Treatment Selection and Design for PFAS Management in a Changing Regulatory Environment

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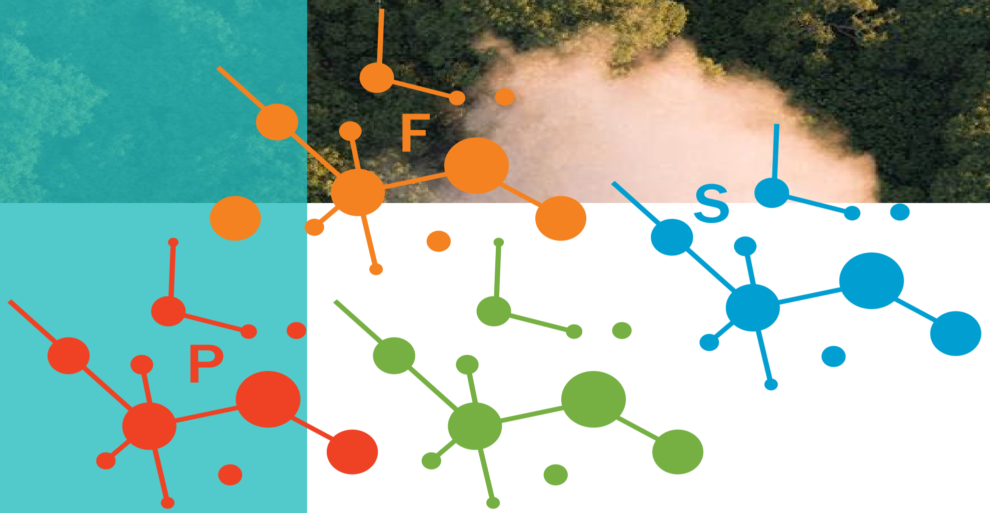
Agenda

1. Drinking water regulatory landscape
2. Developing a roadmap
3. Technology selection and design
   – Cost tradeoffs
   – Site specific considerations
4. Charting your path for treatment implementation

Drinking Water Regulatory Landscape

PFAS Overview

- Per- and Polyfluoroalkyl Substances (PFAS) are fluorinated surfactants with reported chronic human health effects
- Extremely persistent and mobile in the environment
- Difficult to destroy



EPA PFAS Proposed MCL Update

Compound	Provisional HALs 2009	Interim HALs 2016	Interim and Final HALs 2022	Proposed MCLG 2023	Proposed MCL 2023
PFOA	400 ppt	70 ppt	0.004 ppt	0	4 ppt
PFOS	200 ppt	70 ppt	0.02 ppt	0	4 ppt
PFNA			-	Hazard Index <1.0*	Hazard Index <1.0*
PFHxS			-		
PFBS			2,000 ppt		
HFPO-DA (Gen X)			10 ppt		

***The Hazard Index calculation for the sum of these four compounds should not exceed a ratio of 1 based on individual health-based water concentrations.**

How to calculate the Hazard Index (HI)

Monitored concentration of compound

$$\text{Hazard Index}^{*} = \frac{GenX_{water}}{10} + \frac{PFBS_{water}}{2000} + \frac{PFNA_{water}}{10} + \frac{PFHxS_{water}}{9}$$

Health-based water concentration (ppt)

should not exceed a ratio of 1

What is the timeline?

March 14, 2023
Draft MCLs announced

May 4, 2023
EPA public hearing

Late May 2023*
60-day public comment period ends
Docket ID Number: *EPA-HQ-OW-2022-0114*

