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July 16, 2026

Jennifer McLain
Director
Office of Ground Water and Drinking Water
Environmental Protection Agency
1200 Pennsylvania Ave. NW
Washington, DC 20460

SUBMITTED ELECTRONIALLY

RE: Extending the Compliance Deadline for the PFOA and PFOS Maximum Contaminants Levels (Docket ID: EPA-HQ-OW-2025-1742)

Dear Dr. McLain,

The American Water Works Association (AWWA) appreciates the U.S. Environmental Protection Agency's (EPA) efforts to propose a federal exemption framework to facilitate compliance with the maximum contaminant levels (MCLs) for perfluorooctanoic acid (PFOA) and perfluorooctane sulfonic acid (PFOS). AWWA supports EPA's objective of providing a streamlined approach for processing Safe Drinking Water Act (SDWA) exemptions given the extensive capital improvements many water systems will need to make to come into compliance. Certainty that additional time is available allows water systems the opportunity to consider and implement more efficient, less costly options to comply with the MCLs. Taking the time to develop sustainable compliance strategies assists systems reduce the cost burden borne by individual household ratepayers.

Water systems are only eligible for the federal exemption if their state has not yet taken primacy. Consequently, the number of systems that will be able to take advantage of the proposed exemptions framework will be reduced if the rule is not finalized quickly. EPA should finalize this rule as expeditiously as possible. Timely finalization of this rule will also ensure these systems have the full 180-day window to submit their request for an exemption to EPA.

AWWA's attached comments focus on the value of additional time for rule compliance. The comments also address:

1. Primacy and timing considerations impacting operationalization of the federal exemptions framework;
2. The need to clearly explain EPA's basis for using 12 ppt as a threshold for requiring additional health risk reduction measures, and a proposal for an alternative approach; and
3. Input on the proposed rule's economic analysis.

This rule is premised on a concurrent rulemaking proposing to rescind regulatory determinations and related provisions for the Hazard Index (HI) PFAS. As EPA is aware, there is an ongoing judicial review of the 2024 PFAS NPDWR. The timing of the PFAS Rescission Rule is uncertain, as is the outcome of the ongoing judicial review proceedings. As such, the exemptions framework finalized by EPA should be expanded to include the HI PFAS (i.e., HI and individual MCLs) in addition to PFOA and PFOS in the event that the judicial review or the concurrent rulemaking does not come to closure such that those provisions remain in place. Otherwise this rulemaking will not provide meaningful relief to the regulated community.

We hope that these comments will assist EPA in finalizing this rule as expeditiously as possible to ensure the feasibility of implementation for public water systems and primacy agencies alike. If you have any questions regarding this correspondence, please contact me or Steve Via at 202.326.6130 or svia@awwa.org.

Best Regards,
ON BEHALF OF THE AMERICAN WATER WORKS ASSOCIATION

G. Tracy Mehan III

G. Tracy Mehan III
Executive Director – Government Affairs
American Water Works Association

Attachment (1)

cc: Eric Burneson, EPA/OW/OGWDW/SRMD
Christina Wadlington, EPA/OW/OGWDW/SRMD
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Who is AWWA

The American Water Works Association (AWWA) is an international, nonprofit, scientific and educational society dedicated to providing total water solutions assuring the effective management of water. Founded in 1881, the Association is the largest organization of water supply professionals in the world. Our membership includes more than 4,500 systems that supply roughly 80 percent of the nation's drinking water and treat almost half of the nation's wastewater. Our 50,000-plus total membership represents the full spectrum of the water community: public water and wastewater systems, environmental advocates, scientists, academicians, and others who hold a genuine interest in water, our most important resource. AWWA unites the diverse water community to advance public health, safety, the economy, and the environment.

COMMENTS
PREPARED BY THE
AMERICAN WATER WORKS ASSOCIATION
ON
EXTENDING THE COMPLIANCE DEADLINE FOR THE PFOA AND PFOS MAXIMUM CONTAMINANT LEVELS

(Docket ID: EPA-HQ-OW-2025-1742, May 20, 2026, 91 Federal Register 29425)

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COMMENTS
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AMERICAN WATER WORKS ASSOCIATION
ON EXTENDING THE COMPLIANCE DEADLINE FOR THE PFOA AND PFOS MAXIMUM CONTAMINANT LEVELS

(Docket ID: EPA-HQ-OW-2025-1742, May 20, 2026, 91 Federal Register 29425)

The American Water Works Association (AWWA) appreciates the opportunity to comment on the Environmental Protection Agency's (EPA) proposed rule "Extending the Compliance Deadline for the PFOA and PFOS Maximum Contaminant Levels". AWWA has prepared the following comments to assist EPA in moving forward with a final rule that is grounded in science and that can be effectively implemented by public water systems (PWSs) and primacy agencies.

Need for Additional Time for Rule Compliance

AWWA supports EPA's efforts to afford additional time for PWSs to achieve compliance with the perfluorooctanoic acid (PFOA) and perfluorooctane sulfonic acid (PFOS) maximum contaminant levels (MCLs). As AWWA stated in its comments on EPA's proposed National Primary Drinking Water Regulation (NPDWR) for per- and polyfluoroalkyl substances (PFAS) in 2023, the standard implementation timeline afforded to PWSs under the Safe Drinking Water Act (SDWA) is not sufficient for compliance with the PFAS NPDWR given the complexity of PFAS treatment technologies and workforce limitations.[1] As the typical timeline for planning, design, permitting, and construction of a new drinking water treatment facility for PFAS may reasonably take more than five years, the standard compliance timeline of three years under SDWA presents feasibility and cost challenges for PWSs, particularly when EPA embeds a prescribed initial monitoring period intended to inform compliance strategy decisions within that period. Even with EPA previously having incorporated the SDWA two-year capital improvement extension into the base compliance timeline, many PWSs will still face challenges becoming reliably compliant with the PFAS MCLs by April 2029 while taking the appropriate care to evaluate a sustainable long-term strategy.

Based on the most recent release of data from the Fifth Unregulated Contaminant Monitoring Rule (UCMR 5), only 0.6% of sampled water systems that exceed the rule MCLs are implicated by the Hazard Index (HI) standard alone.[2] In other words, 99.4% of implicated PWSs exceeding the MCLs that were sampled under UCMR 5 to date are anticipated to take some intervention to comply with the PFOA and/or PFOS MCLs. This means that even if the agency succeeds in rescinding the HI provisions under the 2024 PFAS NPDWR, the vast majority of implicated PWSs will still be implicated due to PFOA and/or PFOS concentrations above their respective MCLs. As such, compliance with the revised rule still presents a substantial feasibility and cost challenge for the many systems that are expected to make capital improvements to comply with the PFOA and PFOS MCLs. Black & Veatch's recently released 2026 Water Report indicates that 35% of water systems surveyed plan to implement PFAS treatment, with 61% of those systems planning to pursue main treatment plant retrofits.[3]

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[1] AWWA. 2023. Comments on Proposed PFAS NPDWR, EPA-HQ-OW-2022-0114-1759.
[2] Corona Environmental Consulting. UCMR5 PFAS Analysis Update, Latest from EPA's January 2026 Data Release (11th Data Release). Accessed May 15, 2026 at https://media.licdn.com/dms/document/media/v2/D561FAQFsF5gOF_wJuw/feedshare-document-pdf-analyzed/B56Z4teX53JIAY-/0/1778879401355?e=1784160000&v=beta&t=BVeJwxMPq7JhMdRpmBgkhRVw_y0VtlL9n7HFFfjEPFA&acrobatPromotionSource=linkedin_chrome-post_view.
[3] Black & Veatch. 2026 Water Report. Accessed June 29, 2026 at https://www.bv.com/en-US/resources/water-report.

