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WISCONSIN
DEPT. OF NATURAL RESOURCES

August 5, 2024

MS. DENICE NELSON
JOHNSON CONTROLS, INC
5757 N. GREEN BAY AVENUE
MILWAUKEE, WI 53209

Via Email Only to denice.karen.nelson@jci.com

SUBJECT: Response to *GETS Progress Report #3 (Nov. 13, 2023 – May 12, 2024)*
JCI/Tyco FTC PFAS, 2700 Industrial Parkway South, Marinette, WI
BRRTS #02-38-580694

Dear Ms. Nelson:

On June 3, 2024, the Wisconsin Department of Natural Resources (DNR) received the GETS Semi-Annual Monitoring Report (the "GETS Progress Report #3") for the above-referenced site (the "Site"). The report was submitted by Arcadis U.S., Inc. (Arcadis) on behalf of Johnson Controls, Inc. and Tyco Fire Products LP (JCI/Tyco) and was accompanied by the fee required under Wisconsin Administrative Code (Wis. Admin. Code) § NR 749.04(1) for DNR review and response.

In this letter, the DNR provides a review of the groundwater extraction and treatment system (GETS) relative to the performance criteria JCI/Tyco set for this interim remedial action and requests that JCI/Tyco respond to questions the DNR has on JCI/Tyco's proposed updates to the GETS.

Background

JCI/Tyco is investigating and responding to the discharge of per- and polyfluoroalkyl substances (PFAS) to the environment at the JCI/Tyco Ansul Fire Technology Center (FTC), located at 2700 Industrial Parkway South in Marinette, Wisconsin. The discharge occurred as the result of fire suppressant training, testing, research and development of PFAS-containing aqueous film forming foams (AFFF) at the Site starting in the early 1960s.

JCI/Tyco's site investigation revealed PFAS concentrations greater than 10,000 parts per trillion (ppt) in groundwater beneath and to the east of the FTC property, which contributes to PFAS upwelling into the surface water in Ditch B and migration of PFAS to the Bay of Green Bay. In Feb. 2021, JCI/Tyco proposed an interim remedial action – the GETS – to capture and treat highly contaminated groundwater that is migrating east from the FTC and upwelling into Ditch B.

The GETS includes nine vertical groundwater extraction wells that pump and convey contaminated groundwater through buried pipes to a treatment building on the FTC property. Treatment includes oxidation, filtration, granular activated carbon (GAC) and ion exchange resins to remove PFAS from the groundwater. The treated water is discharged back to Ditch B surface water downstream of where the ditch crosses Pierce Avenue.

NR 205 WPDES Permit

The discharge of treated water to Ditch B is done under a Wisconsin Pollutant Discharge Elimination System (WPDES) General Permit No. WI-0046566-07-0 and the associated coverage letter dated Oct. 15, 2021. The DNR's Wastewater Program administers the WPDES permit. A review of the reporting for the permit is not included with this letter.

Summary and DNR Review of GETS Progress Report #3

GETS Operations:

The GETS has pumped and treated approximately 148 million gallons of groundwater from Nov. 14, 2022, through May 12, 2024. Pumping rates varied across the extraction wells: EX-5, EX-6, EX-7 were able to sustain higher pumping rates (35 – 40 gallons per minute [gpm]), EX-1 and EX-8 were slightly lower at 30 gpm and EX-2, EX-3 and EX-4 were between 6 and 25 gpm. Minimal water has been pumped from extraction well EX-9 because it was found to have very low concentrations of PFAS and has only been used for sampling after it was constructed. Maintenance to address biofouling has improved pumping rates overall in extraction wells EX-1, EX-2 and EX-3.

The GETS was effective at removing PFAS from the water it treated. For example, perfluorooctanoic acid (PFOA) concentrations in the influent groundwater ranged from 4,500 to 14,000 ppt and the treated water had concentrations less than 3.1 ppt, and for perfluorooctanesulfonic acid (PFOS), the influent groundwater concentrations ranged from 540 to 900 ppt and the treated water had concentrations less than 0.87 ppt. All the concentrations in effluent samples were below the Wis. Admin. Code § NR 102.04 surface water standards for PFOA and PFOS.

GETS Performance Evaluation:

The GETS monitoring results are evaluated below relative to the performance criteria JCI/Tyco established in its July 12, 2021, GETS Long-Term Monitoring Plan (GETS LTMP). A copy of Table 4 from the GETS LTMP and a comparison to the data included in GETS Progress Report #3 are provided in Attachment A.

1. *Has the GETS reduced upwelling of groundwater into the upper, middle, and lower reaches of Ditch B? What locations or conditions are contributing to continued upwelling if any are observed?*

   Operation of the GETS appears to have reduced, but not eliminated, groundwater upwelling into Ditch B (Table 10). The monitoring results suggest that upwelling of contaminated groundwater persists near monitoring points U10 through M07 and in the tributary flowing southwest into Ditch B at Pierce Avenue.

2. *How has the GETS affected groundwater migration paths between the FTC and Ditch B?*

   Operation of the GETS has created a zone of drawdown, which focuses groundwater migration and capture near extraction wells EX-5 and EX-7; however, the GETS has not had a strong effect on the overall groundwater migration pathways between the FTC and Ditch B (Figures 6 and 7). Water levels recorded by transducers set near each extraction well indicate the shallow groundwater remains connected and is most strongly influenced by the temporal changes and short-term precipitation events in the region (Figures 3-5).

(NOTE: On Figure 7, there appears to be a few errors in the water elevations used to develop the potentiometric surface near Ditch B. When corrected, the potentiometric surface shows Ditch B as a gaining stream between monitoring points U10 and U03.)

3. *Have PFAS concentrations in Ditch B surface water diminished? What locations or conditions contribute to observed increases, if any*?

   There has been an overall decrease in the concentration of PFAS in surface water in Ditch B following startup of the GETS; however, the concentrations in Ditch B downstream of the GETS still exceed the Wis. Admin. Code § NR 102.04 surface water standards for PFOA and PFOS (Figure 8 and Table 13).

   One likely contribution to these exceedances is the upwelling of contaminated groundwater that persists, albeit reduced, between monitoring points U10 through M07 as discussed above in item 1 and as shown on the first figure in Attachment B. JCI/Tyco's supplemental monitoring of surface water during this reporting period for points along the tributary to Ditch B near Pierce Avenue revealed that groundwater upwelling introduces PFAS contamination to this surface water tributary that enters Ditch B upstream of extraction well EX-3, near monitoring point M09.

   The high groundwater levels influenced by spring melt and precipitation, and the drainage/runoff through streambanks and wetlands that accompany these events may also contribute to PFAS that continue to exceed surface water standards in Ditch B.

   As noted in Attachment A, JCI/Tyco should prepare trend plots to evaluate the cause of the elevated PFAS concentrations detected in Ditch B. These plots include, spatial plots of PFAS concentrations from the streambed mini-piezometers (see example in Attachment B) and temporal plots that overlay streamflow rate with PFAS concentrations at selected locations.

4. *How has the GETS affected trends of PFAS concentrations in groundwater near the GETS?*

   There has not been a significant change in the PFAS concentrations in groundwater within the area of influence of the GETS. JCI/Tyco reported that concentrations increased in some wells and decreased in others over the last 6 months. These fluctuations are within an expected range and may also indicate shifting flow paths induced by the pumping of the extraction wells. JCI/Tyco indicates that statistical analysis of the trends in groundwater concentrations will be provided once at least eight rounds of data are available. One notable trend is the increase in PFAS observed in the groundwater near extraction well EX-3.

   As noted in Attachment A, the DNR recommends that JCI/Tyco add trend plots for certain PFAS in selected wells within the area of influence of the GETS (see example in Attachment B).

5. *How much PFAS mass has been removed by the GETS over time?*

   Operation of the GETS from Nov. 14, 2022, through May 12, 2024, has removed approximately 6 kg (13.2 pounds) of PFOA and PFOS; a majority of which (~93 percent) is PFOA. Other PFAS are removed by the GETS, but the specific mass removed is not reported (Table 14).

   A majority (around 80 percent) of the mass of PFOA and PFOS removed by the GETS to date has come from groundwater captured from extraction wells EX-5, EX-6, EX-7 and EX-8 (Tables 2 and 5). This is a result of the higher concentrations of PFAS present in groundwater at these well locations and the higher pumping rates sustained to date at these four wells.