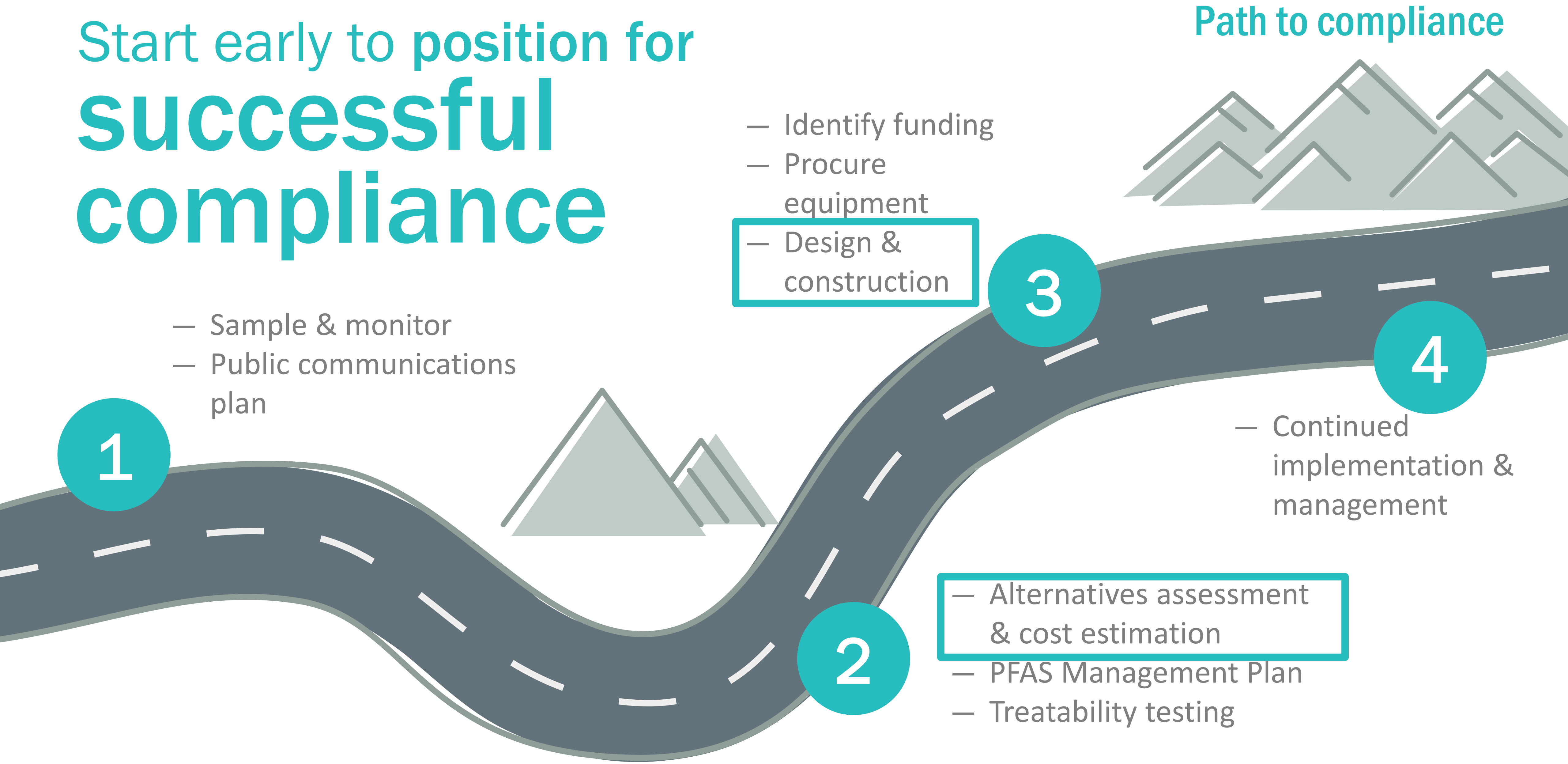
December 2023*
MCLs finalized

December 2026*
MCLs become enforceable standards for drinking water utilities

December 2028*
Utility compliance waiver ends (case-by-case basis)

**anticipated dates*

Start early to **position for successful compliance**



Technology Selection and Design: Cost tradeoffs

Current best available treatment technologies

Granular Activated Carbon (GAC)

Anion Exchange (IX)

Reverse Osmosis (RO) or Nanofiltration (NF)

These technologies have tradeoffs

Granular Activated Carbon (GAC)

Ion Exchange (IX)

Pros

Granular Activated Carbon (GAC):

- Established and widely used
- Removes many co-contaminants (TOC, color, T&O, VOCs)

Ion Exchange (IX):

- Effective for long- and short-chain PFAS
- Some resins have high selectivity for PFAS
- Smaller equipment footprint

