A Study of the Effectiveness of Colloidal Activated Carbon as an In-Situ Treatment to Mitigate PFAS Migration in Groundwater at a Michigan Army National Guard Site

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Problem Statement

- Multiple PFAS point sources
- Comingled with PCE plume
- Identified at the property boundary and migrating off-site
- Many potential downgradient receptors
- Limited budget for field testing of remedial technologies

- Question:

  Can CAC be used as a means to mitigate the risk of PFAS to the sensitive receptors?

Grayling Army Airfield

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Site Description

Site Location:
Camp Grayling Joint Maneuver Training Center

- Founded 1913
- 147,000 acres
- Largest National Guard training center in the country
- Training facility for military, emergency responders, and private-sector from all over the world
- Home to the Grayling Army Airfield

Grayling Army Airfield (GAAF)

- 900-acre
- Built during World War II

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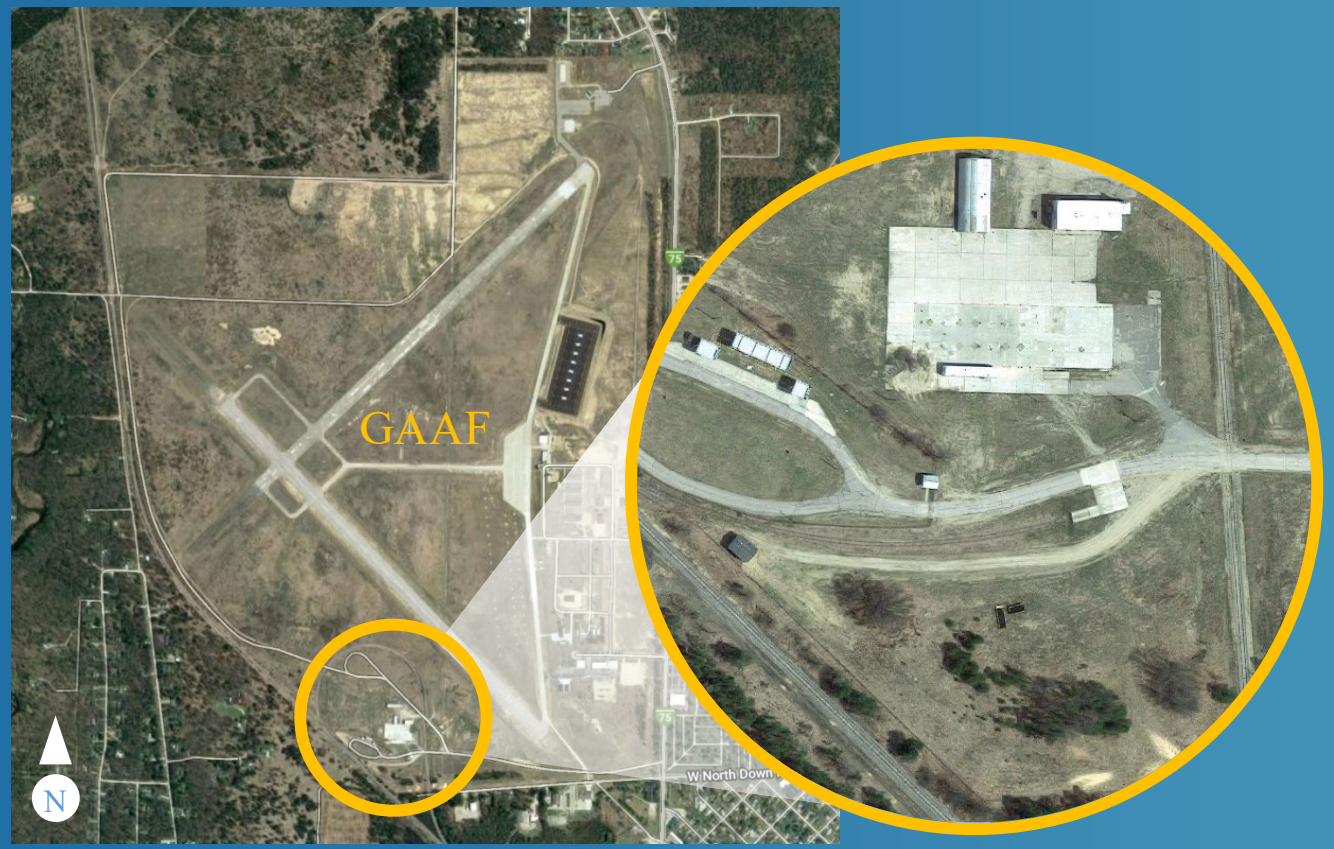
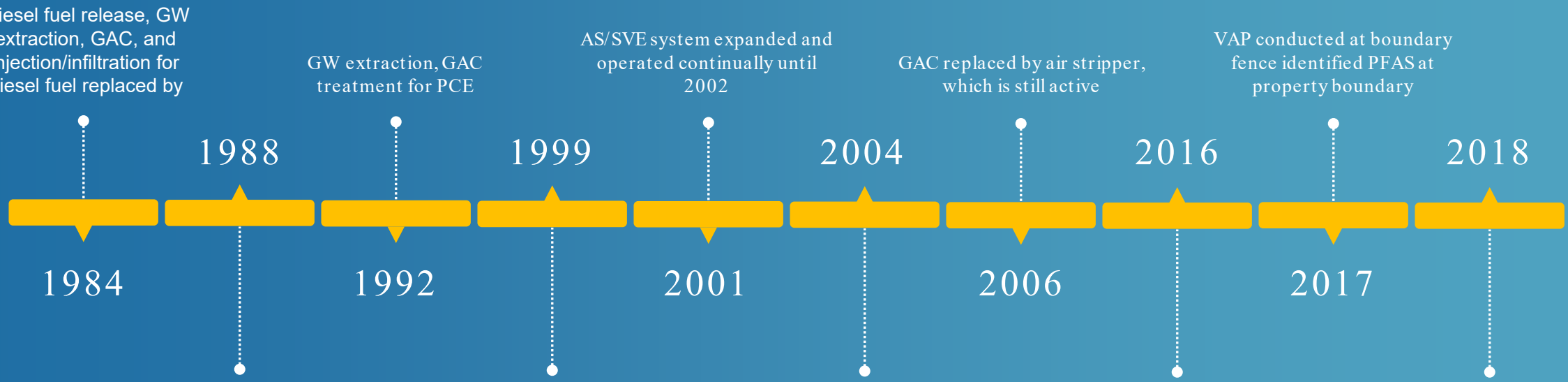
Former Bulk Fuel Storage Area