6. *Evaluate sustainability of the GETS operation in accordance with Wis. Admin. Code § NR 722.09(2m).*

   The performance parameters (e.g., kilowatt hours and granulated activated carbon [GAC] usage during the reporting period) were included in the report. This information is helpful and JCI/Tyco may consider having similar summaries completed for the Ditch A and Ditch B interim actions to assist in future decision making on remedial actions at the Site.

Proposed Updates to the GETS

Summary of Updates

JCI/Tyco proposed five new extractions wells in three areas (Ditch B, Weathered Bedrock and Ditch A) and additional monitoring to accompany these updates to the GETS. JCI/Tyco plans to request approval for high-capacity wells for the proposed increase in the volume of groundwater to be extracted by the GETS and to request modifications to the WPDES permit for proposed changes to the existing treatment system that will be required to accommodate the higher flow volume.

The proposed upgrades are described in Appendix A and Figure 15 of GETS Progress Report #3. The DNR's understanding of the proposed updates to the GETS are summarize below.

Ditch B:

- System Update: Add two new extraction wells (EX-3S and EX-4S) to enhance groundwater capture and further reduce upwelling of groundwater to Ditch B near existing extraction wells EX-3 and EX-4.
- Monitoring Update: Add a piezometer next to each new extraction well to monitor groundwater levels. Include surface water monitoring points SW-P1, SW-P4 and SW-P5 in the GETS LTMP to evaluate if the new extraction wells reduce upwelling and, by effect, the concentration of PFAS in the tributary to Ditch B.

Weathered Bedrock:

- System Update: Convert bedrock monitoring well PX-64-67 to an extraction well (EX-4BR) to capture contaminated groundwater migrating from the FTC property in the weathered bedrock.
- Monitoring Update: Use bedrock monitoring wells PZ-1D and PZ-29-68 to monitor the effect the new extraction well EX-4BR has on groundwater levels. Include bedrock monitoring wells PZ-1D, PZ-28-54, PZ-29-68 and PZ-63-30 in the GETS LTMP to evaluate the effect the new extraction well EX-4BR has on concentration of PFAS in the weathered bedrock layer.

Ditch A:

- System Update: Add two new extraction wells (EX-10 and EX-11) to capture shallow groundwater and prevent groundwater upwelling into Ditch A.
- Monitoring Update: Add a piezometer next to each new extraction well EX-10 and EX-11 to monitor groundwater levels. Include groundwater monitoring wells HMW-2-1S and PZ-70-17 and surface water monitoring points SW-25 and SW-27 in the GETS LTMP to evaluate the effect the new extraction wells have on concentration of PFAS in groundwater and surface water near where Ditch A flows south off the FTC property. (The PFAS concentrations in the influent and surface water monitoring point SW- 40 that are collected as part of monitoring for the existing Ditch A treatment system will also be included in the evaluation of performance for extraction wells EX-10 and EX-11.)

DNR Review Proposed Updates to the GETS

The remedial objectives established by JCI/Tyco in its Feb. 2021 Remedial Action Plan for the GETS were to (1) reduce upwelling of PFAS-contaminated groundwater into Ditch B; (2) treat the recovered groundwater to reduce the PFAS concentration in the water; and (3) reduce PFAS-mass flux throughout groundwater plume.

Generally speaking, the proposed updates to the GETS should help reduce PFAS-mass flux in groundwater and the updates for Ditch B will likely help reduce the upwelling near Pierce Avenue. However, there is insufficient information provided to determine if the proposed updates have been optimally designed towards these qualitative objectives.

Prior to implementing the proposed updates to the GETS, the DNR requests that JCI/Tyco submit a response to the following questions:

General:

- What are the design specifications and anticipated pumping rates for the new extraction wells?
- Will the flow rates and concentrations from each new extraction well be monitored at the influent to the GETS building as is done for the current extraction wells?
- How/where will the new extraction wells connect to the treatment building?
- How will the additional volume of groundwater water captured by the GETS that was not hydraulically connected to Ditch B (i.e., from extraction wells EX-4BR, EX-10 and EX-11) affect the water level, flow rate and upwelling in Ditch B?
- What is the anticipated schedule for installing and putting the new extraction wells online?

Ditch B:

- Did JCI/Tyco evaluate other locations (e.g., near PZ-23) or designs for the new extraction wells to optimize the reduction of upwelling of groundwater in Ditch B between U10 and M07?

Bedrock:

- Why was PZ-64-67 selected for the bedrock extraction well? Did JCI/Tyco evaluate placing a bedrock extraction well where PFAS concentrations are higher (e.g., near PZ-69-30, PZ-4D or closer to the eastern FTC property boundary) to optimize the reduction of PFAS-mass flux in the weathered bedrock?
- Will, or did, JCI/Tyco perform a short-term pumping test on the proposed bedrock extraction well to evaluate potential pumping rates, drawdown and yield?
- What monitoring will JCI/Tyco perform to confirm that pumping from a bedrock extraction well does not pull groundwater down from the overlying unconsolidated aquifer?
- Does JCI/Tyco expect that water levels in monitoring wells PZ-1D and PZ-29-68 will be influenced by pumping in well PZ-64-67? Why was a piezometer adjacent to the new bedrock extraction well not proposed as was done for the extraction wells in the unconsolidated aquifer?

Ditch A:

- Is JCI/Tyco proposing a new remedial objective for the GETS associated with Ditch A?
- Does JCI/Tyco intend to continue to run the Ditch A treatment system?
- What is the design basis for the locations selected for extraction wells EX-10 and EX-11?

- How were the gaining/losing conditions of Ditch A on the FTC property factored into the proposed updates to the GETS in this area?
- Previous monitoring has shown that concentrations of PFAS in Ditch A increase between surface water monitoring points SW-40 and SW-26. How will the proposed extraction wells EX-10 and EX-10 reduce PFAS entering Ditch A in the area between surface water monitoring points SW-40 and SW-26? Will JCI/Tyco monitor PFAS in Ditch A at surface water monitoring point SW-26 or other downstream location(s) to evaluate the effect the proposed extraction wells have on downstream concentrations of PFAS in Ditch A?
- Did JCI/Tyco evaluate other locations along the southern boundary of the FTC property to reduce the mass flux of PFAS in groundwater and surface water south of the FTC?
- Why were monitoring well PZ-70-33 and surface water monitoring point SW-26 not included in the monitoring plan?

Next Steps

- Submit the GETS Progress Report #4, in accordance with the schedule outlined in the GETS LTMP (Wis. Admin. Code § NR 724.13 (3)). Please include the specific evaluations noted in Attachment A and evaluate the GETS relative to the performance criteria set in the GETS LTMP (i.e., the six criteria listed above).
- Submit a response to questions on proposed updates to the GETS within 60 days of receipt of this letter (Wis. Admin. Code. NR § 724.09).
- Obtain all necessary approvals and permits for proposed updates to the GETS (Wis. Admin. Code. NR § 724.09).
- Submit an addendum to the GETS Construction Documentation Report within 60 days after the new extraction wells are hooked up to the treatment building (Wis. Admin. NR § 724.15).

As a reminder, this Site is subject to an enforcement action and therefore all submittals to the DNR under Wis. Admin. Code chs. NR 700-799 and submittals directed by the DNR must be accompanied by an Wis. Admin. Code ch. NR 749 fee per Wis. Stat. § 292.94. These fees are not pro-ratable or refundable per Wis. Admin. Code § NR 749.04(1). If you have any questions about whether to include a fee with a submittal, please contact DNR staff prior to submitting a document without a fee.

If you have any questions, please contact me at Alyssa.Sellwood@wisconsin.gov or (608) 622-8606.