The Federal Exemptions Framework is Not a Blanket Extension

AWWA appreciates EPA's efforts to provide additional time for PWSs to come into compliance with the PFOA and PFOS MCLs via the proposed national exemptions framework. Some of EPA's previous public statements forecasting this rule proposal suggested that additional time for compliance would take the form of a blanket two-year extension for all PWSs.[4] What EPA is proposing in this rule is not a blanket two-year compliance extension; rather, PWSs must apply for and be granted an exemption upon satisfying specific criteria. What is included in EPA's national exemptions framework proposed under this rule clearly takes its form directly from EPA's Variance and Exemption Regulations, which codified provisions concerning variances and exemptions as amended under SDWA sections 1415 and 1416.[5] Some of these provisions can prove to be arduous in the way of implementation for PWSs, for instance implementation of point-of-use devices and point-of entry devices as a condition for granting an exemption.

Given the implementation burden presented by some of these provisions, as well as the time it will take for systems to submit information to apply for an exemption and for EPA to process and grant exemptions, AWWA recommends that EPA:

1. Finalize this rule as expeditiously as possible;
2. To the extent possible, endeavor to expedite the review and approval process for exemption applications so that PWSs that apply have as much certainty as possible when implementing the PFAS NPDWR; and
3. Ensure that all agency staff and state primacy staff clearly convey that the federal exemptions framework outlined in this rule proposal requires meeting certain criteria and application for approval.

The need for expeditious finalization of this rule is discussed further in the subsequent subsection of this comment letter entitled "*Primacy Considerations".*

PFAS Treatment Implementation Costs Drive Need for Additional Time

To better understand the costs to comply with EPA's 2023 proposed PFAS NPDWR, AWWA contracted with Black & Veatch to develop a national cost estimate for water systems to remove PFAS from drinking water. Black & Veatch developed a national cost model, and collected case studies from PWSs. Black & Veatch then compared its analyses with model outputs from EPA's Work Breakdown Structure (WBS) units cost curves for granular activated carbon (GAC) and ion exchange (IX). The resulting estimates indicated that EPA's WBS models substantially underestimated the costs associated with PFAS treatment using GAC treatment.[6]

In an effort to re-evaluate the cost estimates from 2023, AWWA worked with Black & Veatch to generate updated capital cost estimates for implementing PFAS treatment infrastructure (i.e., GAC and IX) across

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[4] EPA. EPA Announces It Will Keep Maximum Contaminant Levels for PFOA, PFOS. Accessed June 26, 2026 at https://www.epa.gov/newsreleases/epa-announces-it-will-keep-maximum-contaminant-levels-pfoa-pfos.
[5] EPA. Revision of Existing Variance and Exemption Regulations to Comply with Requirements of the Safe Drinking Water Act; Final Rule. 98 Federal Register 21746.
[6] AWWA. 2023. Comments on Proposed PFAS NPDWR; Appendix B: WITAF 056 Technical Memorandum Update: PFAS National Cost Model Report. EPA-HQ-OW-2022-0114-1759.

a range of water treatment plant (WTP) capacities, with a primary focus on facilities treating between 0.25 and 50 million gallons per day (MGD). The updated 2026 cost estimates were generated by compiling recent GAC and IX treatment implementation cost data from PWSs collected from several outreach methods. For more information on the cost estimation methodology, please see Appendix A entitled "*PFAS Treatment Implementation Cost Study*".

The updated 2026 cost data were plotted alongside cost data from Black & Veatch's 2023 national cost model and case studies as well as data derived from EPA's WBS cost curves for both GAC and IX treatment systems. The comparison of capital costs for GAC and IX are shown in Figures 1 and 2 below, respectively (Figures 3-7 and 3-8 in Appendix A).

