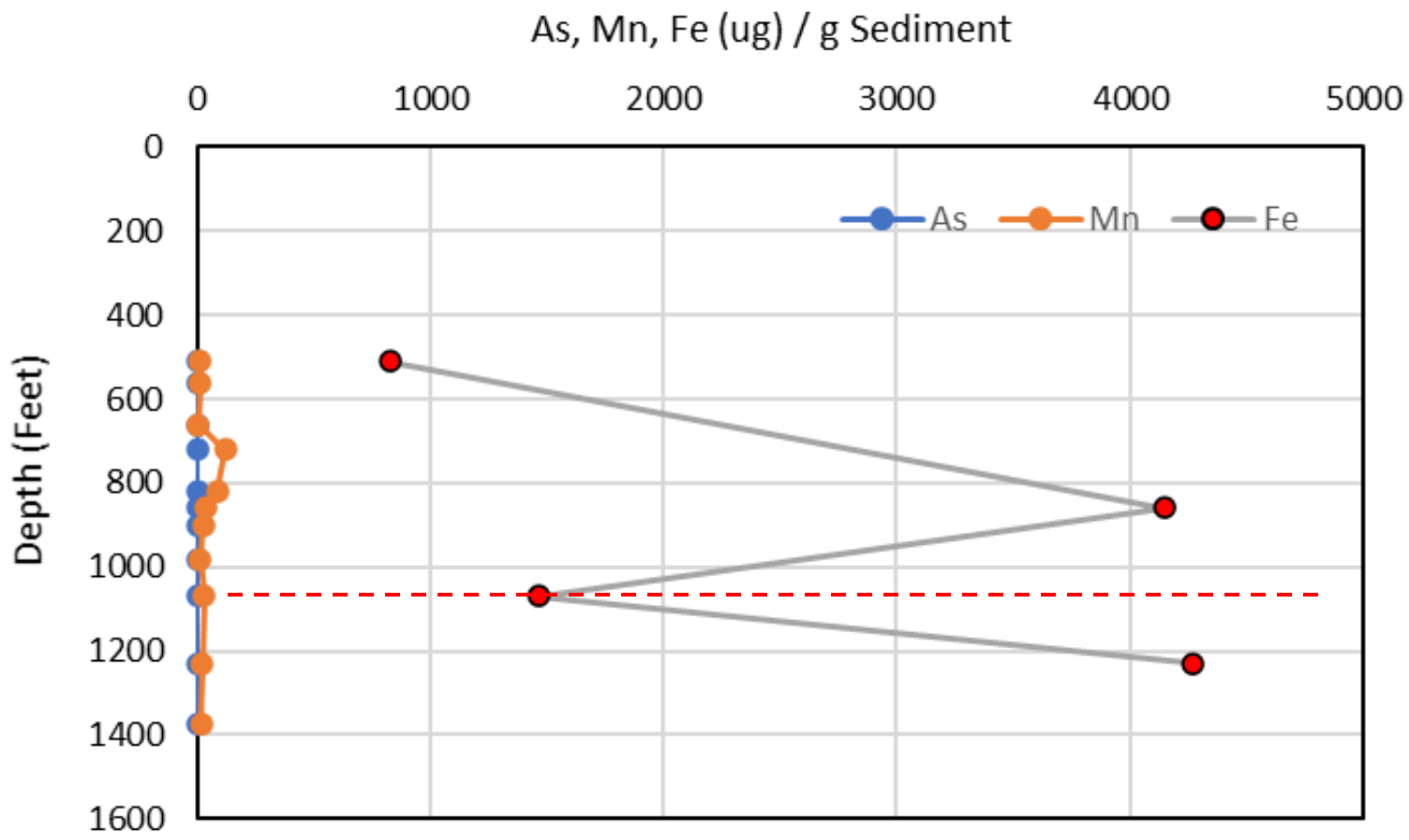
Arsenic Distribution Across the Upper, Middle and Lower Potomac Aquifer