Sincerely,

Alyssa Sellwood, PE
Water Resources Engineer
Remediation & Redevelopment Program

Attachments: Attachment A: Table 4 from GETS LTMP
Attachment B: Examples of trend plots for future progress reports.

cc: Jodie Thistle, DNR (via email: Jodie.Thistle@wisconsin.gov)

Attachment A
Table 4 from GETS LTMP with checklist comparing to the content of GETS Progress Report #3

Performance Parameter	Evaluation Process	DNR's Comparison to June 2024 Report
Document reductions of upwelling in upper, middle, and lower reaches of Ditch B and/or identify locations or conditions contributing to observed upwelling	Calculate and track (in a table) head differentials in mini-piezometers and surface water	✓
	Calculate and track (in a table) the average system effluent rate and stream flow rate (at the existing Ditch B system) on days that mini-piezometers and surface water are gauged	✓
	Calculate and track (in a table) daily average flow rate in Ditch B and daily average effluent discharge rate and stream gauge measurements (when available)	✓
Monitor and assess groundwater migration from the FTC (as it relates to the GETS and Ditch B specifically)	Create tables and graphical plots (as needed) to summarize groundwater and surface water levels within the area of the GETS	✓
	Create figures illustrating groundwater elevations and approximate capture zones of the extraction wells	✓
	Create cross-sections through the monitoring area (including Ditch B) illustrating wells, groundwater elevations, and approximate capture zones of the extraction wells	✓
Document PFAS reductions in Ditch B surface water and/or identify locations or conditions contributing to potential increases	Create tables summarizing PFAS concentrations detected in groundwater and surface water PFAS concentrations at mini-piezometers.	✓
	Create post-maps and trend plots illustrating PFOA and PFOS concentrations in groundwater and surface water at mini-piezometers over time.	Add
	Create graphical trend plots showing contemporaneous flow rates and PFOA and PFOS concentrations for both GETS effluent and Ditch B surface water.	Add stream flowrate
Document PFAS trends in groundwater (decreasing, stable, increasing) within the area of the GETS	Create tables to summarize groundwater PFAS concentrations at monitoring wells over time	✓
	Create graphical plots (as needed) to track concentration trends of specific PFAS constituents (e.g., PFOA, PFOS, PFHxA, and FTSA) at monitoring wells	Add (subset of wells)
	Create figures (e.g., isoconcentrations and cross-sections) illustrating concentrations of specific PFAS constituents (e.g., PFOA) in groundwater within the area of the GETS	Add (e.g. PFOA +PFOS isoconcentration on Fig. 10 and 11)
Document PFAS mass removal over time	Create a tabular summary of the average operating flow rate, run time, and volume of groundwater removed per month in each extraction well	✓
	Calculate and track (in tables and graphical plots) estimates of PFAS mass extracted from each well for the reporting period, and include updated cumulative estimated mass of PFAS extracted from each well since startup	✓
	Create a tabular summary of the total volume of groundwater extracted and treated per reporting period and cumulatively since GETS startup	✓
	Create a tabular summary of the influent and effluent concentrations of PFAS from the GETS during the reporting period	✓
	Calculate and track (in tables and graphical plots) estimates of PFAS mass removed by the GETS for the reporting period, and include updated cumulative estimated mass of PFAS removed since startup	✓
Evaluate sustainability of the GETS operation in accordance with NR 722.09(2m)	Create a tabular summary of run time and down time of the GETS during the reporting period	✓
	Estimate energy usage by the GETS per reporting period and cumulatively	✓
	Summarize the carbon regeneration volume/mass per reporting period and cumulatively	✓
	Summarize the disposal volume/mass for filters and ion exchange resin per reporting period and cumulatively	✓

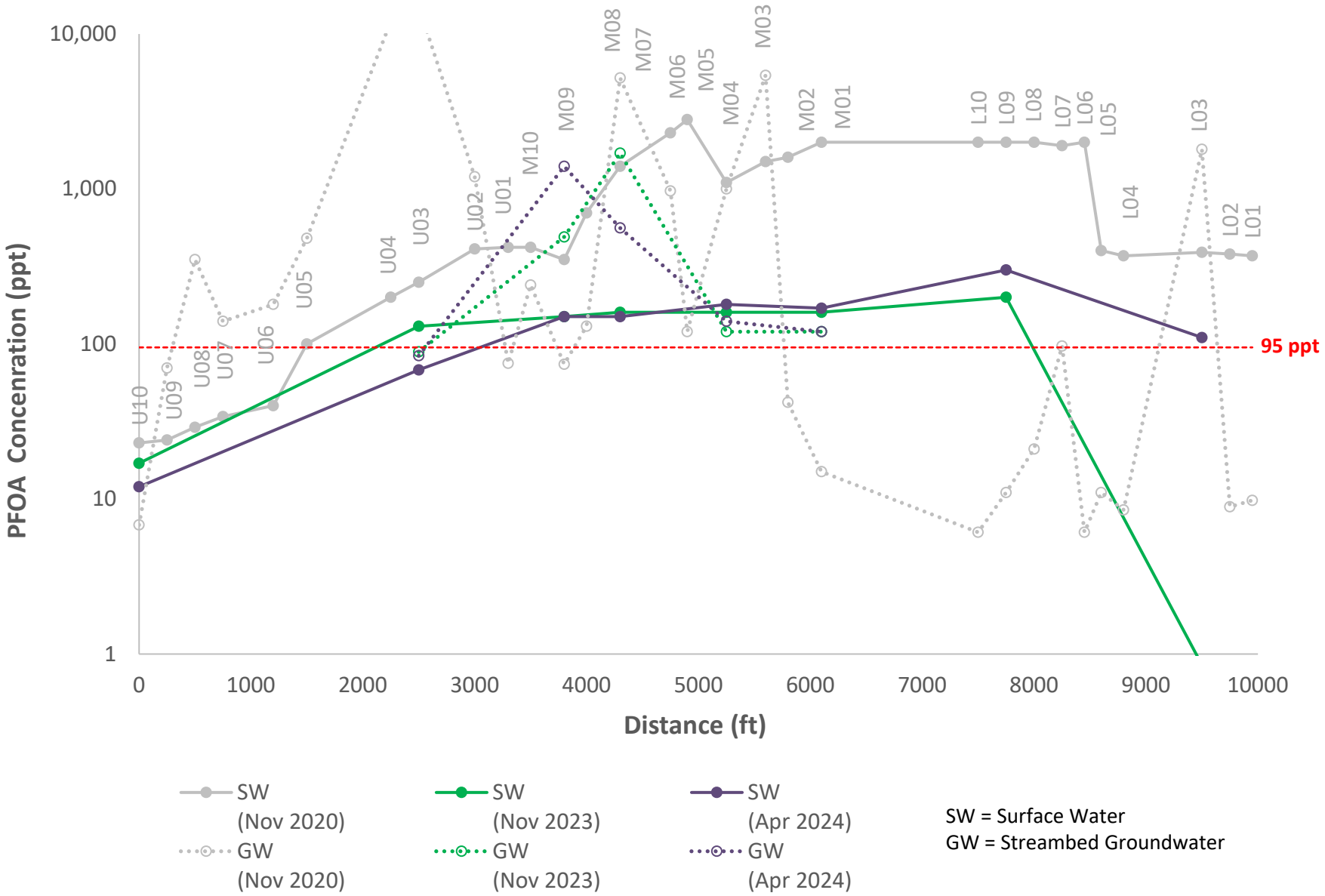
DNR Notes

✓ = content was included in GETS Progress Report #3

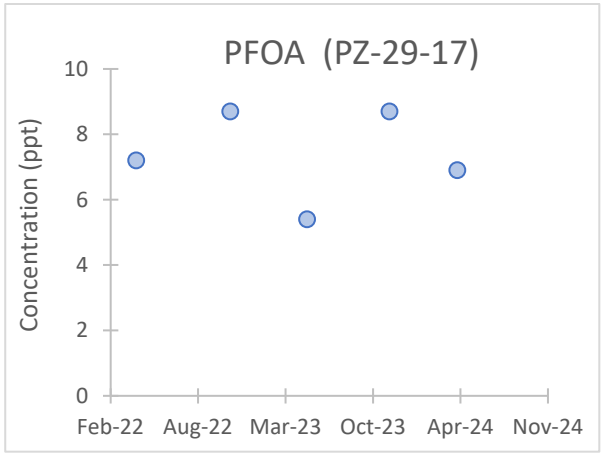
"Add" = content not found in the GETS Progress Report #3. Add as requested or when needed to document trends.

