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Tracking PFAS in Surface Water: Watershed to Treatment



May 7th, 2026
Thursday Technical Section
Caitlin M. Glover, PhD

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Acknowledgements

Stantec Joseph G. Jacangelo, Stephanie Elliott, and DeeAnn Turpin

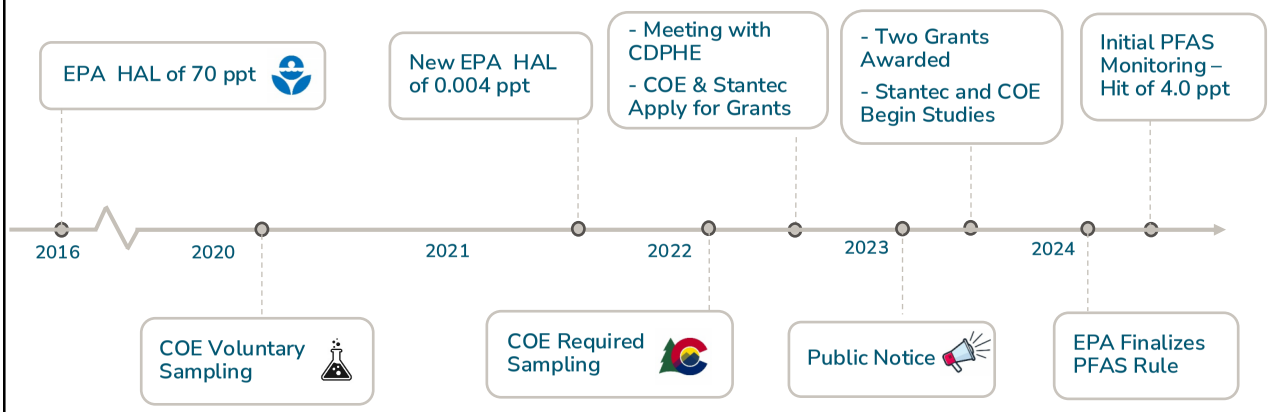
Englewood Zackary Alabbasi, Adam Marquez, Ezzie Sauter, and Chris Edelstein

Johns Hopkins University Chandana Lakkasandrum and Kellogg Schwab

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PFAS Projects – how did we get here?



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CDPHE Projects

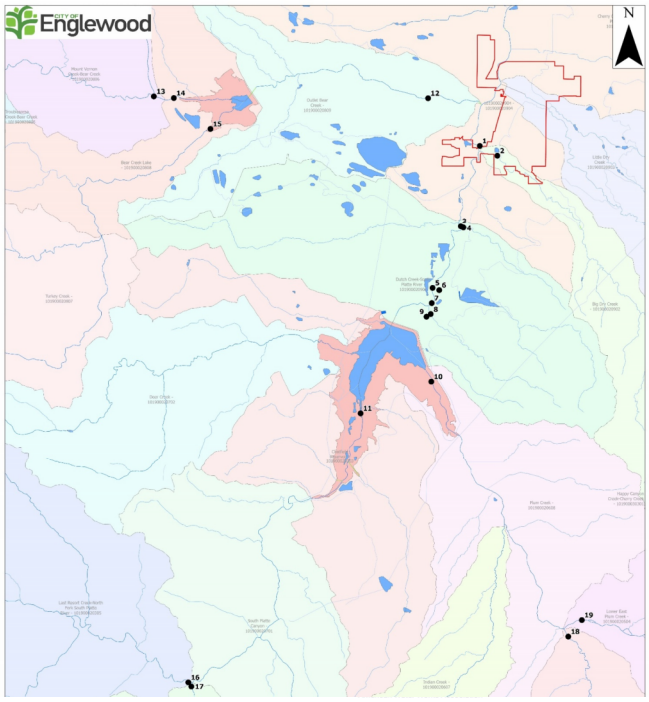
- Watershed Project
  - 19 sites sampled quarterly from May 2024 to February 2025
  - Sites selected by City of Englewood and CDPHE
- Pilot Project
  - Evaluated impact of surface water operation on five media
  - Assess alternative media

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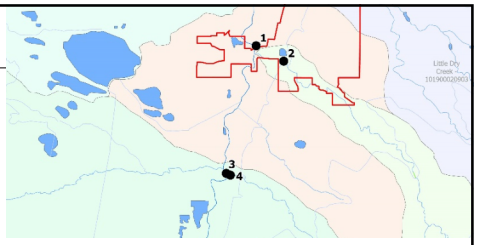
Sites