Cons

Granular Activated Carbon (GAC):

- Competitive adsorption by co-contaminants
- Contaminants can desorb
- Moderate removal of short-chain PFAS

Ion Exchange (IX):

- Often requires pre-treatment
- Competing contaminants (sulfate and nitrate) reduce IX resin efficiency
- More costly than GAC media

Technology Selection and Cost Considerations

Case Study: City of Vancouver, WA

PFAS Levels

- PFOA range ~7 - 14 ng/L
- PFOS range ~16 - 25 ng/L

Proposed Treatment Flow

Design flow: 10,700 gpm

Considerations

- Treatment is add-on to existing site with site constraints
- Multiple wells operate intermittently
- Existing air stripper for VOC removal in treatment train

Assessment Design Criteria

Case Study: City of Vancouver, WA

Designed flow: 10,700 gpm

Parameter	GAC	IX
# of Paired Vessels, Lead Lag Configuration	8	6
Vessel Type	14' diameter	12' diameter
Media Volume (per vessel)	60,000 lbs	20,000 lbs
Media Unit Costs (*March 2022)	$2.30/lb	$7.20/lb
Empty Bed Contact Time (EBCT)	11.5 min	2 min
Maximum Hydraulic Loading Rate	9 gpm/sf	16 gpm/sf
Media Change Out Frequency	50,000	300,000

Capital and O&M Costs Comparison

Case Study: City of Vancouver, WA

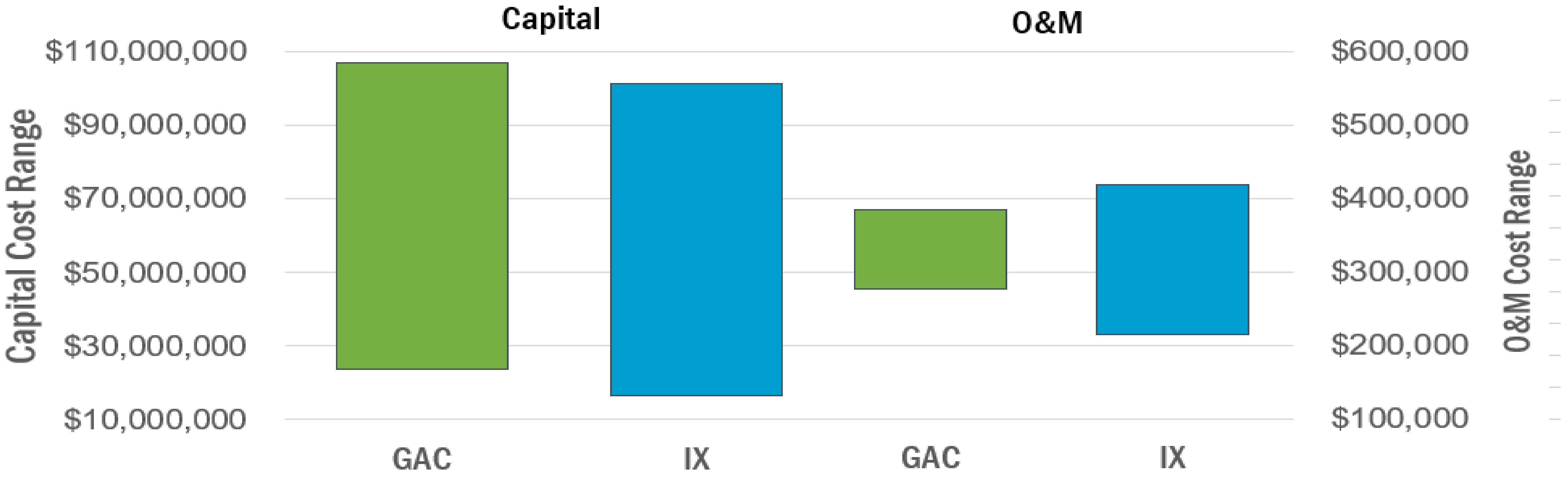
	GAC	IX
Capital Class 5 Estimate (– 50% to + 100%)	$51M ($26M - $102M)	$31M ($16M - $63M)
O&M Estimate	$328,000	$295,000