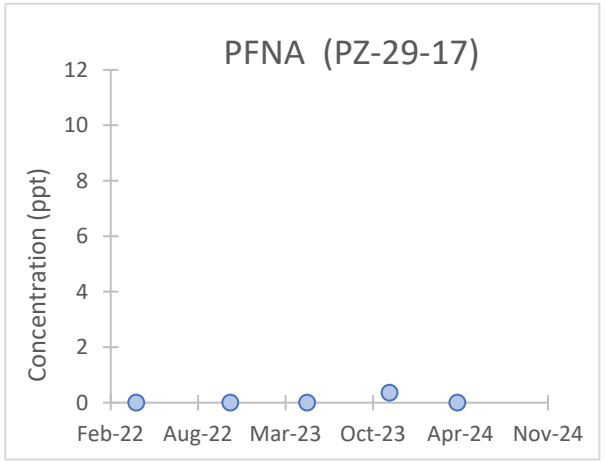
Attachment B - Example Plot

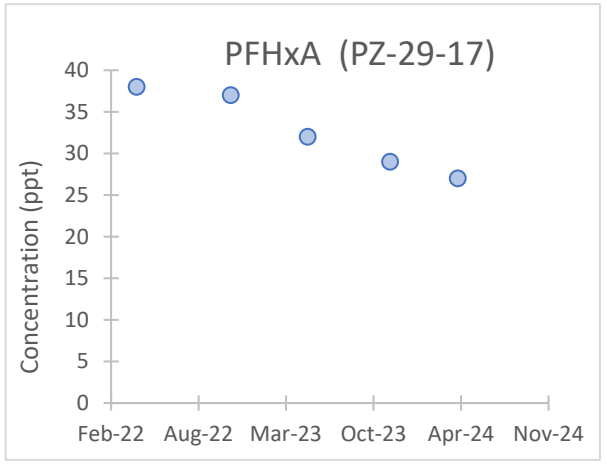
Ditch B PFAS Mini-Piezometer Concentrations

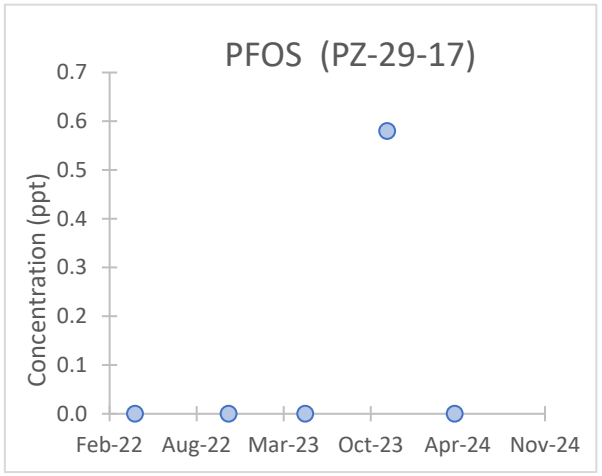


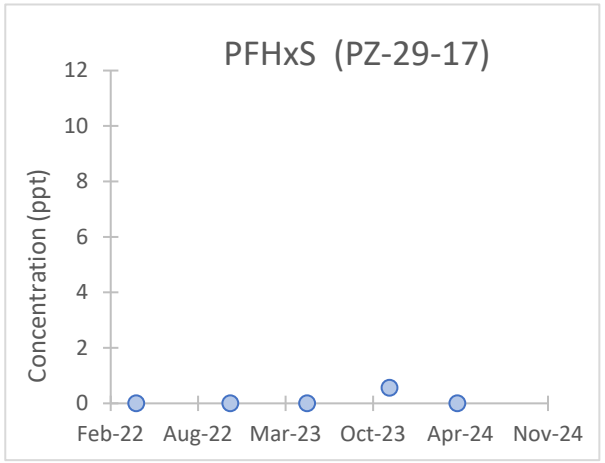
Attachment B - Example Plots
Groundwater PFAS Concentrations