- Generally flat, slight slope downward toward the south
- Surficial geology: sand and gravel
- Non-continuous clay layer at ~ 25-27 feet bgs
- 2nd deeper clay layer in some areas at ~45-60 feet bgs
- GW at ~ 17 feet bgs and flows south toward Au Sable River, ~4000 feet away

Remediation History



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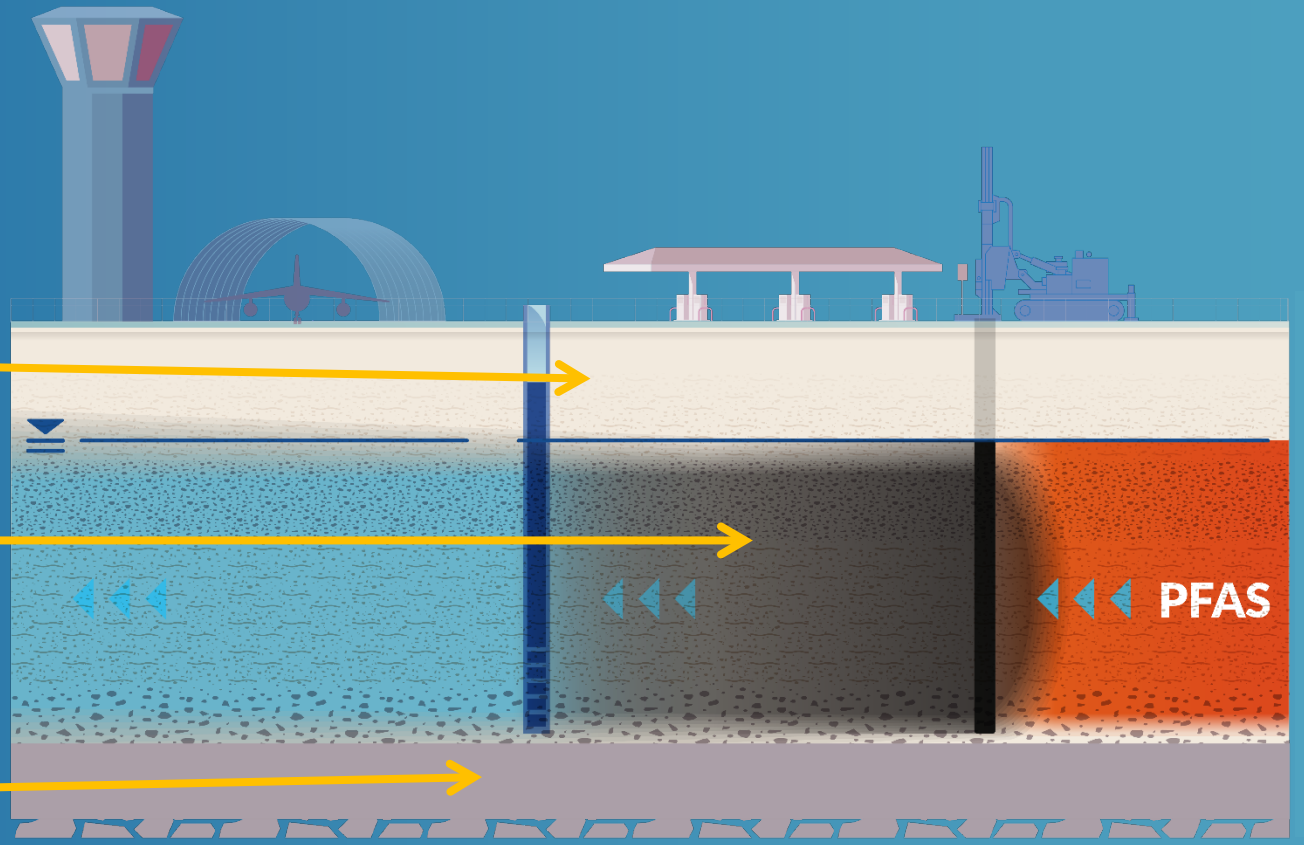
Colloidal Activated Carbon