- Prefab building
- Backwash tank
- Site improvements
- Contingency
- Escalation

O&M Costs based on BV's to meet target of **WA SALs**

Sensitivity Analysis

Case Study: City of Vancouver, WA



Technology Selection and Design: Site Specific Considerations

GAC design for 3,200 gpm facility

Case Study: Sammamish Plateau Water

Sammamish Plateau Water

Timeline of PFAS Journey

2013 - 2015

- UCMR3 sampling with PFAS detections in nearby wells

2016-2017

- Voluntary sampling detected PFOS in low levels in two wells

Response

2018-2019

- Feasibility Study (by Corona Environmental) considered both GAC and IX

2020

- Design through 90% (Brown and Caldwell)
- Bench-scale RSSCT Study with GAC Media (Corona Environmental)

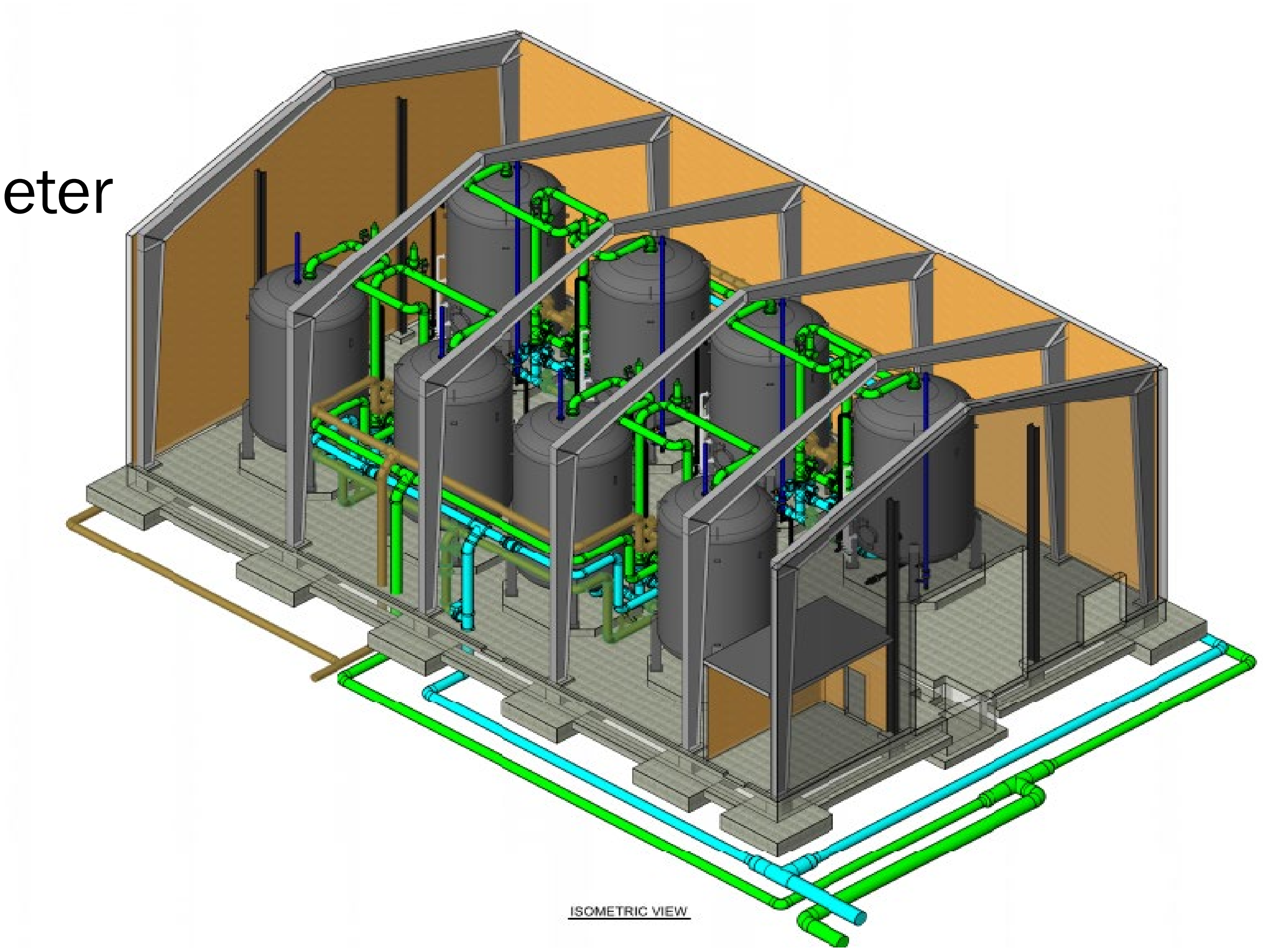
Why GAC for this site?