Site	Site Name
1	Intake from S. Platte to WTP at Union Ave
2	Big Dry Creek
3	S. Platte downstream of Lee Gulch
4	Lee Gulch
5	S. Platte downstream of Dad Clark Gulch
6	Dad Clark Gulch
7	S. Platte downstream of Marcy Gulch
8	Marcy Gulch
9	City Ditch Headgate
10	Plum Creek
11	S. Platte before Chatfield Reservoir
12	Bear Creek Inlet to McBroom Pipeline
13	Bear Creek above Raceway
14	Bear Creek below Raceway
15	Turkey Creek
16	S. Platte Confluence North
17	S. Platte Confluence South
18	Plum Creek above Confluence
19	East Plum Creek above Confluence



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Sites 1 – 4



Site 1 – Intake at Union Ave



Site 2 - Big Dry Creek



Site 3 – S. Platte



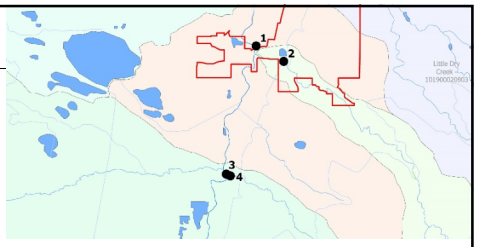
Site 4 – Lee Gulch

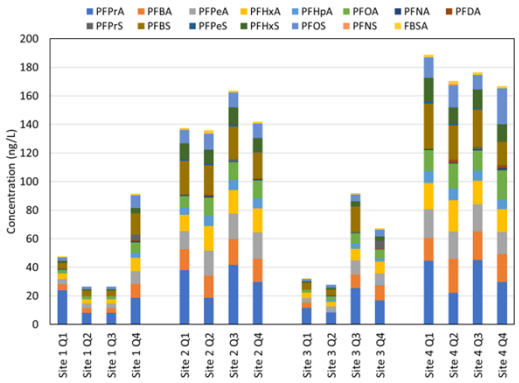


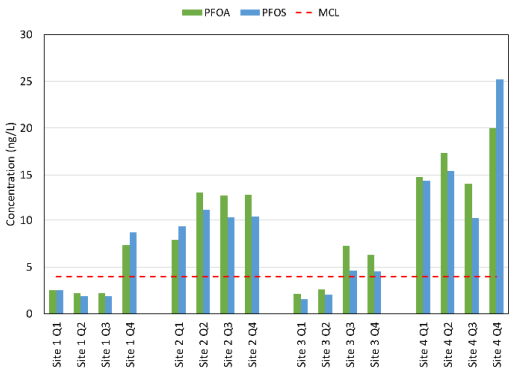
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Sites 1 – 4







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Sites 5 – 9



Site 5 – S. Platte



Site 6 – Dad Clark Gulch



Site 7 – S. Platte



Site 8 – Marcy Gulch



Site 9 – City Ditch

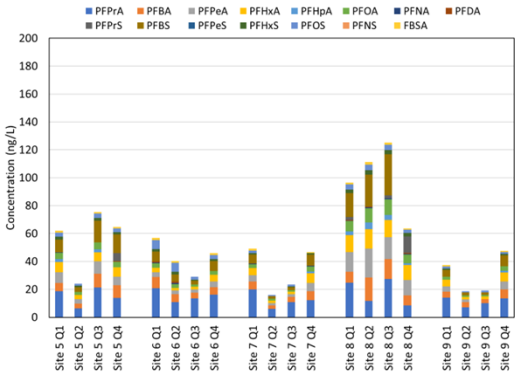


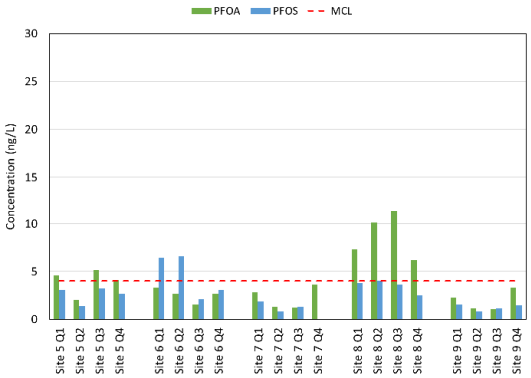
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Sites 5 – 9