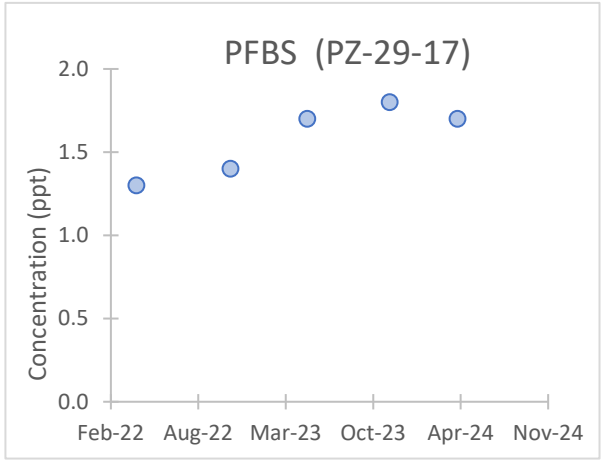


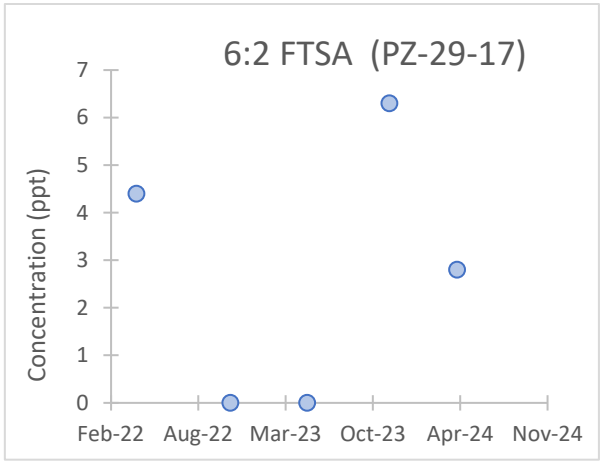


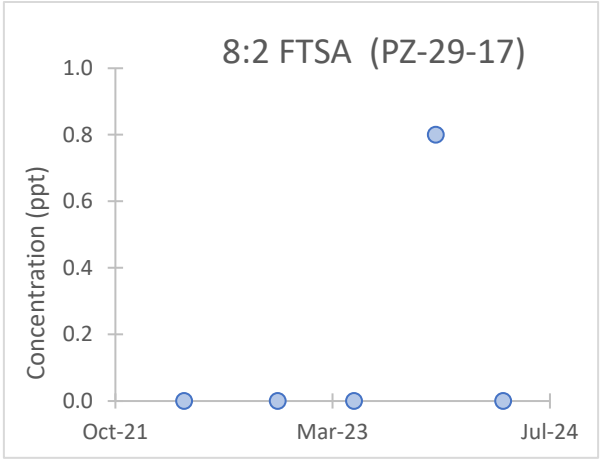


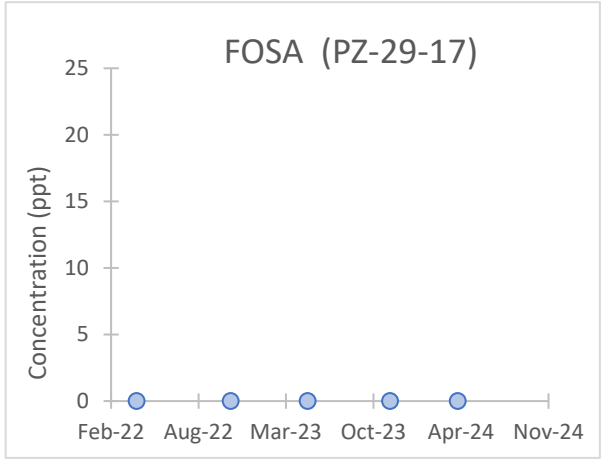




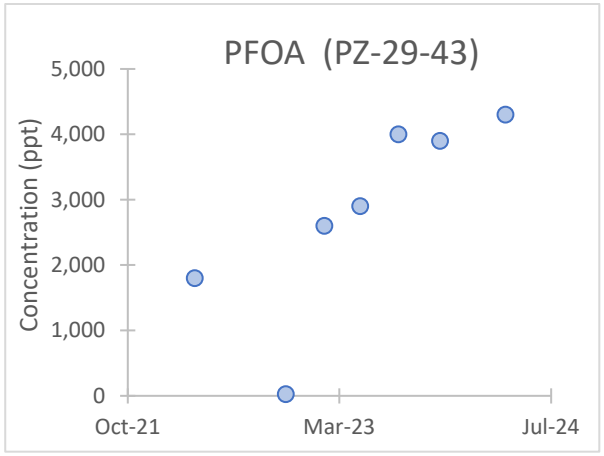


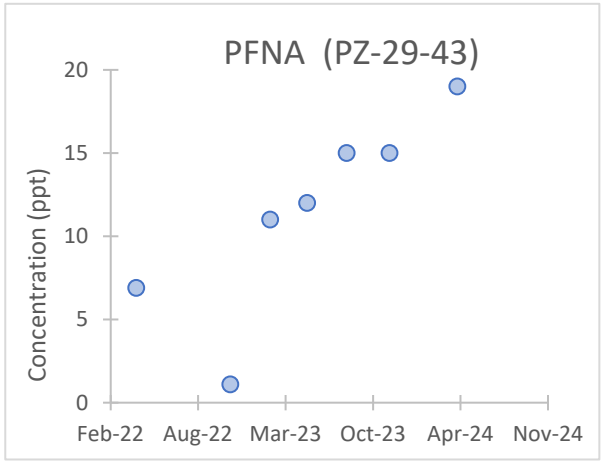


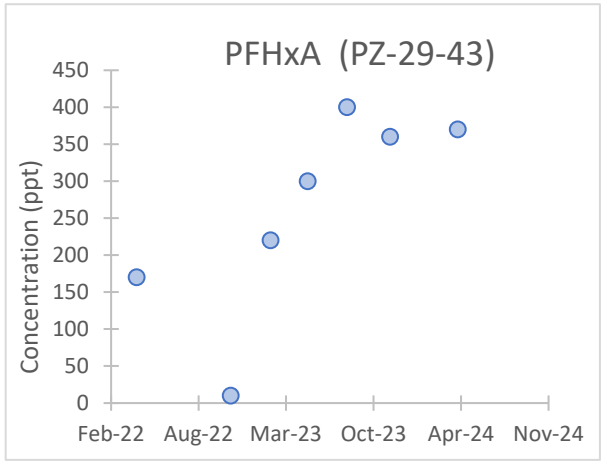


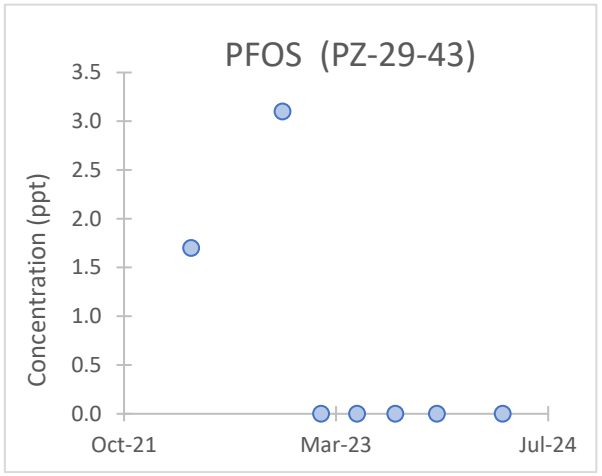


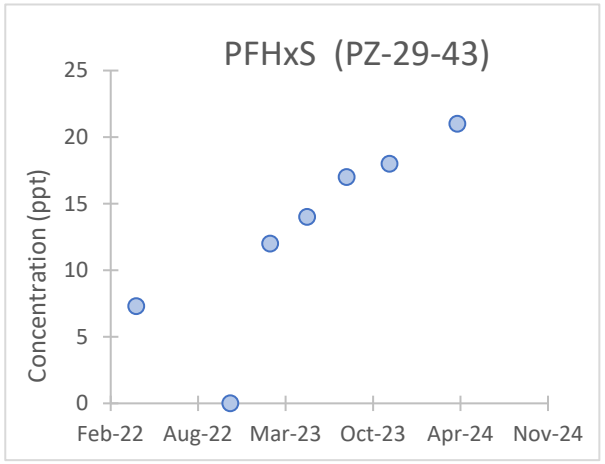
Attachment B - Example Plots
Groundwater PFAS Concentrations