- Size: 1 – 2 µm
  - 2-3 OOM smaller than GAC (500-1,000 µm)
  - Size of a red blood cell
  - Suspended in water/polymer
  - Distributes widely at low pressure
  - Extremely fast sorption
  - Huge surface area
  - Converts polluted aquifer into purifying filter

Treatment of Flux Zones and Control of Back Diffusion



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Field Test Location

Former Bulk Storage Tanks Location

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Simple Plume Cut-Off Barrier

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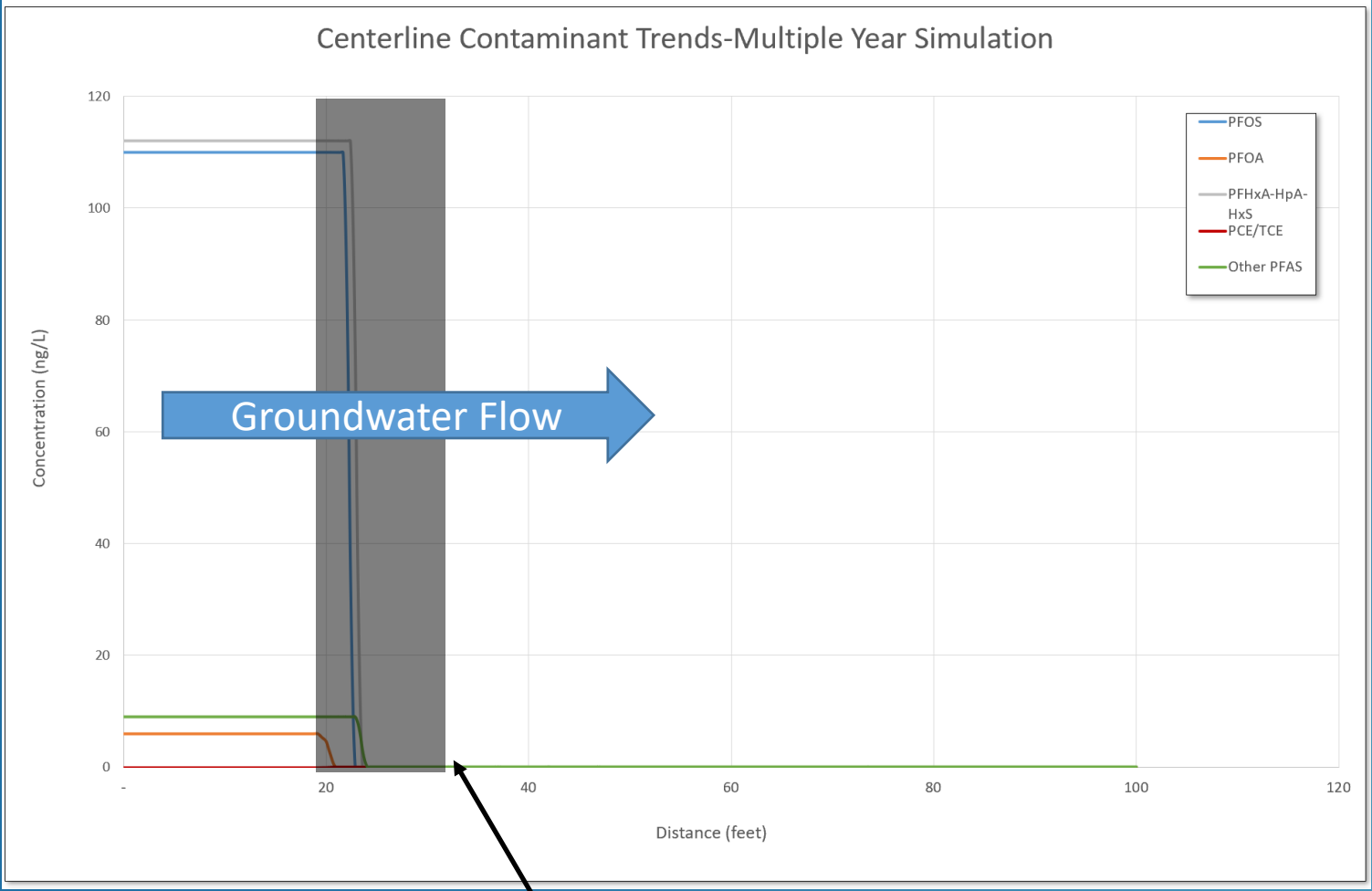
Modeling in the Design Process



Considerations

- Soil Type/Porosity
- Groundwater Seepage Velocity/Mass Flux
- Vertical Variations
- Barrier Thickness
- Carbon Demand
  - Specific COCs
  - Full Scans 8260/537
  - Non-Target Compounds
- Time (>75yrs)