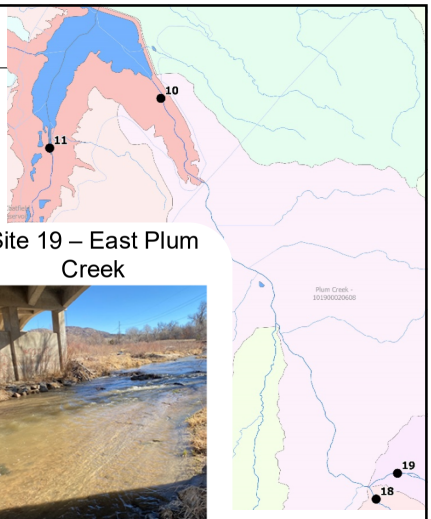




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Sites 10, 11, 18, and 19



Site 10 – Plum Creek



Site 11 – S. Platte



Site 18 – Plum Creek

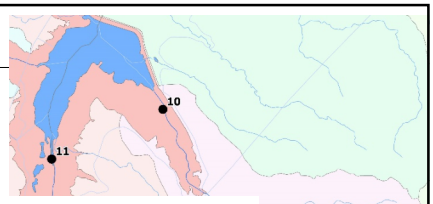


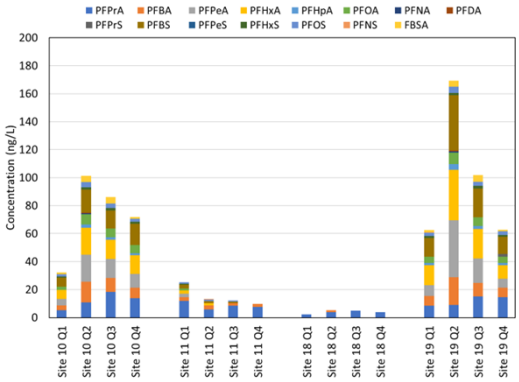
Site 19 – East Plum Creek

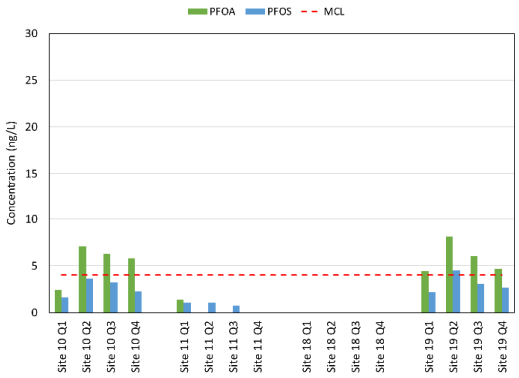
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Sites 10, 11, 18, and 19









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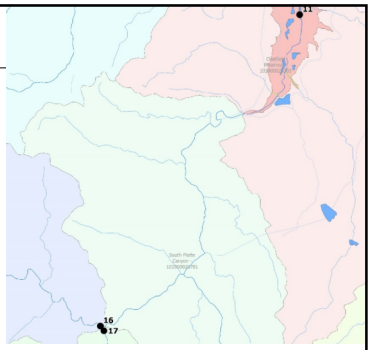
Sites 16 and 17