Site considerations

- PFAS detections mostly PFOS (longer chain)
- Adequate space availability for GAC vessels
- Limit head losses to avoid booster pump upgrades

GAC design overview

- 3,200 gpm
- Four lead/lag pairs of 12’ diameter vessels
- 40,000 lbs carbon vessels
- Pre-fabricated building

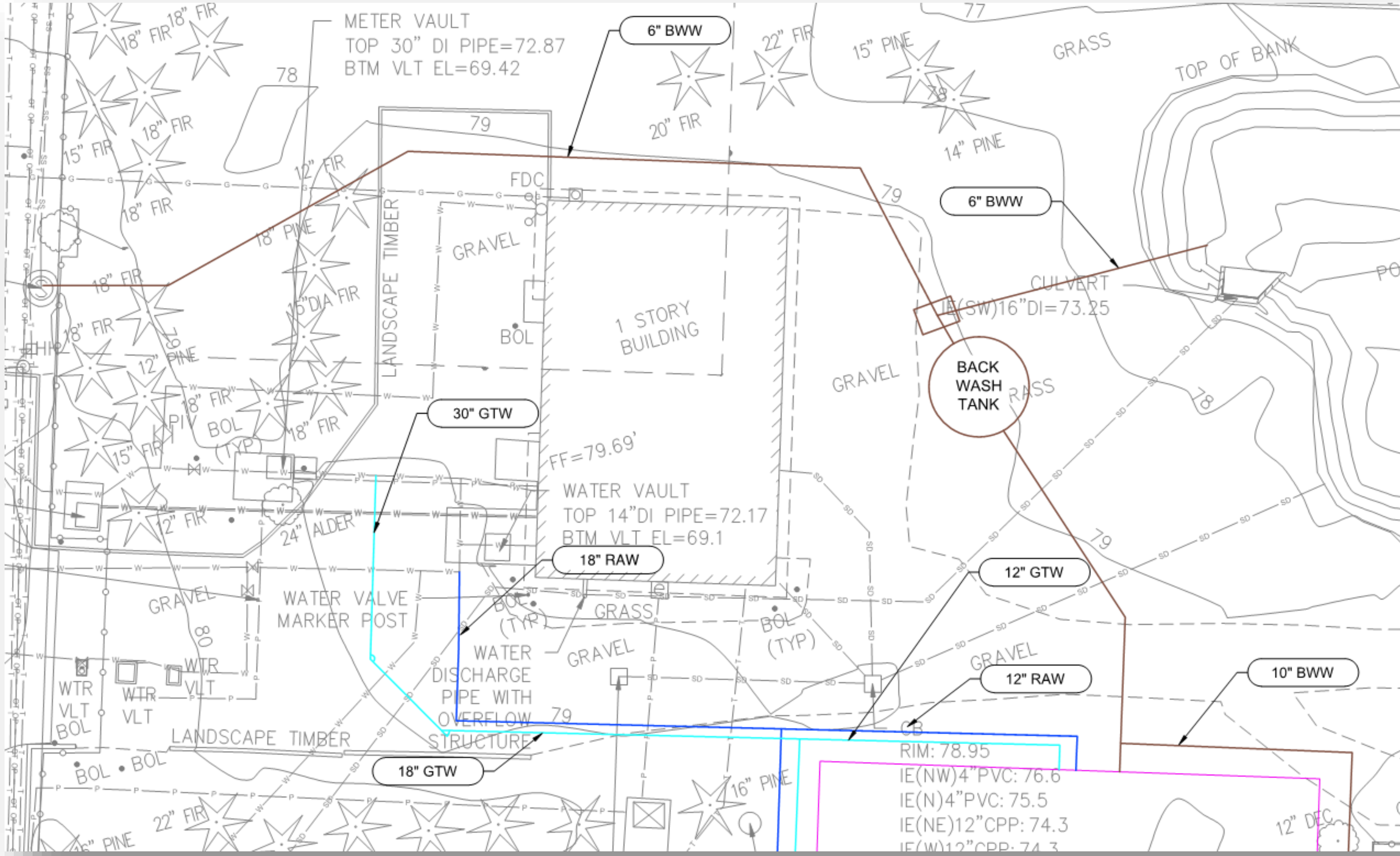


Backwash discharge considerations

- Backwash volume generated from one vessel wash (~36,000 gallons)
- Site conditions:
  - Infiltration basin for site drainage
  - No direct connection to sewer, but in vicinity