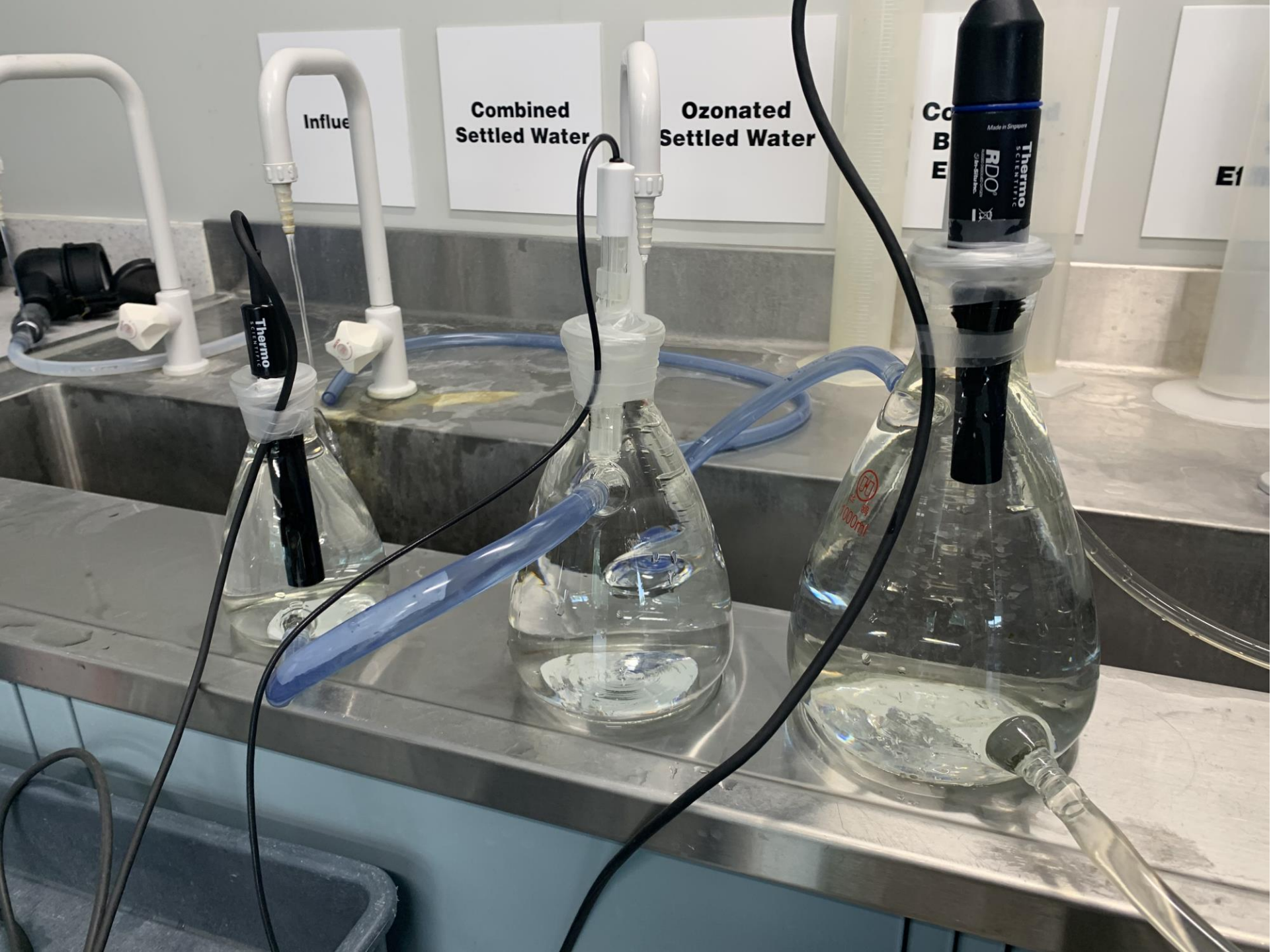
As and Mn Distribution Across the Upper, Middle and Lower Potomac Aquifer



As, Mn, and Fe Distribution Across the Upper, Middle and Lower Potomac Aquifer



Questions?



On-site Measurement of DO, pH, and ORP