Site 16 –
Confluence North



Site 17 –
Confluence South

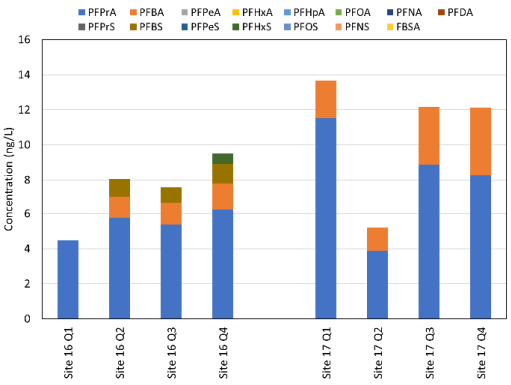


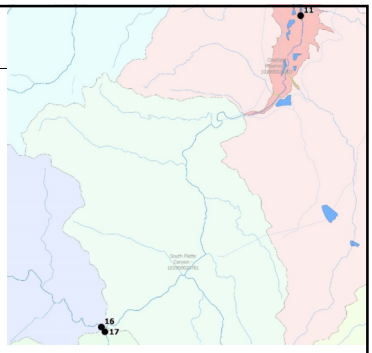


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Sites 16 and 17



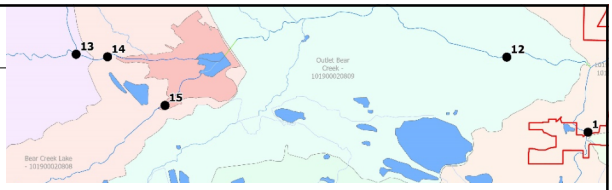


- No PFOA or PFOS detected

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Sites 12 – 15



Site 12 – Bear Creek, McBroom Pipeline inlet



Site 13 – Bear Creek above Raceway



Site 14 – Bear Creek below Raceway



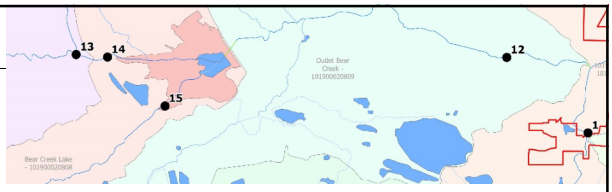
Site 15 – Turkey Creek

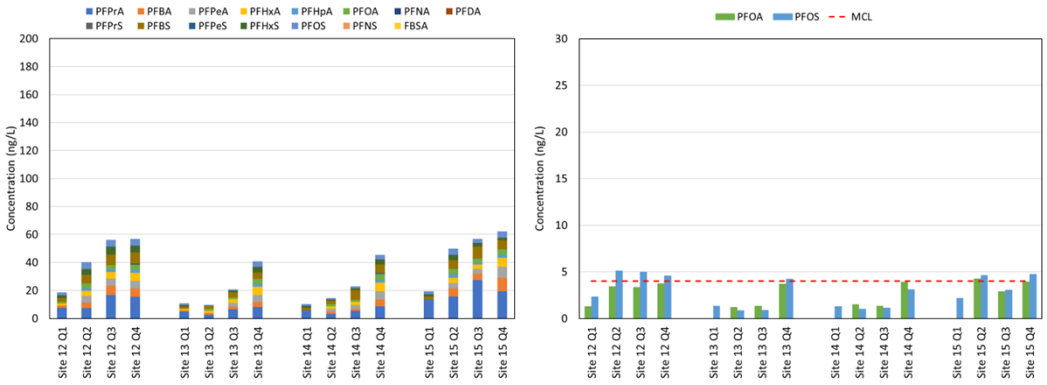


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Sites 16 and 17

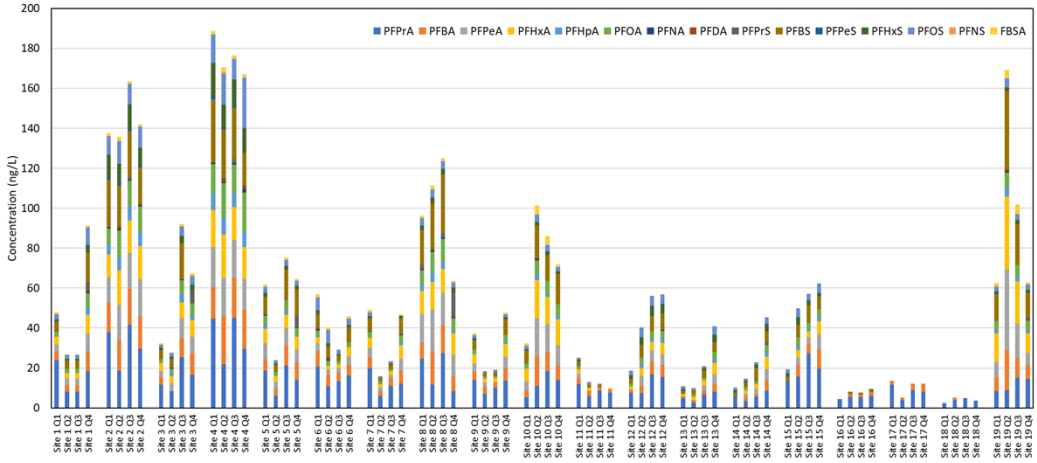




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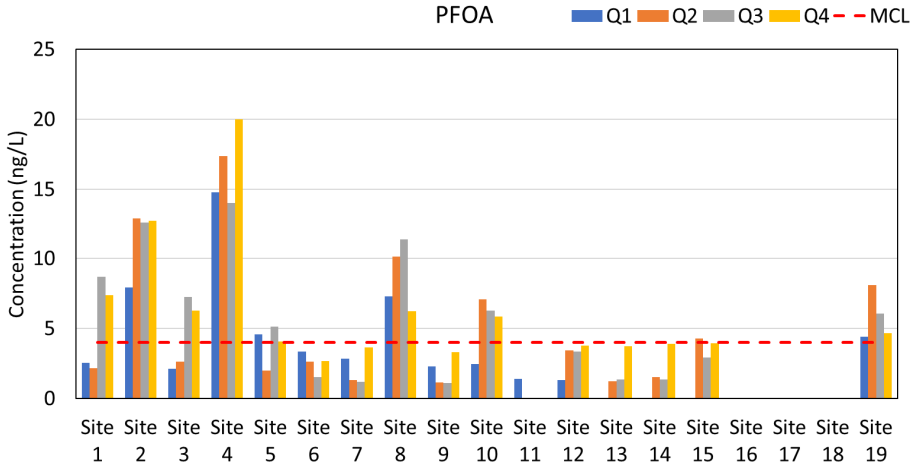
All PFAS Detected