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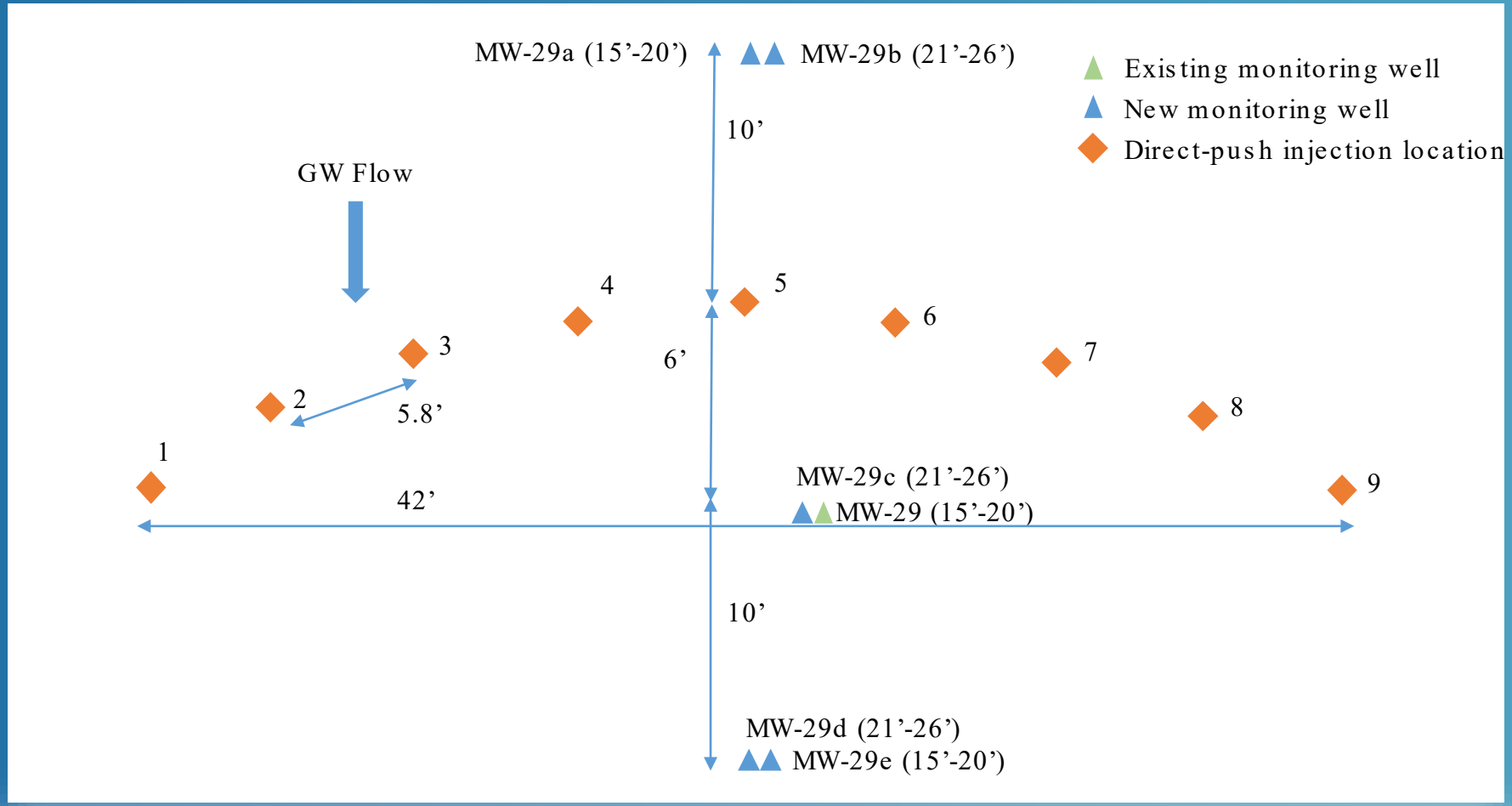
Field Test Layout