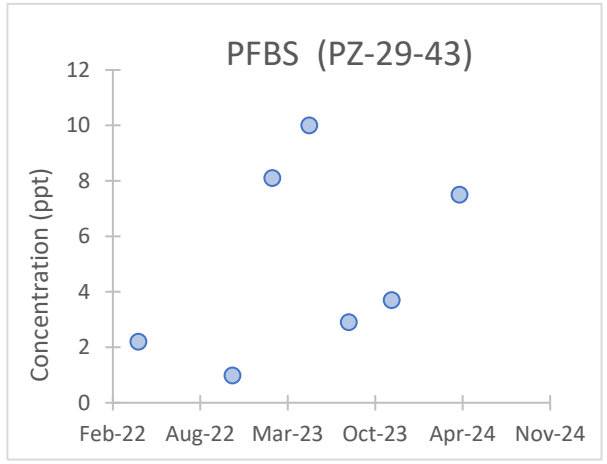


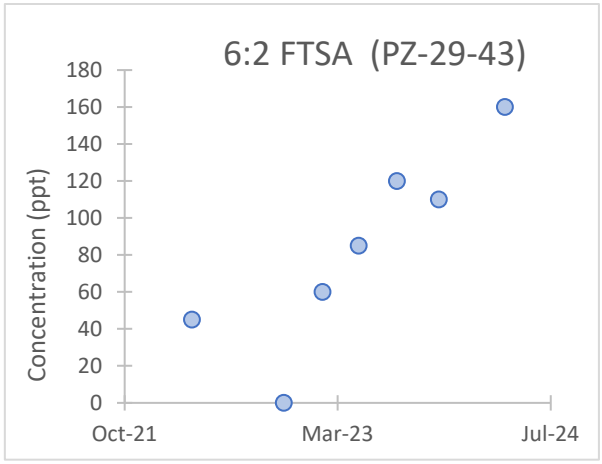


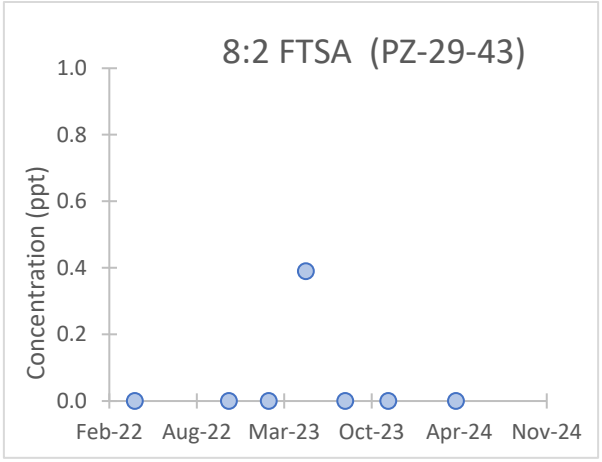


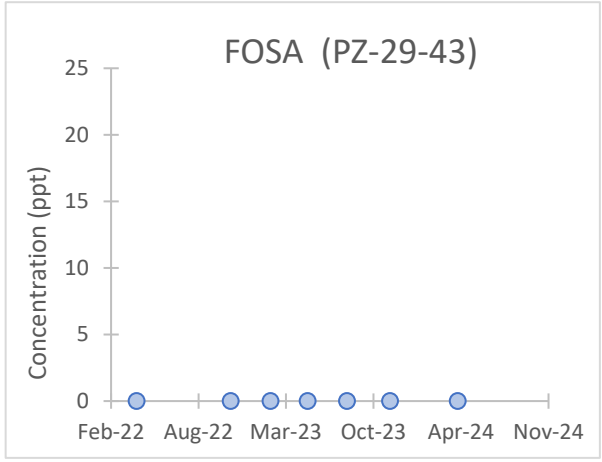




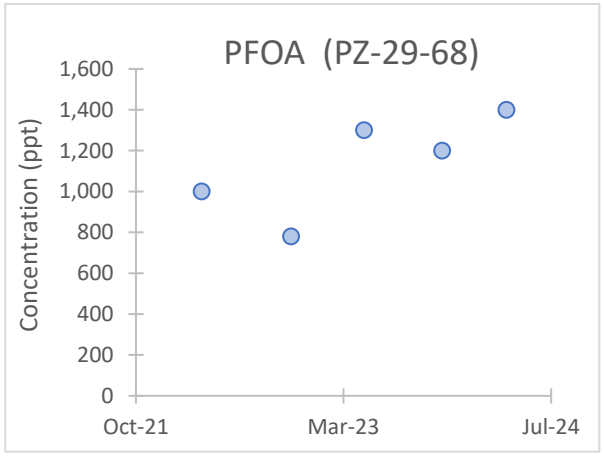


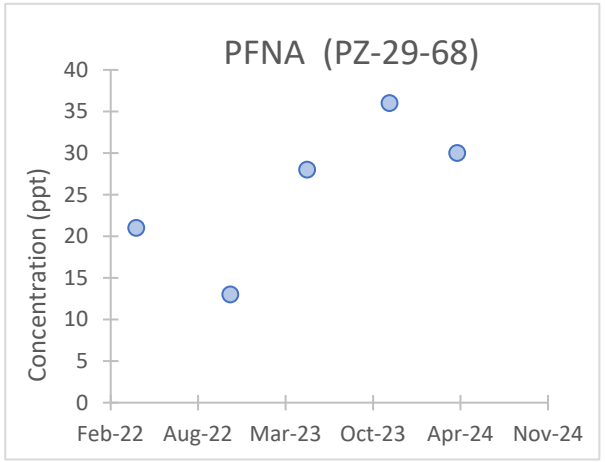


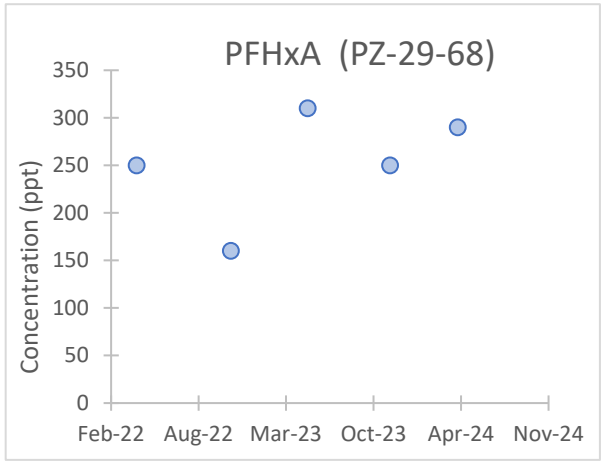


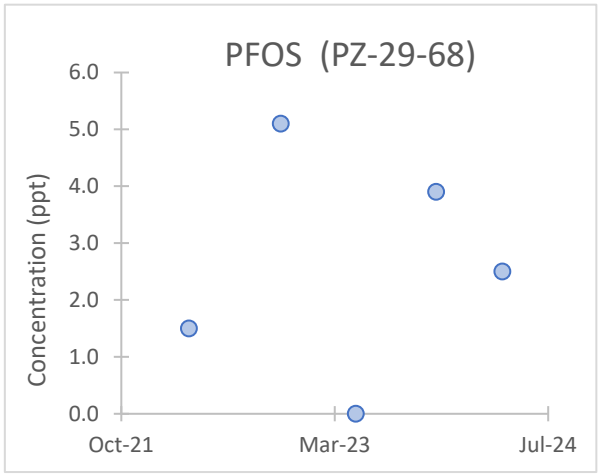


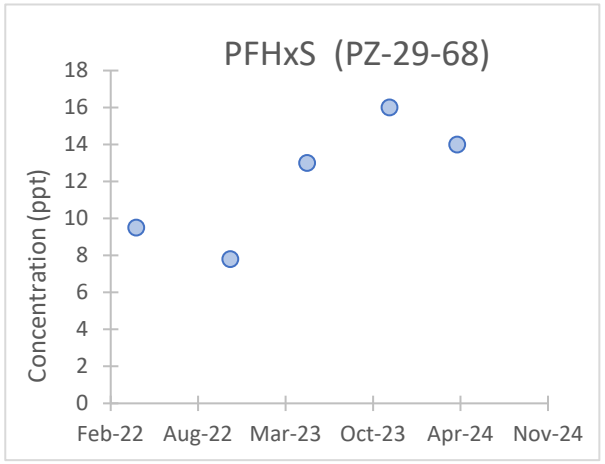
Attachment B - Example Plots
Groundwater PFAS Concentrations

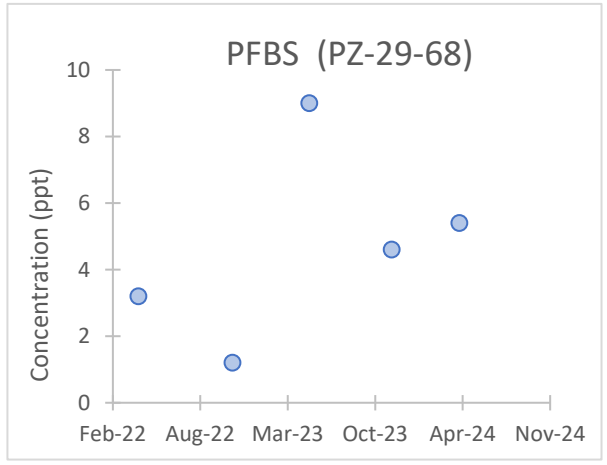


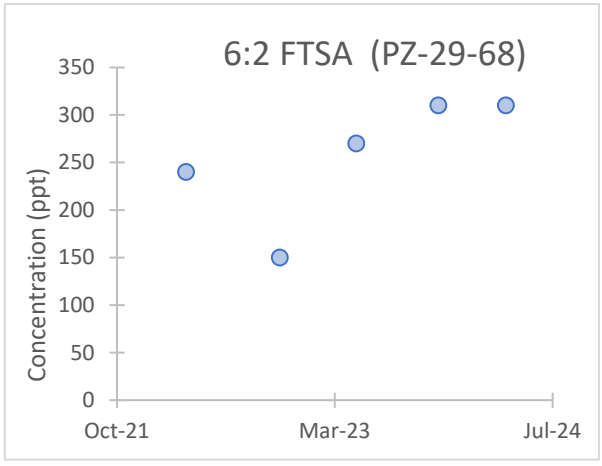


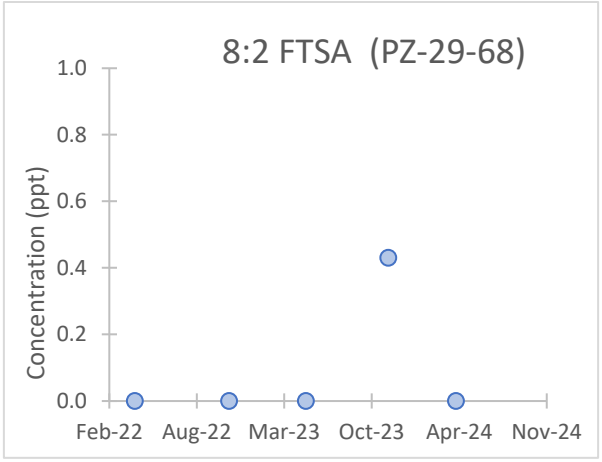


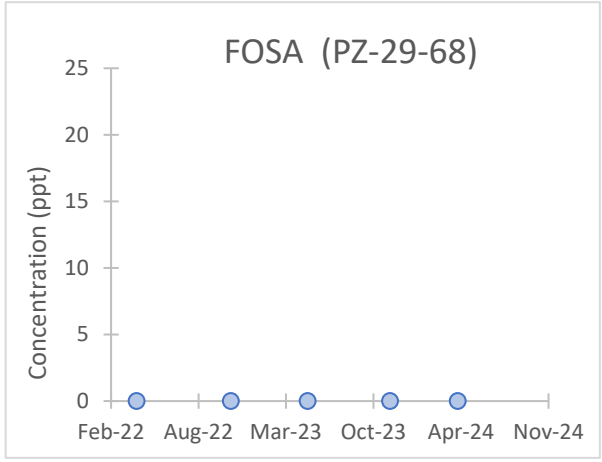












Attachment B - Example Plots
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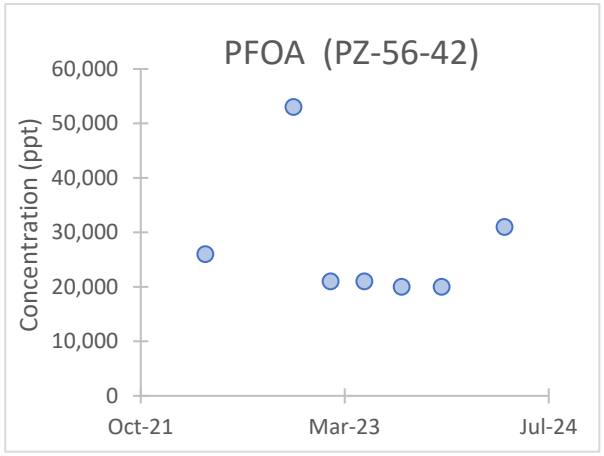