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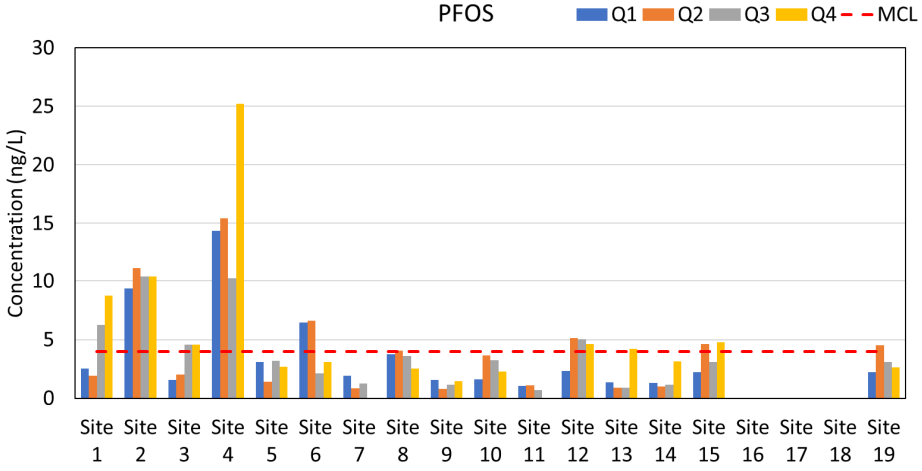
Regulated PFAS



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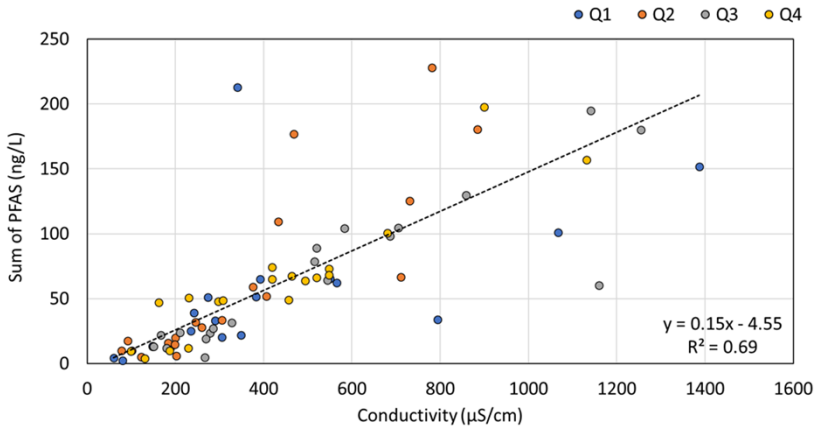
Regulated PFAS



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Correlations with Water Quality



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Summary of Watershed Study

- Highest total levels (> 100 ng/L in at least one quarter) observed:
  - Site 2, 4, 8, 10, and 19
  - Site 8, 11, and 19 are WWTF effluents
- PFAS levels were generally less than MCL
- No clear seasonal trend observed
- S. Platte main stem contains higher levels than Chatfield Reservoir





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PFAS Pilot Set-up

- Pilot fed from the combined filter effluent
  - Pre-treated via cartridge filter (1 µm)
- Five medias piloted
  - Two GACs
  - Surfactant modified clay
  - β-Cyclodextrin media
  - Ion exchange resin



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PFAS Pilot Set-up

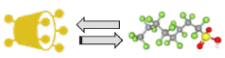
- Surfactant modified clay
  - Fluoro-Sorb 200 (FS200)
  - Limited impact of organic matter
- β-Cyclodextrin media (DEXSORB)
  - Limited impact of organic matter and inorganic ions
  - Renewable, corn-based and can be regenerated