Figure 1: Comparison of Capital Costs by GAC Treatment System Size

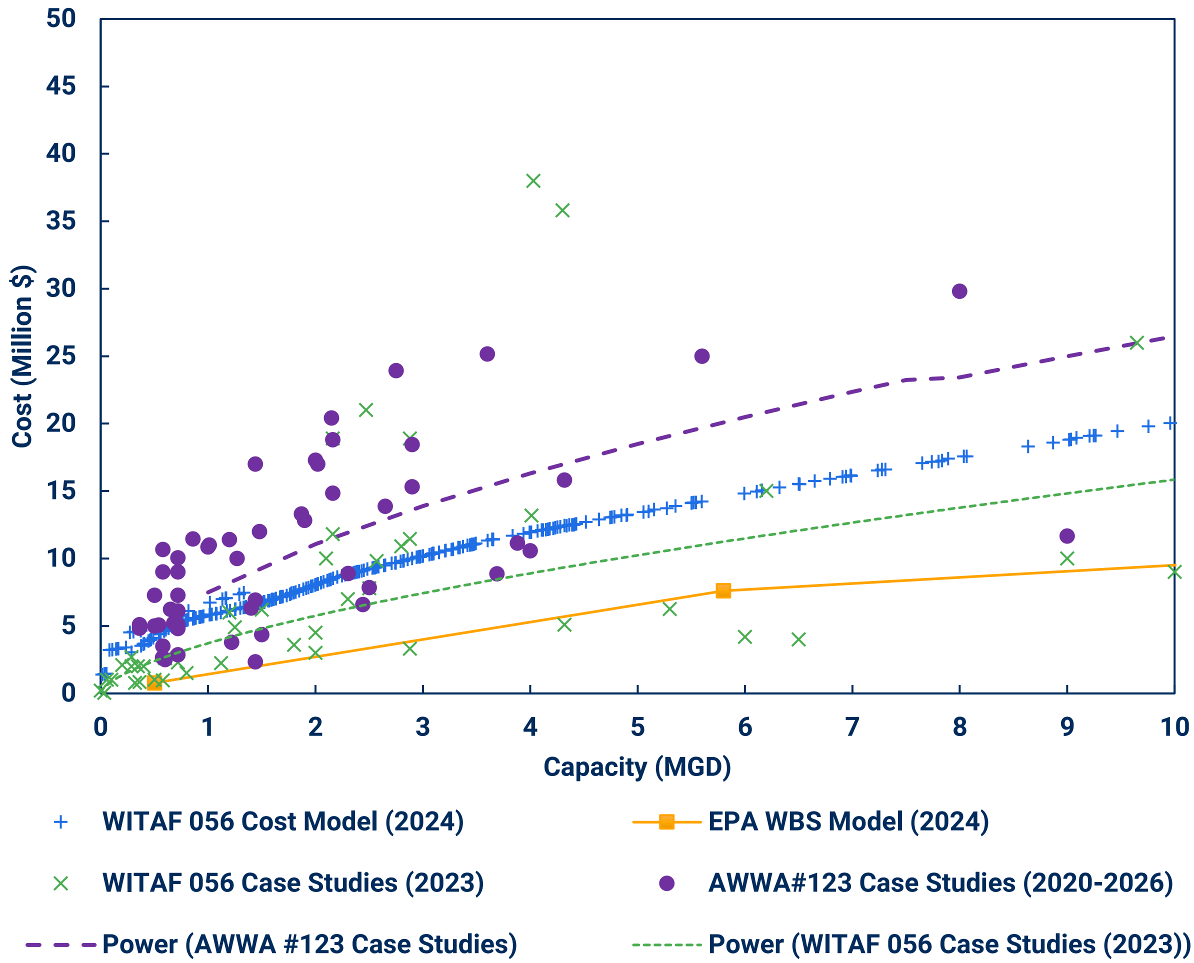
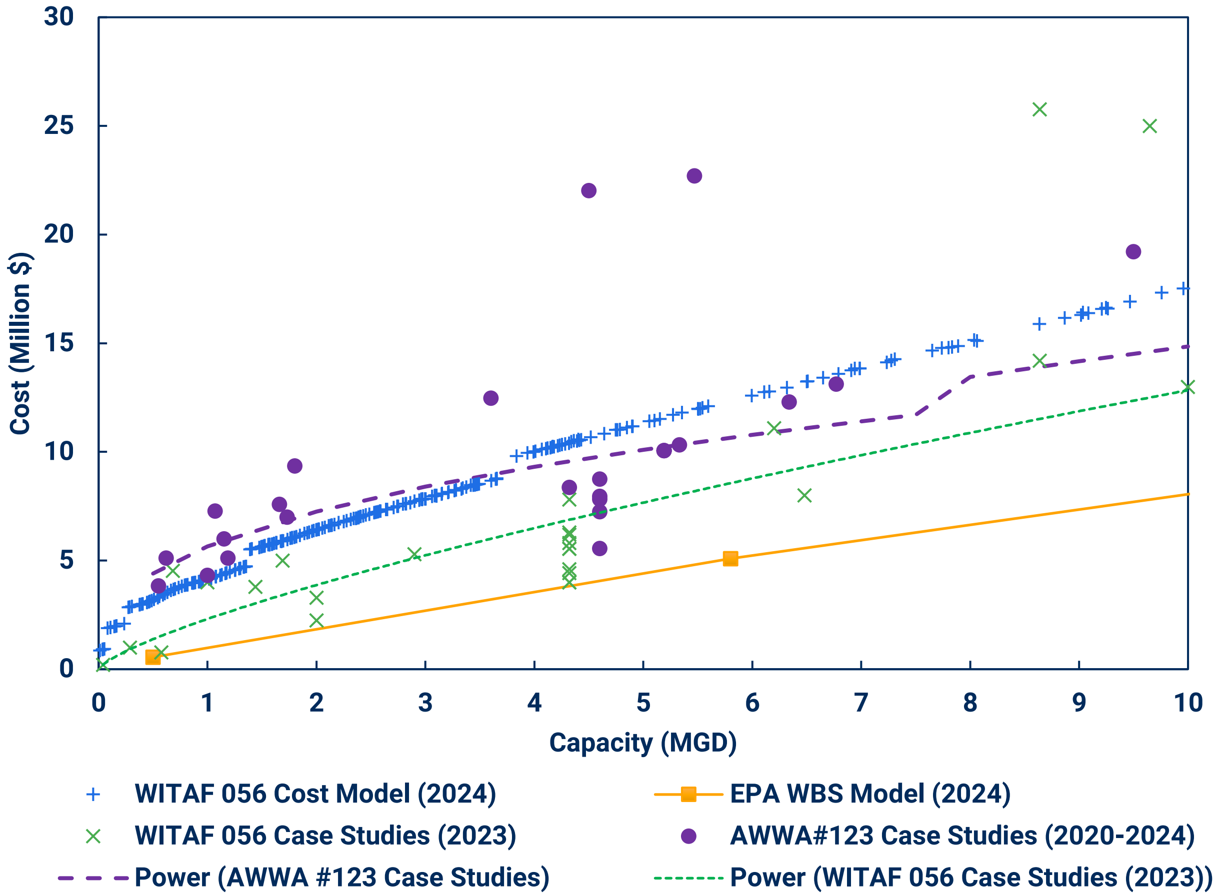


Figure 2: Comparison of Capital Costs by IX Treatment System Size



GAC project costs ranged from $2.0-$10.9 million per MGD treated and IX project costs ranged from $1.2-$6.2 million per MGD treated. As shown in Figures 1 and 2, for both GAC and IX treatment, data compiled in 2026 generally follow the same directional trend as that for the previously collected cost data but also tend to be higher, reflecting higher capital costs than those previously estimated. Increases in capital costs based on the updated 2026 data are likely due to inflation in construction materials costs for PWS equipment, steel market volatility, and supply chain constraints for GAC and IX, as well as the inclusion of non-construction costs (e.g., piloting, engineering, legal/administrative, permitting, construction phase services, etc.). When compared to costs from EPA's Work Breakdown Structure models, 2026 treatment costs were projected to be 215-272% higher and 93-266% higher across treatment capacities for GAC and IX, respectively.

This work clearly demonstrates that the costs to install treatment to comply with the PFOA and PFOS MCLs are much higher than EPA's analysis shows and have become even more substantial. These increases in costs are as expected given that more than 4,500 water utilities are impacted by this rule. As previously noted, approximately two-thirds of PWSs are pursuing new treatment plant modifications that require procurement of pilot testing equipment and services, engineering design services, and construction services at the same time. This surge in market demand for these services is driving these costs up. The compressed timeline of the rule also makes PWSs more susceptible to unforeseen market changes (e.g., tariffs, natural disasters, foreign affairs impacts, etc.) which may be easier overcome with longer implementation timelines.

With the current five-year compliance timeline, many PWSs will be forced to sacrifice careful financial planning and rate-setting in the interest of moving a capital improvement project forward on an aggressive timeline. Affording impacted PWSs additional time to come into compliance will enable them to more effectively plan these capital improvements and associated expenditures. More time also provides PWSs an opportunity to seek out more efficient, potentially less costly options for MCL compliance that will ensure a more sustainable, long-term solution for these PWSs. For instance, systems may be able to secure funding through the Drinking Water State Revolving Fund (DWSRF), find alternative water sources through regionalization, or advance source water protection programs that reduce or eliminate the need for treatment. In general, more time provides a better opportunity for systems to find financially sound alternatives and potentially defray costs, rather than rushing into financing large-scale capital improvements on a more compressed compliance timeline.