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Field Test Layout

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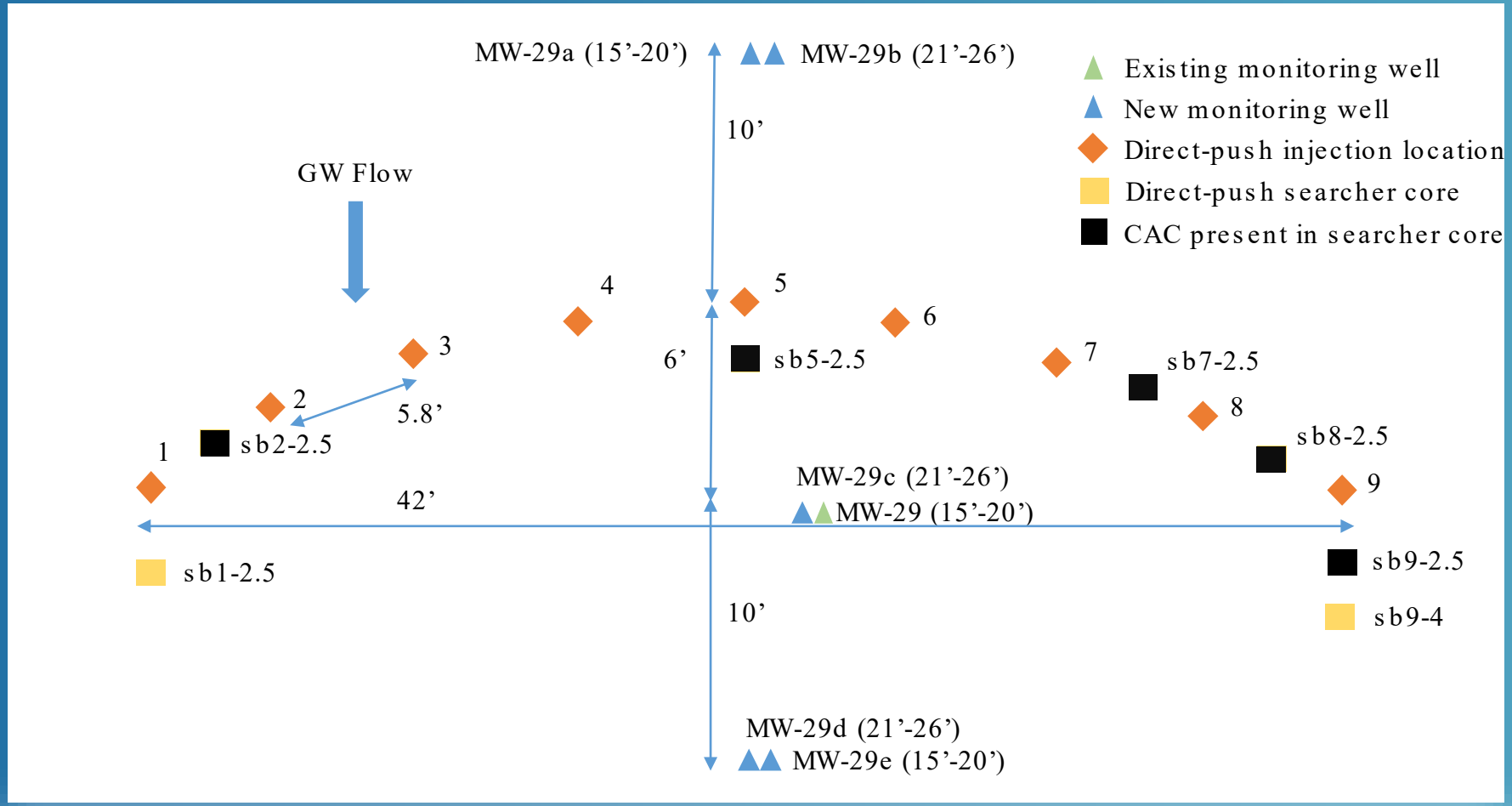

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CAC-Distribution Confirmation