Fluoro-Sorb 200



DEXSORB



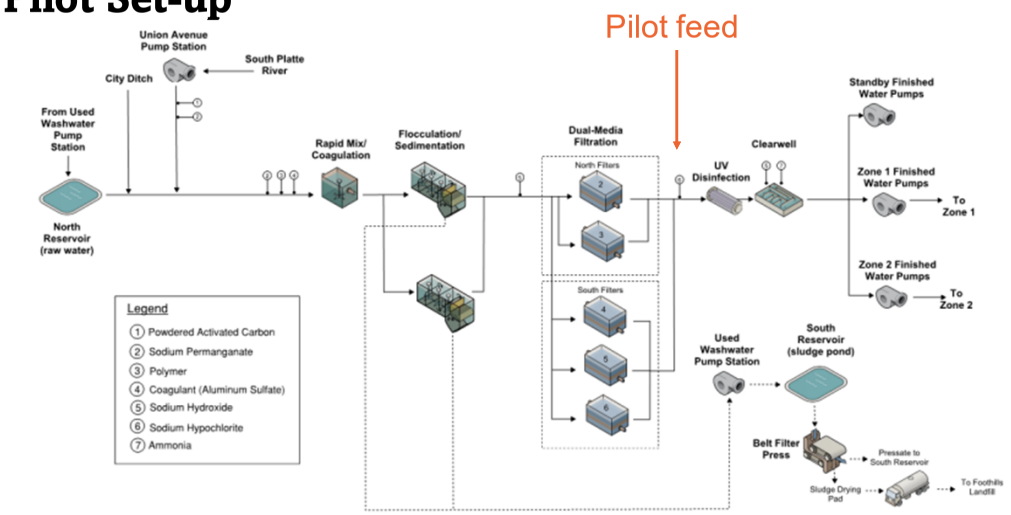


PFAS

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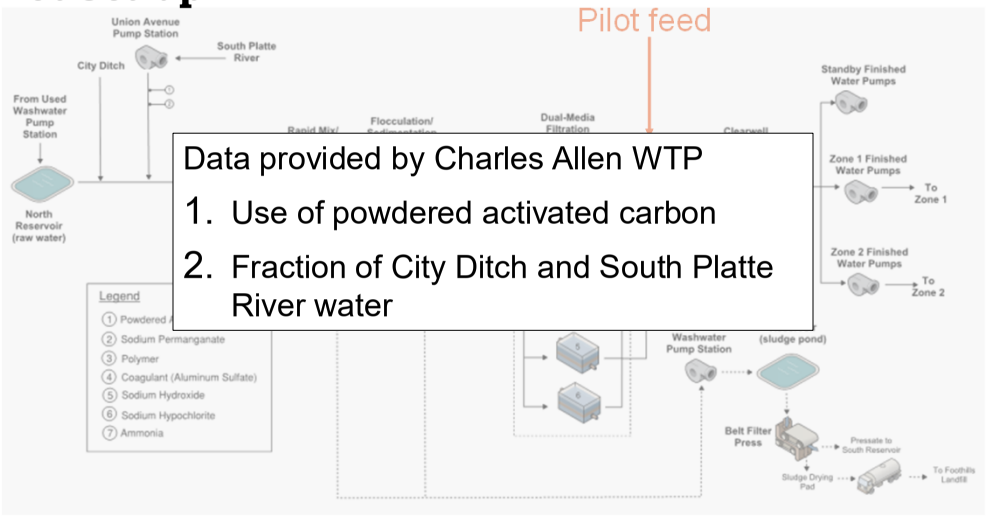
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Pilot Set-up



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Pilot Set-up



Data provided by Charles Allen WTP

1. Use of powdered activated carbon
2. Fraction of City Ditch and South Platte River water

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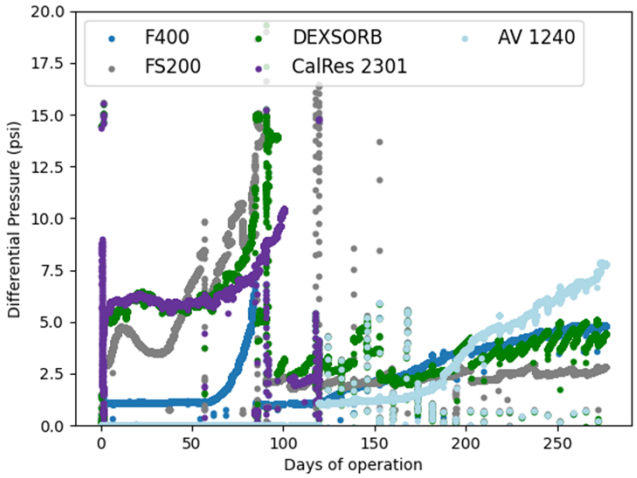
Water Quality Monitoring

- 9-months of testing from May 2024 through February 2025
  - 6-months routine sampling, 3-month limited sampling
- Weekly or biweekly testing during 6-month period
  - 32 PFAS sampled from Port 1 and Effluent
  - Total organic carbon (TOC), turbidity, pH, TDS, free and total chlorine
  - Alkalinity, iron and manganese, sulfate, nitrate, chloride
- Operational parameters – online data collected every 5-minutes
  - Differential pressure, flow, and feed temperatures