Streamlining the Exemptions Framework

As EPA finalizes this rule, it is important that the agency concurrently consider how to rapidly implement the final exemptions framework. EPA is proposing that PWSs apply for exemptions within 180 days of final rule promulgation. We know that many of the PWSs facing compliance challenges under this rule are small or very small and, as such, have limited resources to track and interpret federal rulemakings. Similarly, we must recognize that this process must be implemented by EPA Regions with their own limited resources, as this is a federal exemptions framework. The following are suggestions for the timely and efficient implementation of the final exemptions framework:

1. Develop guidance on how to prepare exemption applications, to be released concurrently with the final rule.
2. If possible in the time available, develop an electronic portal for application submission.
    a. EPA uses the Safe Drinking Water Accession and Review System (SDWARS) system to implement the Unregulated Contaminant Monitoring Rule (UCMR).[7] SDWARS utilizes EPA's Central Data Exchange (CDX) to assure a reliable, secure information exchange.[8] As with UCMR, participating water systems will need time to include or update their system information in CDX in advance of the timeframe available for application submission.
    b. Data elements required in such an online portal will need to be limited to what is necessary for the exemption, straight-forward, described in plain English, and readily available to applicants of all types (e.g., water utilities, municipal government, homeowner associations, private business operators, etc.) subject to the rule.
    c. While the CDX has staffing dedicated to answer user queries by phone or email regarding access and use of the portal, they are not experts in rule-specific matters. A second group of dedicated staff that can answer questions regarding applications would be helpful.

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[7] EPA. Monitoring Unregulated Drinking Water Contaminants, Reporting Requirements. Accessed July 1, 2026 at https://www.epa.gov/dwucmr/proposed-reporting-requirements-sixth-unregulated-contaminant-monitoring-rule-ucmr-6.
[8] EPA. Central Data Exchange. Accessed July 1, 2026 at https://cdx.epa.gov/About/AboutRegulation.

d. Applicants should receive an electronic receipt for submittals. Such receipts are commonplace. One example would be the receipts for comment submittal in www.regulations.gov.

3. While implementing an electronic portal would be ideal, such portals can be difficult to stand up and operate quickly without glitches. The final rule should outline the specifics of a paper or e-mail based submittal process that can serve as a failsafe should there be challenges establishing an electronic portal. This paper or e-mail based filing process should include a receipt from EPA.

4. The proposed rule sets a timeframe for PWSs to submit applications limited to 180 days. Ensuring awareness of this limited window of opportunity will require an active communication strategy on the part of EPA. AWWA will utilize its communication channels to build awareness. Having clear communication materials from EPA as soon as the pre-publication rule is available would best facilitate our efforts.

5. PWSs will need certainty that their applications meet the EPA's expectations within a reasonable period of time. While there may be hundreds of water systems applying for exemptions, the number of applications received by some Regions may require adjusting staffing in order to provide timely responses to water systems. While immediate responses would be ideal, would EPA be able to adequately staff a 30-day response timeframe?

6. In general, the data elements EPA will want to see in applications would appear to be straight-forward. The final rule and guidance should be clear with respect to application expectations for elements like interim control measures. With the period of the exemption not beginning until 2029 and the limited window for applications, it is unlikely that applicants will have documentation of interim control measures, beyond an initial commitment to a path forward to comply.

Applicability of Federal Exemptions Framework

This rule is premised on a concurrent rulemaking proposal to rescind regulatory determinations and related provisions for the Hazard Index (HI) PFAS.[9] Planning for both of these rulemakings to occur apace and be equally well-received is a fraught premise for this rule. EPA implicitly acknowledged this risk in proposing two separate rulemakings. Also, as EPA is aware, there is an ongoing judicial review of the 2024 PFAS NPDWR.[10] With the timing of the PFAS Rescission Rule being uncertain, as well as the outcome of the ongoing judicial review proceedings, EPA should expand the final PFAS federal exemptions framework to include the HI PFAS (i.e., HI and individual MCLs) in addition to PFOA and PFOS in the event that the judicial review or the concurrent rulemaking do not come to closure and those provisions remain in place. Such natural, logical extension of EPA's proposal—capturing presently regulated contaminants that would be treated in much the same way as PFOA and PFOS—would entirely avoid the potential need for a follow-on rulemaking, which would impose yet-additional delay and, as a result, limit the effective relief afforded to PWSs by this extension rule.

[9] EPA. Recission of Regulatory Determinations and Removal of Related Provisions for Four PFAS Substances (PFHxS, PFNA, HFPO-DA (GenX), and the Mixture of These Three PFAS Plus PFBS), Docket ID: EPA-HQ-OW-2025-0654, May 20, 2026, 91 Federal Register 29413.

[10] Petition for Review of the PFAS National Primary Drinking Water Regulation (AWWA and AMWA v EPA, U.S. Federal District of Columbia Court of Appeals, Case #24-1376).

Primacy Considerations

EPA should, as a matter of practice, maintain a publicly accessible listing of the status of state primacy applications for SDWA rules. The lack of such a listing greatly complicates PWS planning to utilize the proposed federal exemption. SDWA provides an existing pathway for PWSs to be granted exemptions by primacy agencies.[11] EPA's proposed exemption-by-rule approach would streamline this SDWA provision and reduce burden on state primacy agencies. Outreach to-date has not identified state laws or regulations that would prevent state primacy agencies from allowing EPA's federal exemption to remain in effect once granted.

However, timing is critical for the exemption-by-rule approach to offer the anticipated efficiencies and meaningful additional time for PWSs seeking exemptions. As crafted, the proposal is limited to systems who apply to EPA before their state has obtained primacy. This will likely limit the number of PWSs the federal exemptions framework benefits, especially if finalization of this rule is delayed.

PWSs Need Clear Insight into Primacy Process

PWSs have limited insight into the timing of the state primacy process. As a consequence, it is not clear how much time, if any, systems will have under federal supervision and thus assured that the federal exemption will be honored. At present, it appears that at least two states have already submitted primacy requests and that the majority of states anticipate submitting primacy requests by April 2028. Several states have indicated that they plan to take oversight of the PFAS rule *after* April 30, 2027. The majority of these states do not know precisely when they will take oversight following this date, with some stating the timing will be dependent upon when EPA finalizes this rule. Only after EPA's rule revisions are finalized will these states begin their rulemaking process (which can take a number of months to complete), with a primacy application to follow.

PWSs are not privy to primacy negotiations and thus lack insight into when *interim* primacy might begin. As footnoted in the Federal Register notice for this rule, EPA does not anticipate issuing federal exemptions once a state has "primacy *or interim primacy*".[12] Interim primacy could be granted concurrently with primacy package submittal or through some other agreement between EPA and the state. Uncertainty as to when state primacy will begin not only impacts the preparation of exemption applications, but also has implications for the viability of relying on a federal exemption. When asked, several states estimate that their formal primacy over the PFAS rule will be approved within two years of April 30, 2027, with a few states estimating closer to six months to one year to obtain primacy approval from EPA. While the majority of states currently appear to plan to honor exemptions granted by EPA, at least one state indicates it does not anticipate approving exemptions until they have taken primacy over the rule and plans to make their own exemption decisions.