Backwash discharge considerations

- Above ground storage tank
- New sewer with 200 gpm capacity for media replacement backwash
- Infiltration basin with 35 gpm discharge for typical backwash
- Control vault to regulate discharge by gravity to either location

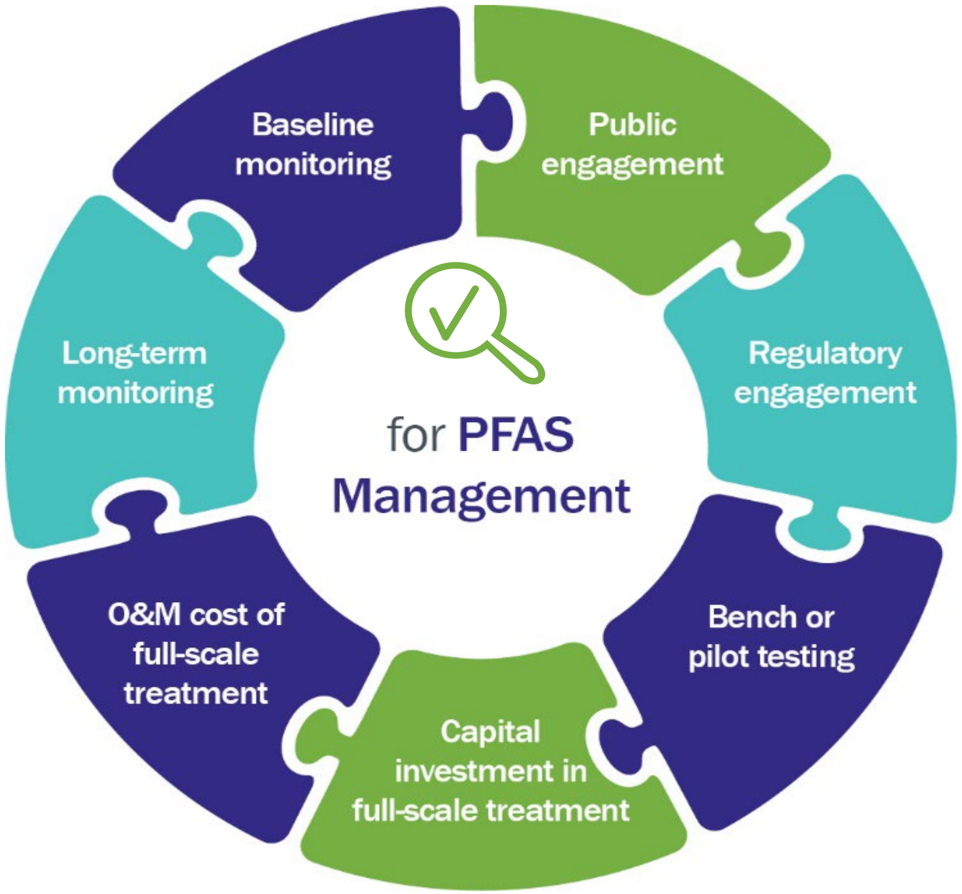


Charting your path for PFAS treatment implementation

One step at a time

“To get through the hardest journey, we need to take only one step at a time”

— *Chinese Proverb*



Thank you.

Questions?

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