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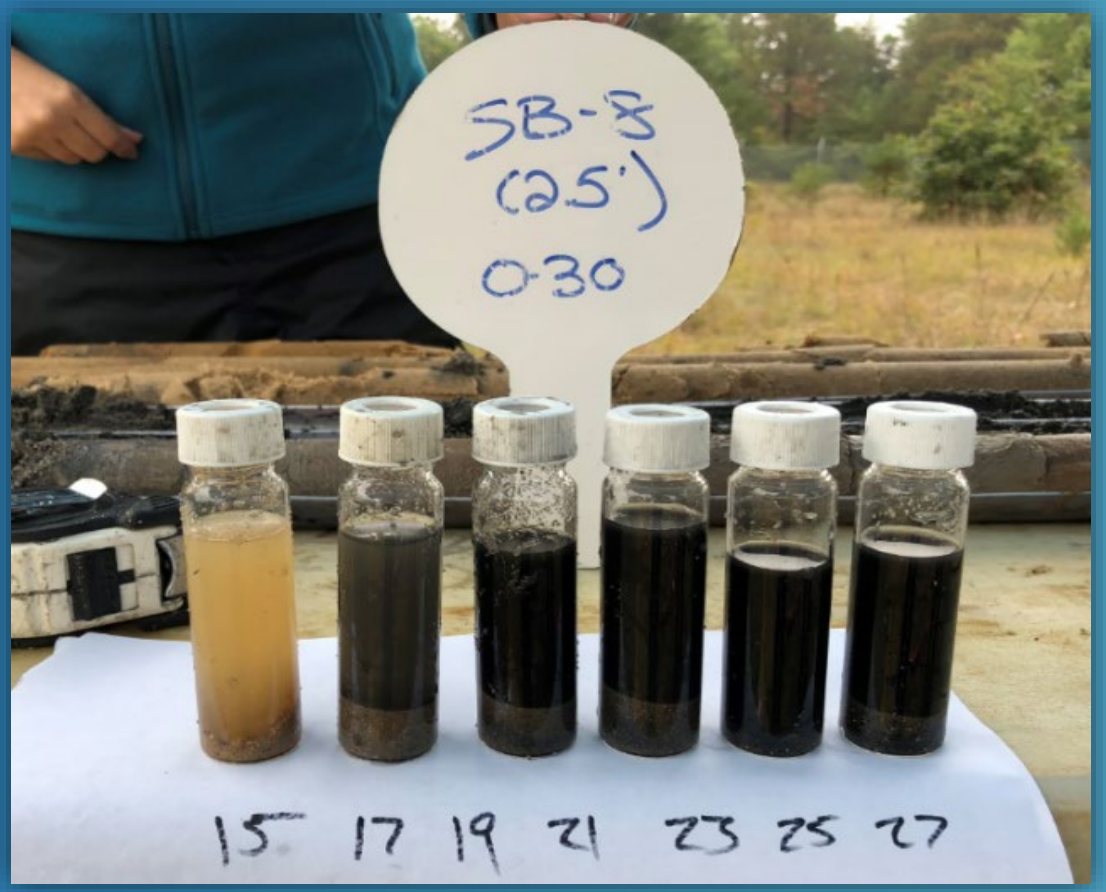
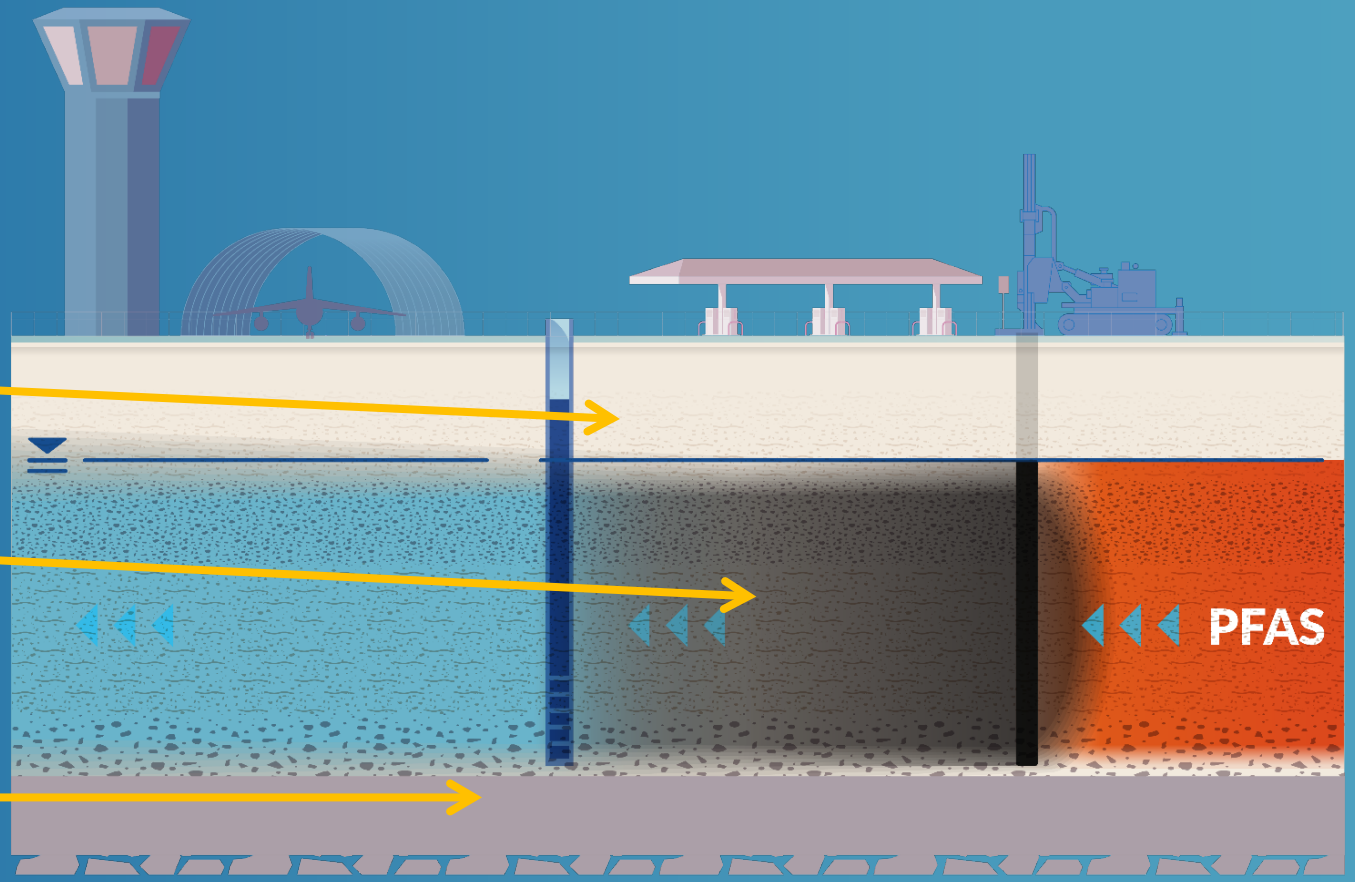
CAC-Distribution Confirmation



Soil Vial Shake Test

CAC-Distribution Confirmation



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CAC-Distribution Confirmation