Finalizing this Rule Should Be Expedited

EPA cannot forestall states second guessing its exemption decisions, but by rapidly finalizing this rule, the agency can facilitate access to the streamlined application process proposed in this rule. This is particularly important if interim primacy begins with primacy application submittal or sooner with an interim

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[11] 42 U.S. Code § 300g-5.
[12] EPA. Extending the Compliance Deadline for the PFOA and PFOS Maximum Contaminant Levels, Docket ID: EPA-HQ-OW-2025-1742, May 20, 2026, 91 Federal Register 29434.

agreement. Finalizing this rule in 2026 has several benefits beyond regulatory certainty for systems that apply, including:

1. Allowing PWSs to prepare the required exemption application within the required 180-day period post-promulgation before PFAS NPDWR compliance monitoring begins, supporting consistent communication with customers.[13] With compliance monitoring, PFAS rule customer communication requirements and Consumer Confidence Rule requirements begin.[14,15]

2. Increasing the likelihood that PWSs will have an opportunity to submit an application for a federal exemption prior to their state primacy taking interim primacy, and the system losing access to the streamlined federal process.

<u>Appropriateness of 12 ppt Threshold for Interim Control Measures</u>

Granting exemptions to PWSs under SDWA requires that those PWSs meet specific statutory criteria, including the finding that granting of the exemption will not result in an "*unreasonable risk to health*" (URTH).[16] In the proposed rule, EPA characterizes URTH as follows:

> "*For systems seeking an exemption with any most recent PFOA and PFOS sampling result(s) at or above 12 ppt…a two-year exemption would not present an URTH if, as a condition of the exemption, these systems would have to implement interim control measures during the two-year exemption period*".[17]

Identifying criteria for when interim control measures are appropriate is an important element of the exemption-by-rule framework. Moreover, the use of simple, easily communicated criteria facilitates timely decision-making.

Clearly Describe Basis for Interim Control Measure Criterion

The Federal Register notice for this rule does not provide a specific basis for why 12 ppt was selected as the threshold for the provision of interim control measures. In finalizing this rule, EPA should describe the basis for the final criterion. PWSs will need this explanation to (1) inform local decision-making, (2) communicate clearly with their customers should the PWS pursue an exemption, and (3) inform how all PWS communicates with the public, particularly if the final criterion is based upon a single PFOA or PFOS observation. In order to facilitate state decisions to continue exemptions or grant exemptions under their own SDWA authority, a clear basis for URTH underpinning the final criterion for additional control measures should be included in the final rule.

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[13] EPA. Extending the Compliance Deadline for the PFOA and PFOS Maximum Contaminant Levels, Docket ID: EPA-HQ-OW-2025-1742, May 20, 2026, 91 Federal Register 29434.
[14] EPA. PFAS National Primary Drinking Water Regulation, Docket ID: EPA-HQ-OW-2022-0114, April 26, 2024, 89 Federal Register 32532.
[15] EPA. National Primary Drinking Water Regulations: Consumer Confidence Reports, Docket ID: EPA-HQ-OW-2022-0260, May 24, 2024, 89 Federal Register 45980.
[16] Safe Drinking Water Act, 42 USC §300g-4.
[17] EPA. Extending the Compliance Deadline for the PFOA and PFOS Maximum Contaminant Levels, Docket ID: EPA-HQ-OW-2025-1742, May 20, 2026, 91 Federal Register 29431.

Clearly Describe the Criterion

In finalizing the criterion, EPA should provide a clearer description and explain how the criterion will be operationalized:

1. Clarify the relevant dataset. Is the initial basis for the exemption based on initial monitoring results as implied but not stated in the proposal? The following text from the proposed rule, "*with any most recent PFOA and PFOS sampling result(s) at or above 12 ppt,*" creates considerable uncertainty.[18]
2. Clarify if interim control measures must continue if PFOA and PFOS levels are consistently below the threshold concentration in subsequent monitoring. While consistent with the SDWA framework for exemptions, the interim control measures are challenging to reliably assure and adequately document for purposes of compliance. Also, achieving compliance with the PFOA and PFOS MCLs may involve stopgap measures or a series of changes that ultimately result in a sustainable, resilient compliance strategy. Nearer term actions may reduce PFOA and PFOS levels below the final threshold concentration but not assure compliance with the MCLs at 4 ppt.

An Alternative Criterion

Realizing the importance of the proposed criterion, EPA requested comment on whether there are other levels aside from 12 ppt that the agency should consider when evaluating exemption criteria under SDWA.[19]

<u>A single observation criterion is inappropriate</u>. The proposed criterion for interim control measures during a two-year exemption is a single sampling event observation. Using a criterion based on a single observation is at odds with the risk reduction premise of the 2024 PFAS NPDWR. The maximum contaminant level goals (MCLGs) for PFOA and PFOS in the NPDWR are based on chronic exposure. The NPDWR describes this premise saying "*MCLG values are based on health effects that occur after chronic exposure to PFAS (i.e., cancer).*[20] EPA's Health Risk Reduction and Cost Analysis goes on to describe benefits as accruing over a period of analysis of 80 years to "*capture health effects from chronic illnesses that are typically experienced later in life (i.e., cardiovascular disease [CVD] and cancer)*".[21] Compliance with the PFOA and PFOS MCLs that emerged from this analysis is based upon concentrations calculated using a running annual average (RAA) of monitoring results.[22] Similarly, the NPDWR's public notification requirements are set at Tier 2 for MCL violations, based on adverse health effects due to chronic exposure to PFAS.[23] In this context, the criterion for undertaking interim control measures during the two-year period of the exemption should be consistent with the risk premise set forth in the NPDWR.

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[18] EPA. Extending the Compliance Deadline for the PFOA and PFOS Maximum Contaminant Levels, Docket ID: EPA-HQ-OW-2025-1742, May 20, 2026, 91 Federal Register 29431.
[19] 42 U.S. Code § 300g-5(a)(3)
[20] EPA. PFAS National Primary Drinking Water Regulation, Docket ID: EPA-HQ-OW-2022-0114, April 26, 2024, 89 Federal Register 32621.
[21] EPA. PFAS National Primary Drinking Water Regulation, Docket ID: EPA-HQ-OW-2022-0114, April 26, 2024, 89 Federal Register 32634.
[22] 40 CFR 141.903(f)(1)(i).
[23] Appendix A to Subpart Q of Part 141, Title 40.