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Operational Results

- Challenge: increasing differential pressures and need to maintain the mass transfer zone
- Back rinse schedule implemented
  - Break-up of top layer of media

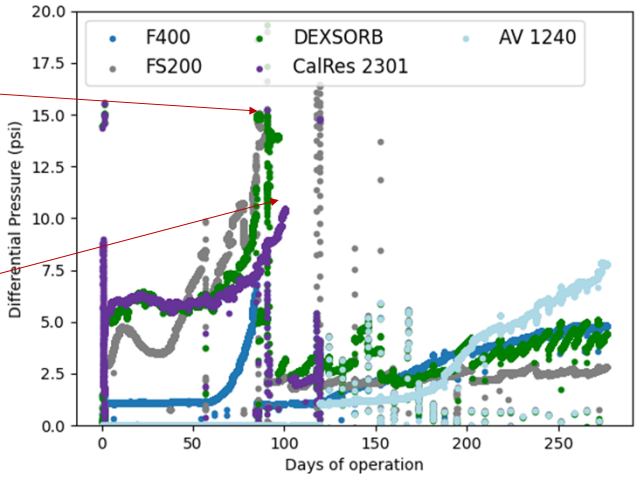


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Operational Results

First back rinse of GAC #1 (F400), surfactant modified clay (FS200) and β-Cyclodextrin (DEXSORB)

Back-fluff of IX resin

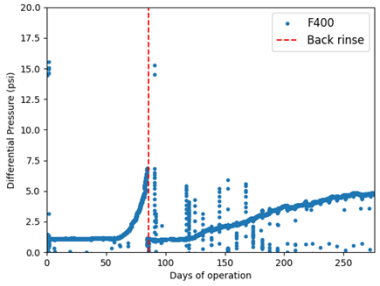


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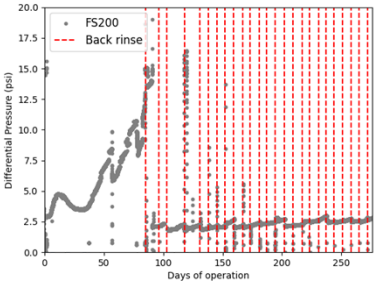
27

Operational Results

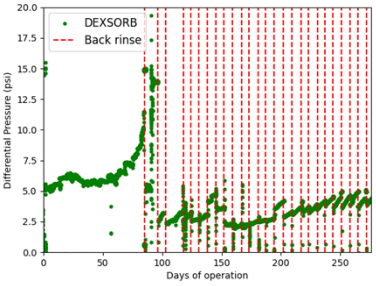
GAC #1
- Once during pilot



Surfactant modified clay
- Weekly



β-Cyclodextrin media
- Weekly

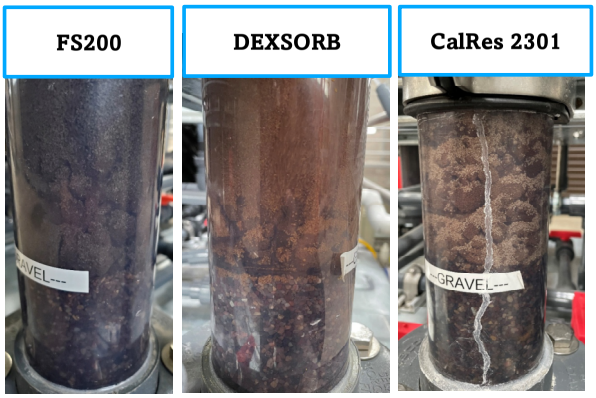


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Operational Results

- Severe clump formation observed in three of four columns tested
  - No clumping observed in either GAC
  - Led to discontinuation of CalRes 2301
- Clumping potentially driven by microbial growth, metal oxides, organic matter, or post-filtration coagulation



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Summary of Water Quality Data