Sample MW-29c

Field Test Kit

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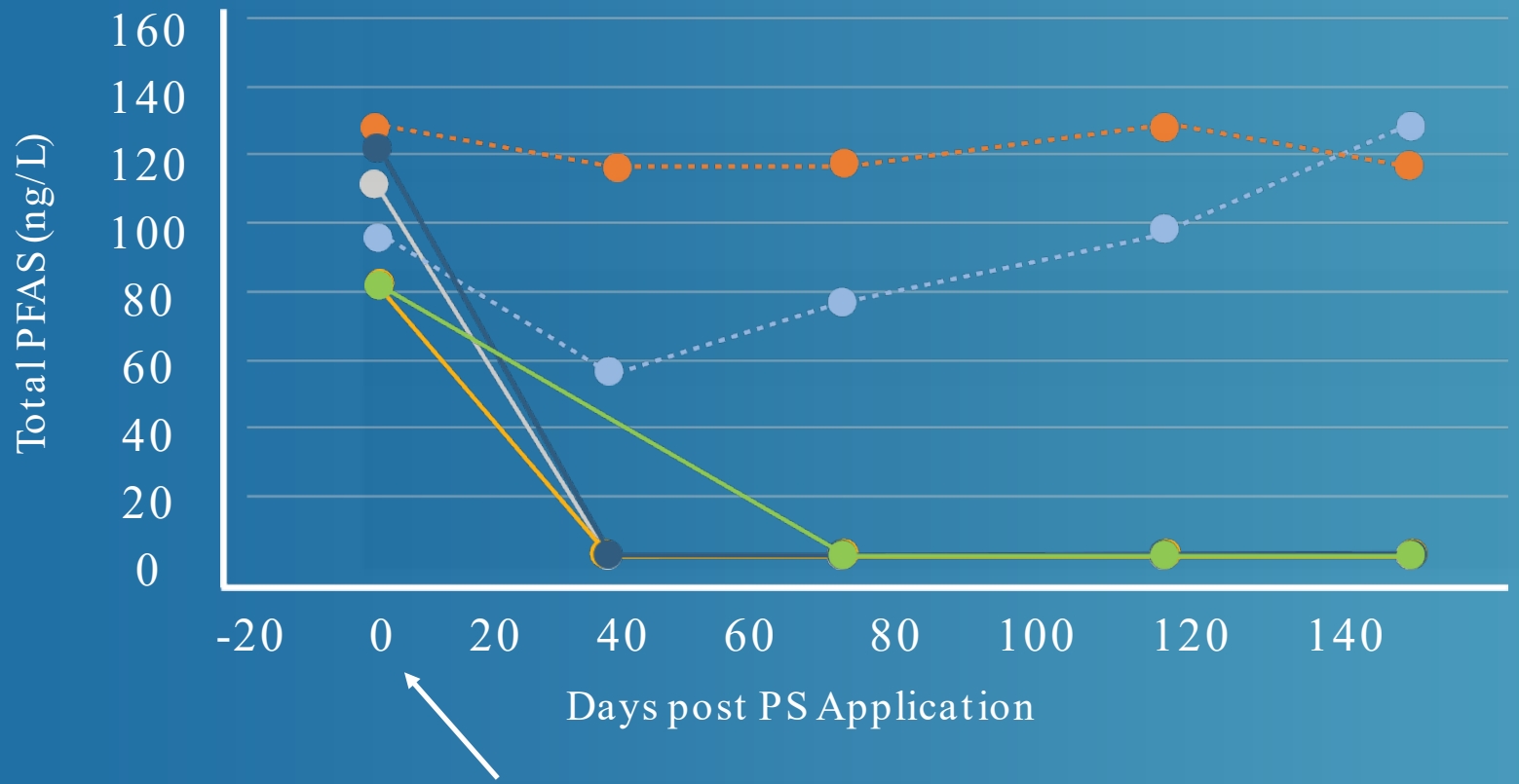
Total PFAS Results:
132 Days Post-application



Upgradient wells
- MW-29a (15-20')
- MW-29b (21-26')

6' Downgradient wells
- MW-29 (15-20')
- MW-29c (21-26')

16' Downgradient wells
- MW-29e (15-20')
- MW-29d (21-26')

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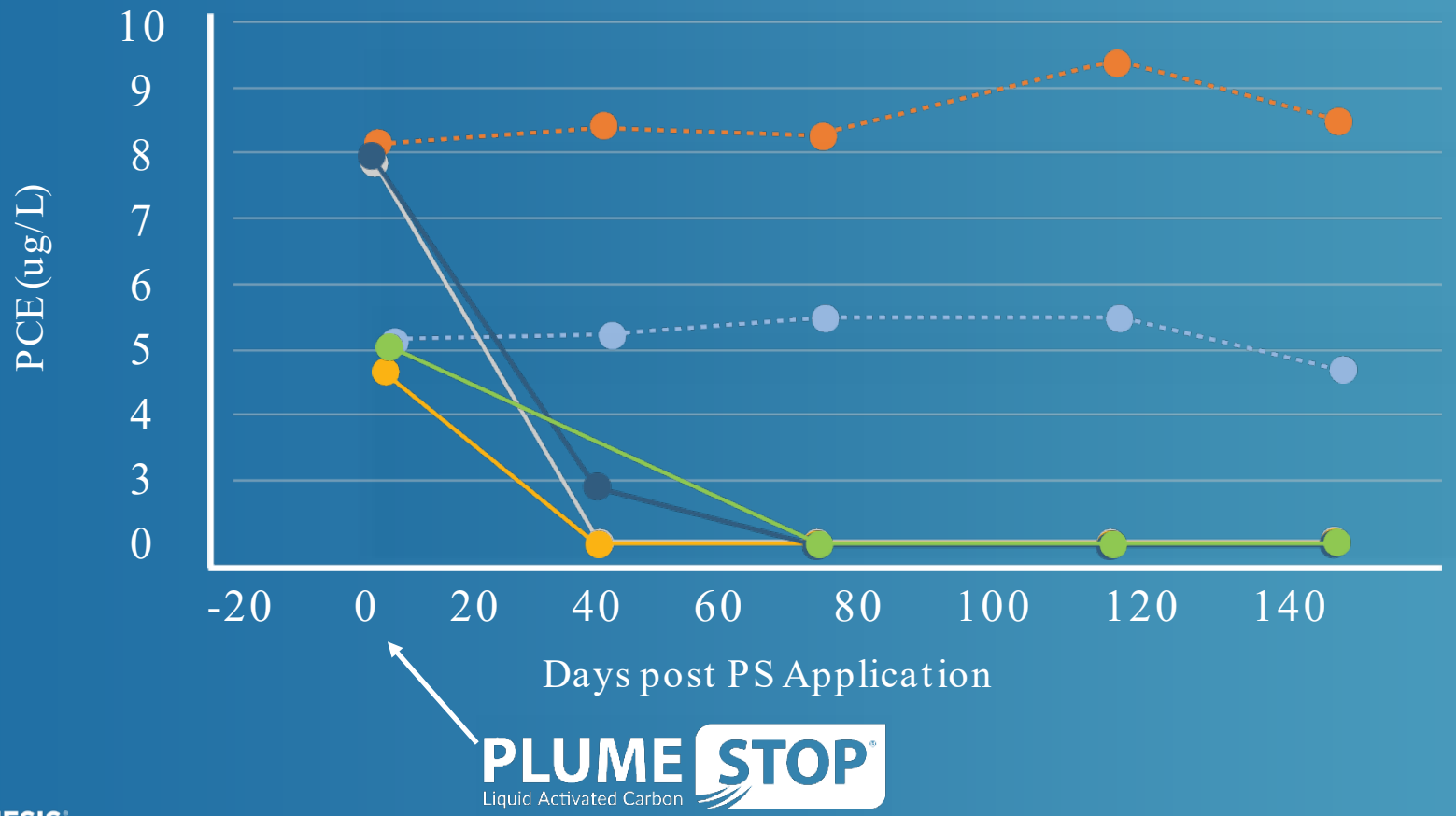
PCE Results:
132 Days Post-application