However, if EPA maintains its decision to utilize a single PFOA or PFOS measurement to determine the need for implementation of interim control measures during the exemption period, AWWA recommends instead utilizing a **16 ppt** threshold concentration as the criterion for implementation of interim control measures during the two-year exemption period. Because violation of the PFOA and PFOS MCLs of 4 ppt are based on an RAA, a single measurement of PFOA or PFOS at or above 16 ppt would automatically trigger an MCL violation under the current NPDWR framework. This approach would more appropriately serve as a threshold against which to make a determination of "unreasonable risk to health" as it is grounded in the framework of chronic exposure to PFAS (i.e., RAA) upon which the NPDWR is fundamentally based. This framework is not novel. The Stage 2 Disinfection Byproduct Rule incorporates a similar concept, "operational evaluation levels" as a safeguard against excessive total trihalomethane (TTHM) and haloacetic acid five (HAA5) levels.[24]

Inappropriate Assumptions in EPA's Adjusted Economic Analysis

Rather than conducting a new economic analysis for this proposed rulemaking, EPA instead relied on the economic analysis conducted for the 2024 PFAS NPDWR and made a few modest adjustments as follows:

> *"The EPA made the following adjustments to the 2024 analysis of Option 1a to facilitate its use as the baseline: (1) the Agency updated the dollar year for all monetized values from the 2022 dollars used in the 2024 PFAS NPDWR analysis to 2024 dollars using the gross domestic product (GDP) implicit price deflator,[5] and (2) the EPA added two additional years to the period of analysis, resulting in a total of 84 periods, mirroring the two-year exemption to the compliance schedule under this proposal. As explained earlier in this section, the EPA is using the estimated total benefits and costs of Option 1a to characterize the baseline as this action solely focuses on the MCLs for PFOA and PFOS."*[25]

As AWWA stated in its comments on the 2023 proposed PFAS NPDWR, the Economic Analysis's continued reliance on EPA's Bayesian occurrence model rather than nationally representative data from UCMR 5 to characterize impacted water systems and thus the scope of costs and benefits of the rule is flawed. As of January 2026, EPA has released the eleventh set of data collected under UCMR 5, representing roughly 95% of the total results that the agency anticipates receiving under this monitoring effort. This represents the most comprehensive occurrence dataset for PFAS collected to-date, with 10,289 water systems reporting over 64,000 total results for each PFAS analyte in EPA's latest release.[26] Given that EPA anticipates releasing the final UCMR 5 in fall 2026, EPA's failure to adjust its economic baseline to rely upon these occurrence data should be corrected as part of the final rule to provide a picture of impacted systems that is grounded in real-world occurrence data.

Additionally, EPA adjusts both costs and benefits associated with PFOA and/or PFOS reductions by pushing them out two years.[27] This blanket assumption that providing the two-year exemption would change the outcome of the implementation timeline is flawed and should be appropriately modified. This

[24] 40 CFR 141.626.
[25] EPA. Extending the Compliance Deadline for the PFOA and PFOS Maximum Contaminant Levels, Docket ID: EPA-HQ-OW-2025-1742, May 20, 2026, 91 Federal Register 29438.
[26] EPA. The Fifth Unregulated Contaminant Monitoring Rule (UCMR 5), Data Summary: January 2026. Accessed June 9, 2026 at https://www.epa.gov/system/files/documents/2023-08/ucmr5-data-summary_0.pdf.
[27] EPA. 2026. Economic Analysis for the Proposed Rule Extending the Compliance Date for the PFOA and PFOS Maximum Contaminant Levels. EPA-815-R-25-018.

adjustment assumes that all water systems seeking an exemption under the proposed rule would have otherwise been in compliance with the PFOA and PFOS MCLs by 2029. AWWA believes this assumption to be erroneous as many systems, by merit of applying for the two-year exemption, are in need of additional time to make capital improvements or other changes to come into compliance with the MCLs. As such, EPA should not assume that all systems would have been in compliance with the MCLs by 2029 as the entire basis of this rulemaking is predicated on the concept that many systems will in fact need additional time.

For cost estimation purposes, EPA assumes that:

> "*all systems implementing control measures would conduct public education and make pitcher filters available to customers*".[28] EPA's rationale for this assumption is that "*these control measures are the mostly likely to be selected by implementing PWSs…because they represent the least cost alternatives and are administratively the least complex*".[29]

This assumption requires additional substantiation and results in EPA underestimating the costs of the exemption rulemaking for water systems required to implement interim control measures during the two-year exemption period. AWWA recommends that rather than making this simplifying and potentially incorrect assumption, that EPA instead estimate a range of costs, with a lower bound cost associated with implementing the least costly combination of control measures and an upper bound cost associated with implementing the most costly combination of control measures.

Finally, EPA applies an estimated 20% pitcher filter customer use rate from the Lead and Copper Rule Improvements (LCRI) to estimate the benefits and costs associated with this interim control measure.[30] AWWA believes applying this 20% pitcher filter use rate represents an underestimate of the customer use rate. Lead detections at the tap are a fairly localized phenomenon which is largely dependent on home plumbing and service line materials. PFAS detections are expected to be more universal throughout the distribution system once detected at an entry point. As such, it is reasonable to assume a higher demand rate for PFAS mitigation systems like pitcher filters. By assuming a 20% customer usage rate in line with the LCRI, the costs associated with pitcher filter distribution is likely underestimated.

<u>Miscellaneous Comments</u>

There appears to be an inconsistency in EPA's stated timeline for systems seeking the exemption to submit information to the agency. EPA states that:

> "*to request the federal exemption, the proposed rule requires a water system to directly notify the EPA that it is seeking an exemption and provide the Agency with information according to the proposed requirements of 40 CFR 142.58(b)* ***by November 16, 2026*** *[emphasis added]*".[31] However, in 40 CFR 142.58(b), EPA states that "*to be covered by a PFAS exemption by rule, a*

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[28] EPA. Extending the Compliance Deadline for the PFOA and PFOS Maximum Contaminant Levels, Docket ID: EPA-HQ-OW-2025-1742, May 20, 2026, 91 Federal Register 29439.
[29] EPA. Extending the Compliance Deadline for the PFOA and PFOS Maximum Contaminant Levels, Docket ID: EPA-HQ-OW-2025-1742, May 20, 2026, 91 Federal Register 29439.
[30] EPA. 2026. Economic Analysis for the Proposed Rule Extending the Compliance Date for the PFOA and PFOS Maximum Contaminant Levels. EPA-815-R-25-018.
[31] EPA. Extending the Compliance Deadline for the PFOA and PFOS Maximum Contaminant Levels, Docket ID: EPA-HQ-OW-2025-1742, May 20, 2026, 91 Federal Register 29433.

> *supplier of water must request the exemption for an eligible public water system according to paragraph (a) of this section by submitting a request in writing to a Regional Administrator within **180 days** [emphasis added] of final rule promulgation*".[32]

These two statements are inconsistent; in order for a water system to meet the November 16, 2026 deadline, a *final* rule would have had to be promulgated by May 20, 2026 in order for systems to have a full 180 days to submit this information if seeking an exemption. As the proposed rule was issued on this day, not the final rule, EPA needs to correct this inconsistency in the record so that water systems have clear, consistent information on when and how to submit information in order to request the two-year exemption.

[32] EPA. Extending the Compliance Deadline for the PFOA and PFOS Maximum Contaminant Levels, Docket ID: EPA-HQ-OW-2025-1742, May 20, 2026, 91 Federal Register 29447.