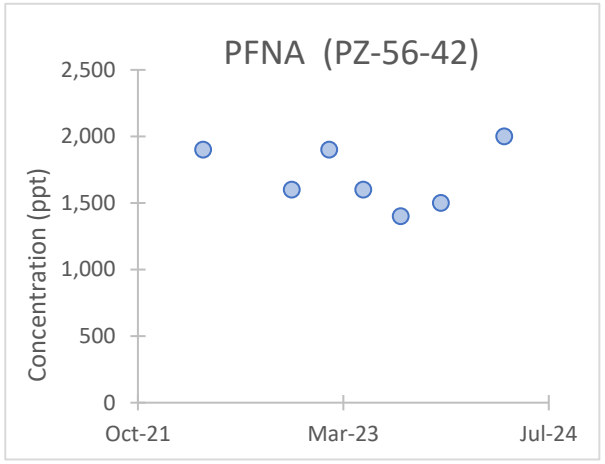

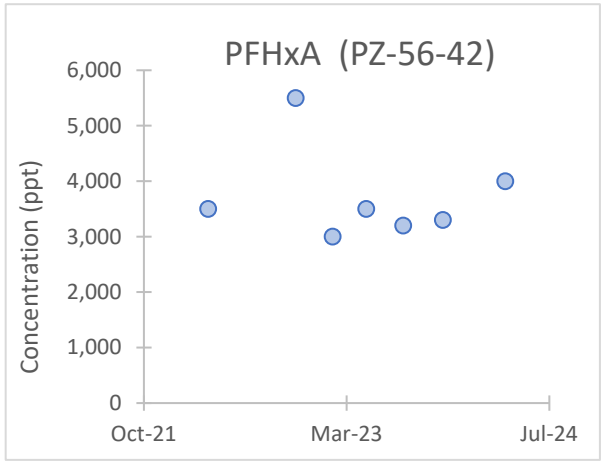

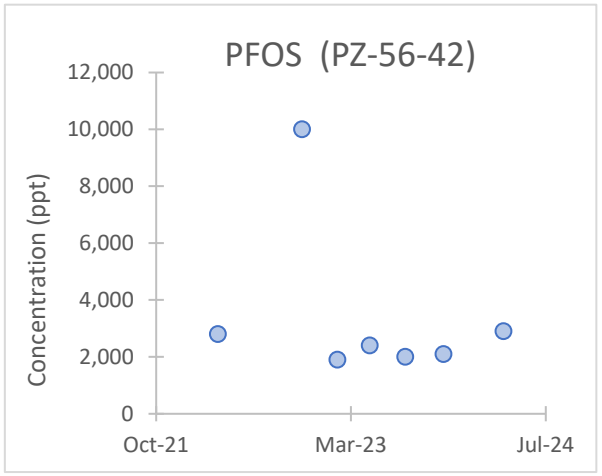

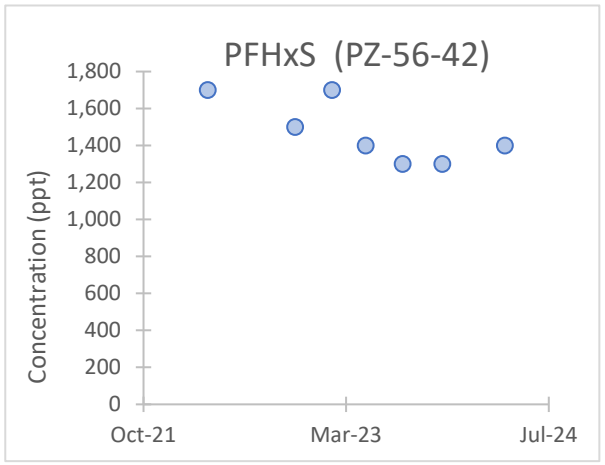

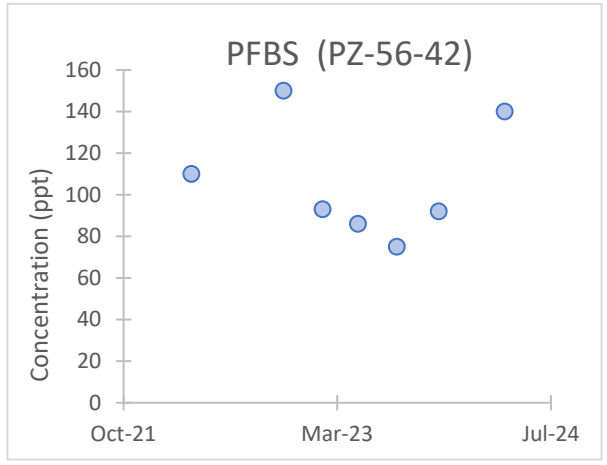

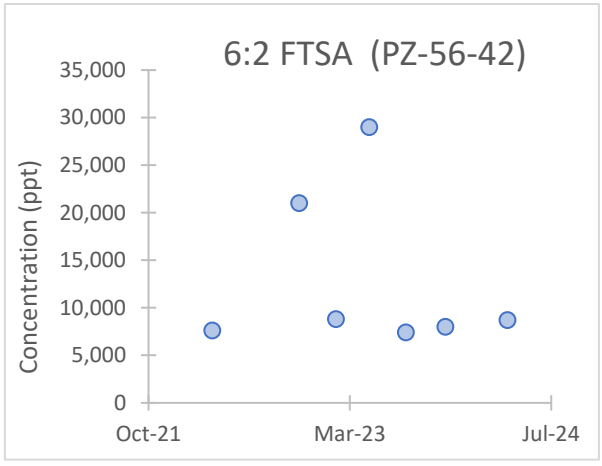

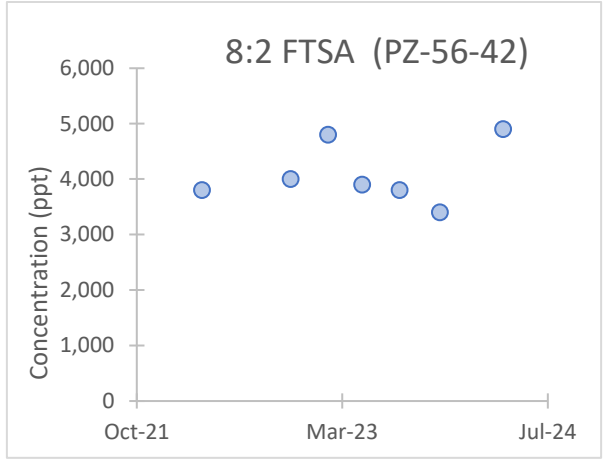

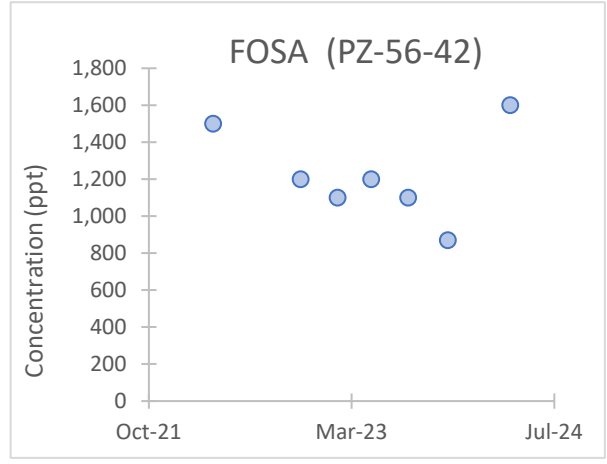

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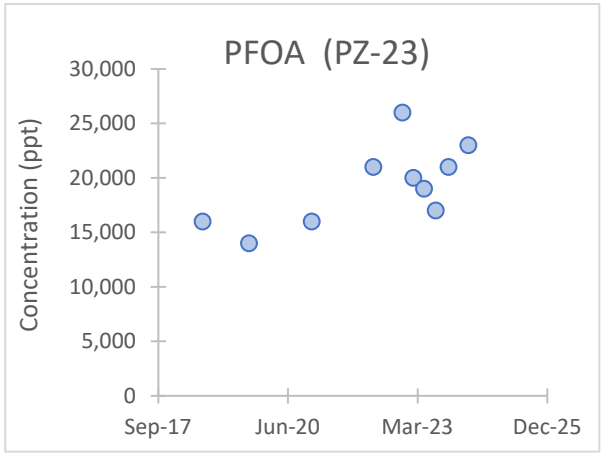