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16' Downgradient wells
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- MW-29d (21-26')

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Summary

- Very Successful Test
  - Verified distribution of CAC
  - Sustained reductions of PFAS and PCE over time
  - Anticipated to last for decades
  - Low cost alternative for possible remediation

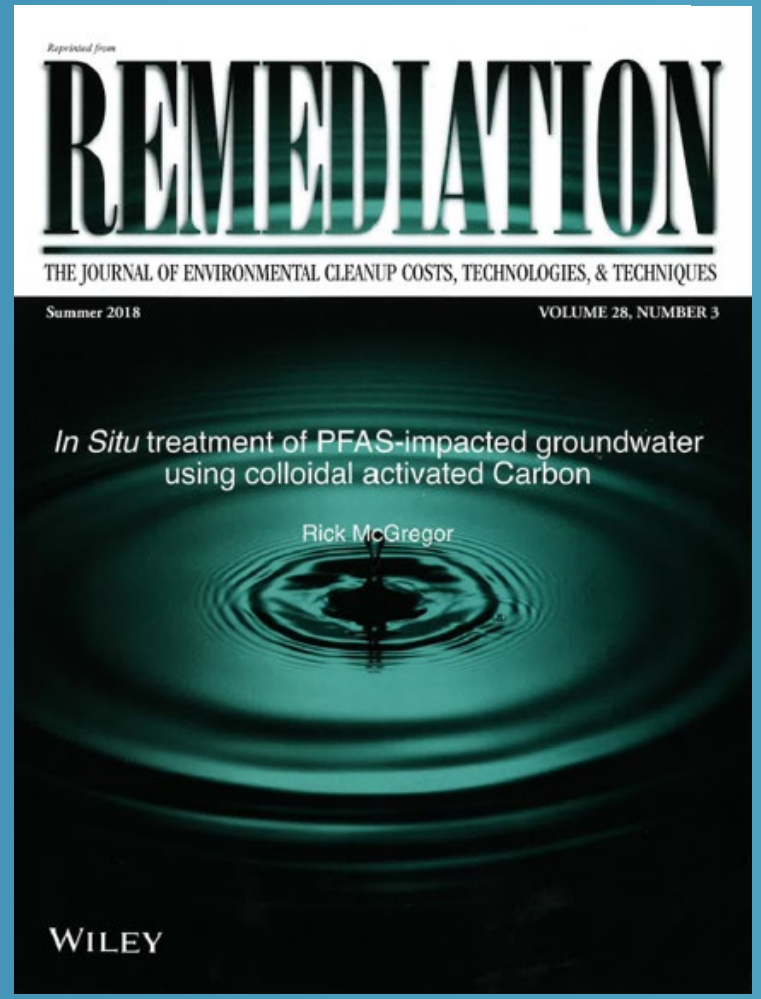
- ANSWER: Yes, CAC can be used to eliminated risk to potential multiple receptors!

Next Steps

- Pilot Test (2019)
  - Additional monitoring wells to assess further downgradient impacts
  - Continue to monitor
- Remedial investigation (2019/2020)
- Develop Sitewide Remedial Strategies (2020/2022)

PFAS Research Articles

- In-Situ treatment of PFAS-impacted groundwater using colloidal activated carbon
- http://www2.regenesis.com/pfas-wiley-article
- Evaluating the longevity of a PFAS *in situ* colloidal activated carbon remedy
- http://www2.regenesis.com/grant-carey-wiley-remediation-journal



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Thank you!
QUESTIONS?

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