APPENDIX A
PFAS TREATMENT IMPLEMENTATION COST STUDY

AMERICAN WATER WORKS ASSOCIATION

PFAS Treatment Implementation Cost Study

AWWA #123

BV PROJECT NO. 425677

1 JULY 2026

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Executive Summary

The American Water Works Association (AWWA) contracted Black & Veatch to compile and evaluate recent construction cost data for granular activated carbon (GAC) and anion exchange (AIX) treatment systems being implemented for per- and polyfluoroalkyl substances (PFAS) removal at drinking water treatment facilities. The purpose of this effort was to support development of updated PFAS treatment implementation cost curves for GAC and AIX systems across a range of treatment capacities, with a primary focus on facilities within the approximately 0.25 to 50 million gallons per day (MGD) range identified in the project scope. The updated cost information is intended to reflect more recent market conditions and support AWWA's evaluation of PFAS compliance implementation costs.

Black & Veatch compiled cost information through water utility outreach, coordination with AWWA and its PFAS Technical Advisory Workgroup (TAW), coordination with the Association of State Drinking Water Administrators (ASDWA), review of State Revolving Fund (SRF) project information, and review of internal Black & Veatch project reference data. A project questionnaire was developed to request consistent information on treatment technology, treatment capacity, project status, cost estimate class, cost year, project scope, reported capital cost, and included cost components. The collected data were screened and normalized to support comparison across treatment technologies, treatment capacities, Association for the Advancement of Cost Engineering (AACE) estimate classes, reported cost years, and project scopes. Normalization included reviewing the reported cost basis, adjusting for missing cost components where appropriate, and converting costs to a common 2029-dollar basis.

The final retained dataset included 101 facility cost data points, consisting of 69 GAC facilities and 32 AIX facilities. The dataset included cost information across AACE Class 1 through Class 5 estimates, ranging from final constructed costs to conceptual estimates. The retained dataset also captured a broad geographic distribution of projects, including representation from most of the states with the highest UCMR 5 public water system exceedances for PFOA or PFOS above the MCL. This distribution provides useful context for the study dataset and does not indicate a regional bias that would be expected to significantly affect the overall PFAS implementation cost trends.

The normalized cost data indicate that capital costs for both GAC and AIX generally increase with treatment capacity and follow power-trend relationships consistent with expected economies of scale (i.e., unit costs expressed on a $/MGD basis generally decrease as treatment capacity increases).

Cost curves were developed to support comparison across small (up to 7.5 MGD), mid-sized (up to 15 MGD), and larger public water systems. Larger-system cost relationships were developed using the full retained datasets for each technology, including facilities up to 150 MGD for GAC and up to 45 MGD for AIX. These capacity ranges were tied to approximate public water system size categories using an assumed water demand of 150 gallons per capita per day. The capacity-based evaluations showed that fitted cost curves can vary depending on the portion of the dataset used, particularly when higher-capacity projects are excluded. As a result, separate best-fit curves were applied for the different capacity ranges for increased accuracy.

GAC costs generally plotted higher than AIX costs across the evaluated capacity range. This trend is consistent with technology-specific differences in design criteria, contactor volume, footprint, and supporting infrastructure requirements. Although AIX systems may require multiple pressure vessels at larger treatment capacities, GAC systems can require larger media volume and additional civil, structural, hydraulic, backwash, and residuals handling infrastructure, particularly where gravity basin configurations are used. Individual project costs for both technologies varied based on site-specific conditions and scope.

The updated AWWA #123 cost data were compared with prior AWWA WITAF 056 cost model and estimates from the EPA WBS model that was used for the EPA's cost-benefit analysis for development of the PFAS NPDWR. The updated dataset followed the same general relationship between treatment capacity and capital cost as the prior data. In comparison to the WITAF 056 cost model data, the AWWA #123 cost data reflected higher capital costs for GAC and similar costs for AIX. Since the WITAF 056 cost model projections already exceeded EPA's WBS model estimates, which were used to complete the cost-benefit analysis for the NPDWR, the AWWA #123 GAC cost data further diverges from the EPA WBS model outputs, indicating substantial underestimation of PFAS costs for GAC in their initial analysis. The AWWA #123 cost data consistently exceeded the EPA WBS model outputs as well, reiterating underestimation of PFAS costs for AIX in their initial analysis.

Overall, this study provides AWWA with an updated planning-level dataset and cost curve framework for evaluating recent PFAS treatment implementation costs for GAC and AIX systems. The results indicate that recent PFAS treatment implementation costs are generally higher than prior case study datasets and that treatment capacity, estimate maturity, project scope, and site-specific requirements all materially affect total project cost. These updated cost relationships provide a more current basis for evaluating PFAS compliance implementation costs across a range of drinking water treatment facility sizes.

1.0 Introduction

On April 26, 2024, the U.S. Environmental Protection Agency (EPA) promulgated the final National Primary Drinking Water Regulation (NPDWR) for per- and polyfluoroalkyl substances (PFAS), establishing enforceable drinking water maximum contaminant levels (MCLs) and nonenforceable maximum contaminant level goals (MCLGs) for perfluorooctanoic acid (PFOA), perfluorooctane sulfonic acid (PFOS), perfluorohexane sulfonic acid (PFHxS), perfluorononanoic acid (PFNA), hexafluoropropylene oxide dimer acid (HFPO-DA, commonly known as GenX chemicals), and a combination of PFHxS, PFNA, HFPO-DA, and perfluorobutane sulfonic acide (PFBS) through a hazard index (HI).

On May 20, 2026, the U.S. EPA published two proposed rules revising the 2024 final PFAS NPDWR. The first proposed rule would retain the enforceable MCLs for PFOA and PFOS at 4.0 ppt while rescinding the regulatory determinations for PFHxS, PFNA, HFPO-DA, and mixtures of these three PFAS plus PFBS. EPA also proposes to rescind associated regulatory provisions for these PFAS, including final MCLGs and MCLs (including the HI). EPA is proposing to take this action because, as stipulated by the best reading of the Safe Drinking Water Act (SDWA), the Agency legally erred by proposing and finalizing regulatory determinations and regulations for these PFAS simultaneously. Additionally, in order to provide additional time for compliance with the rule given the capital improvements many water systems will likely need to take on to treat for PFAS, the EPA also issued a proposed rule intended to streamline the federal exemption application process for a 2-year compliance deadline extension for PFOA and PFOS MCLs, from April 2029 to April 2031.

Since the 2024 PFAS NPDWR was finalized, market conditions have changed considerably, with a reported 20 percent inflation in construction materials for public water system (PWS) equipment between 2024 and 2025 (FRED, 2026), market volatility with steel, and high demands on granular activated carbon (GAC) and anion exchange (AIX) resin (NUCA, 2025). As utilities move toward compliance, updated construction cost information is needed to reflect current market conditions for PFAS treatment implementation. The American Water Works Association (AWWA) contracted Black & Veatch to compile and evaluate recent construction cost data for GAC and AIX treatment systems at drinking water treatment facilities nationwide. The purpose of this effort was to support development of more accurate and up-to-date PFAS treatment implementation cost curves for GAC and AIX treatment systems across a range of treatment capacities. The analysis focused on GAC and AIX treatment systems since those technologies are the most common BATs being incorporated for PFAS treatment. A target treatment capacity range of approximately 0.25 to 50 million gallons per day (MGD) was used since those treatment capacities are most common.