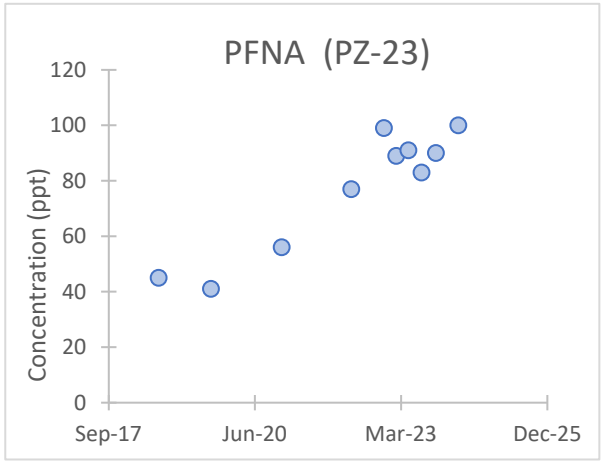
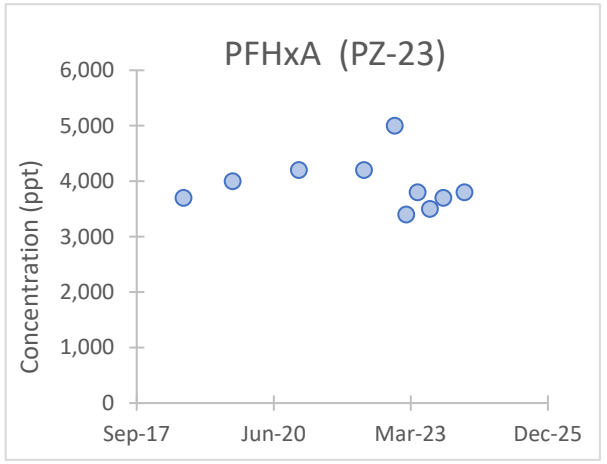
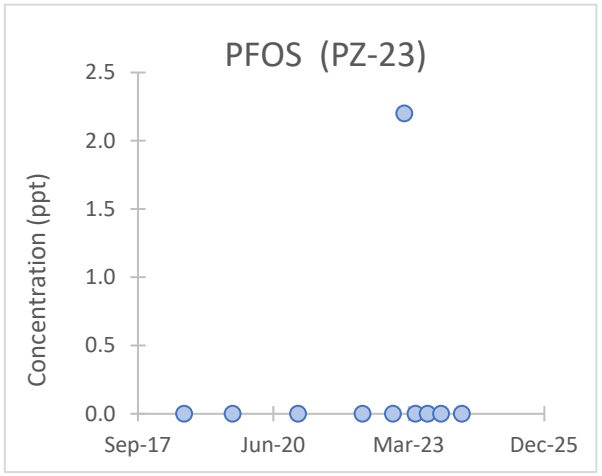
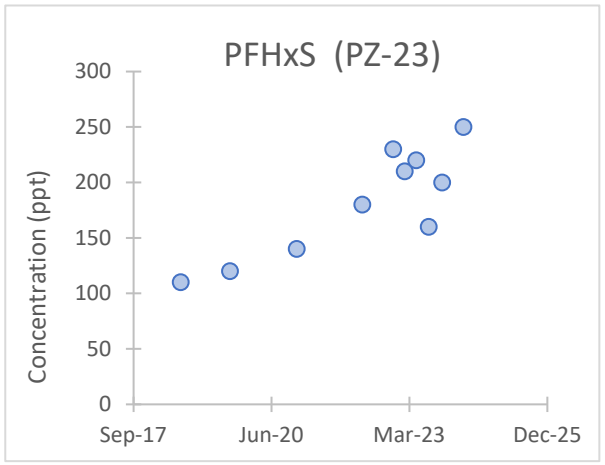
Groundwater PFAS Concentrations

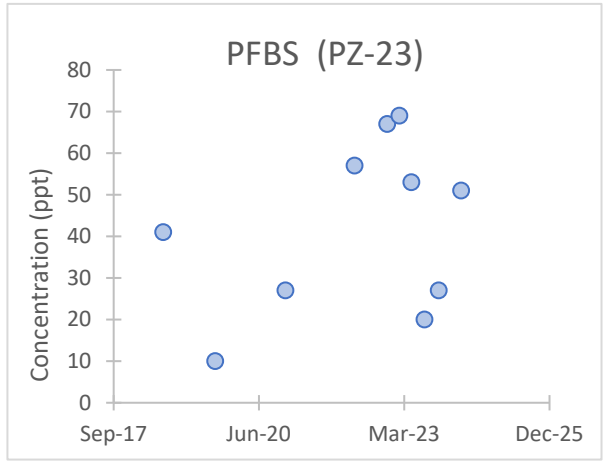


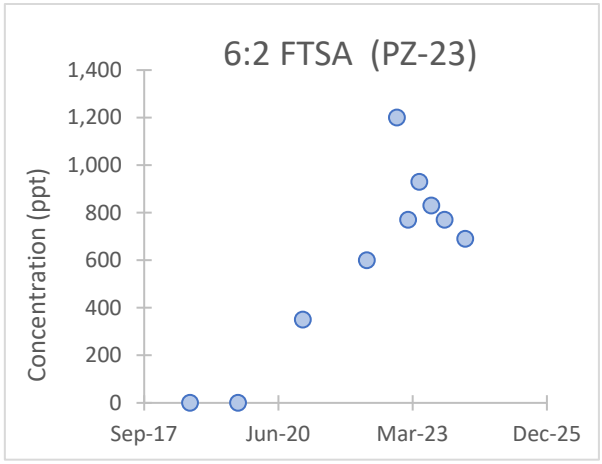


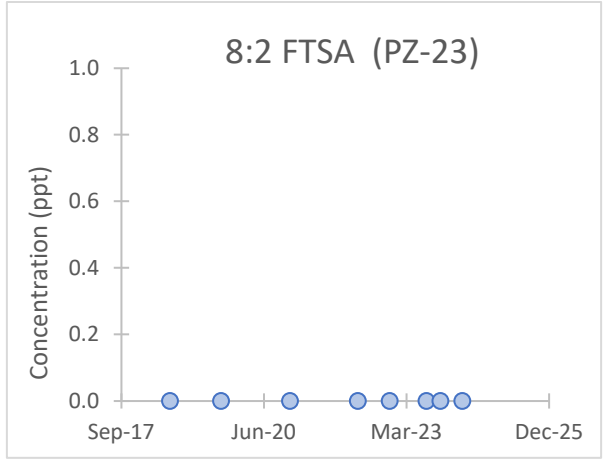


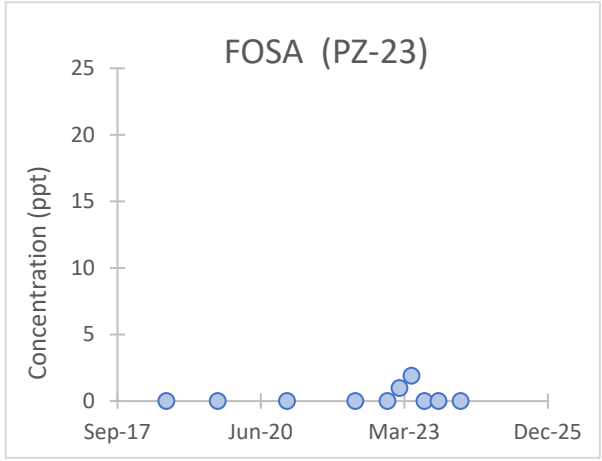












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