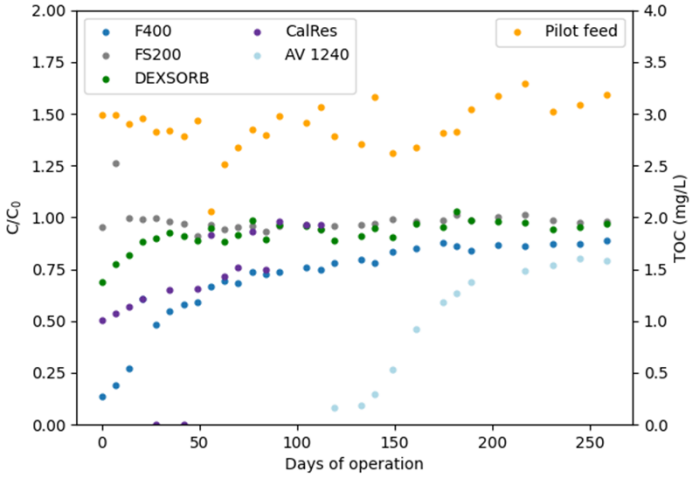
Water quality	Surface water
pH	6.9 – 7.3
TOC (mg/L)	2.5 – 3.3
Nitrate (mg/L as N)	< 0.6
Sulfate (mg/L)	47 – 123
Iron (mg/L)	< 0.02
Manganese (mg/L)	0.039
PFAS	
PFOA (ng/L)	0.90 – 4.0
PFNA (ng/L)	ND
PFBS (ng/L)	1.5 – 9.39
PFHxS (ng/L)	< DL – 2.0
PFOS (ng/L)	0.81 – 2.5

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TOC Removal

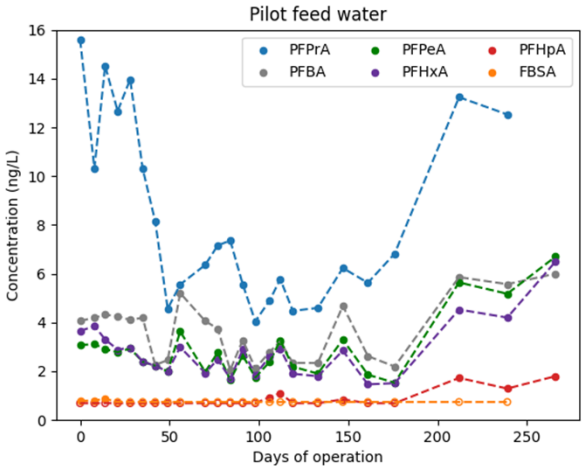
- Limited removal by β-Cyclodextrin (DEXSORB) and minimal removal by surfactant modified clay (FS200)
- GACs and IX resin provided removal

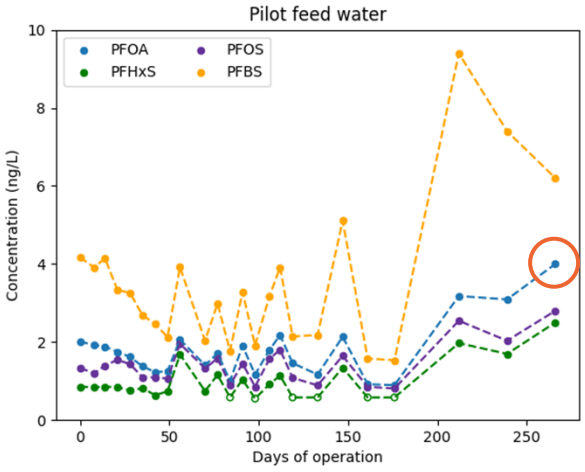


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Presence of PFAS



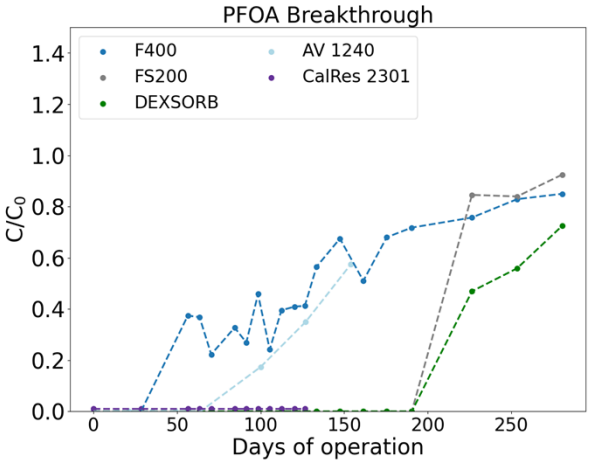


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PFAS Removal

- Recommendation based on PFAS performance alone → IX resin
- Recommendations based on ease of operation → GAC
- Recommendation based on cost of PFAS treatment → GAC



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Take Home Messages

- Higher levels of regulated PFAS associated with WWTF
- S. Platte contains higher levels of PFAS relative to Chatfield Reservoir
- Challenges associated with treating surface waters via adsorptive media
- Maintaining the mass transfer zone may not be feasible for surface waters



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Questions?



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