Cost information was collected through water utility outreach, coordination with AWWA and its PFAS Technical Advisory Workgroup, and review of internal Black & Veatch project reference data from recent PFAS treatment projects. A questionnaire was developed to streamline data collection, including clarifying questions for cost components. Reported costs were reviewed to distinguish PFAS-only infrastructure costs from broader infrastructure improvements where possible. The intent was to support a more consistent comparison of collected cost data across treatment technologies, capacities, and project scopes, as described further in Section 2.2.

To encourage participation and protect contributor confidentiality, utility- and facility-specific cost information is presented anonymously. This memorandum summarizes the data collection approach, cost normalization methodology, and resulting GAC and AIX cost trends.

2.0 Project Methodology

In order to compile updated treatment cost estimates, Black & Veatch compiled recent PFAS treatment implementation cost data, ranging from Association for the Advancement of Cost Engineering (AACE) Class 1 through Class 5 estimates. The data was screened for relevance and completeness, and normalized to support comparison across treatment technologies, treatment capacities, estimate classes, timeframes, and project scopes. .

2.1 Collecting Cost Data

Cost data were compiled from multiple sources to maximize the number of usable PFAS treatment implementation cost data points for comparison across treatment capacities for GAC and AIX. Cost data were collected across various phases of project maturity, from initial planning and design estimates through bid/procurement, construction-phase, and completed project costs.

2.1.1 Cost Data Source

Key participants for project data collection and outreach included the project steering committee, the AWWA's PFAS Technical Advisory Workgroup (TAW), and the Association of State Drinking Water Administrators (ASDWA). The following primary source categories were used to compile recent GAC and AIX implementation cost data. 101 individual responses were collected from these various outreach methods.

1. AWWA compiled a list of the largest PWSs with PFOA or PFOS above their MCLs per data from the Fifth Unregulated Contaminant Monitoring Rule (UCMR 5). Black & Veatch staff and various members of the project steering committee and PFAS TAW engaged in outreach to water systems on this list with which they had existing connections.

2. The project steering committee and PFAS TAW provided recommendations for additional systems known to be incorporating PFAS treatment nationwide, or provided their own internal cost data.

3. The State Revolving Fund (SRF) project list was pulled from the U.S. EPA's public domain to identify additional utilities for outreach. Black & Veatch screened more than 7,500 SRF entries to identify 122 potentially relevant projects associated with PFAS treatment projects for PWSs nationwide. Black & Veatch sorted these projects by state and coordinated with ASDWA to reach out to the respective primacy agency contacts to provide PWS contact information in their states. This effort supported direct outreach to 105 utility contacts.

4. Available PFAS treatment cost data was compiled from internal Black & Veatch project reference information.

2.1.2 Information Requested – Survey Outreach

A project questionnaire was developed to streamline data collection/compilation and provide consistency in information provided from cost data sources 1-3 as summarized in Section 2.1.1. The survey was structured to capture the information needed to directly compare costs across projects that varied by treatment technology, capacity, project status, cost estimate class, timeframe of implementation, and project scope. This structure allowed reported costs to be reviewed and adjusted, where appropriate, to support a more consistent comparison of GAC and AIX treatment implementation costs.

Table 2-1 summarizes the primary information requested through the survey and how it was used in the cost analysis. The full survey is provided in **Appendix A**.

Table 2-1 Summary of Survey Information Requested

Survey Category	Information Requested	Purpose in Cost Analysis
Contributor and system context	Utility/organization name, contact information, number of facilities/entry points operated, and number of facilities/entry points impacted by PFAS	Provided context for the utility system and allowed follow-up clarification where needed. Contributor and utility-specific information was used for data review but anonymized in the final results reported.
Facility and treatment basis	Facility name/location, source water type, facility design capacity, PFAS treatment capacity, and selected PFAS treatment technology	Established the basis for grouping costs by technology and normalizing costs by PFAS treatment capacity.
Project delivery and scope	Single facility vs. multi-facility package, project status, and narrative description of PFAS project scope	Helped determine whether reported costs represented one facility or a combined program and whether the project scope was representative of PFAS treatment implementation.
Ancillary and non-PFAS scope	Additional work required to implement PFAS treatment and ancillary work not required for PFAS treatment	Because PFAS treatment projects are often delivered as part of broader water treatment or site improvement projects, these responses clarified scope of supporting infrastructure that should be retained in the cost basis (e.g. iron/manganese pretreatment upstream of GAC or AIX, influent quench chemical system, land acquisition, scope due to treatment consolidation required for PFAS compliance, etc.) versus unrelated scope that may need to be excluded or flagged (e.g. new maintenance shop addition, existing filter rehabilitation, capacity expansion, etc.).
Reported cost basis	Reported capital cost, whether the cost represented PFAS-only infrastructure or all infrastructure improvements, and PFAS-only cost breakout where available	Helped identify the most comparable cost value for each project and determine whether reported costs required adjustment before inclusion in the final analysis.
Estimate maturity and cost elements	AACE estimate class, year, and cost elements included in the reported value (Note 1)	Supported interpretation of cost certainty (including contingency required if response indicated contingency was excluded from the estimate), escalation to a common cost year (2029), and adjustment for missing cost components.

Survey Category	Information Requested	Purpose in Cost Analysis
Notes: 1. For each reported project cost or cost estimate, respondents were asked to identify whether the following cost elements were included, where known: • Equipment • Installation / construction • Engineering / design • Permitting • Legal / administrative costs • Pre-design, pilot testing, or preliminary investigations • Electrical • Instrumentation and controls / SCADA • Building / structural components • Contractor overhead, profit, and markups • Escalation / inflation • Change orders • Contingency • Sales tax • Other project-specific costs		

2.2 Analyzing Cost Data

The collected cost data were centralized in a single spreadsheet format and normalized as summarized in Section 2.1.2. The data review and normalization process generally consisted of the following steps:

1. Consolidated the cost data received from the three primary data source categories into a common database format. As part of this step, key fields were cleaned and standardized, including treatment technology, treatment capacity, reported cost, cost year, estimate class, and project scope.

2. Reviewed each entry to distinguish PFAS-only treatment costs from broader total project costs. Where PFAS-only costs were provided, those values were used as the basis for analysis. Where reported costs included broader project scope, costs were adjusted where possible to remove non-PFAS components, such as infrastructure not required for PFAS treatment implementation. When making this distinction was not feasible, those data points were excluded from the analysis.

3. Split combined facility entries into separate rows in cases where multiple facilities were reported under one combined cost entry. Follow-up was completed where possible to clarify the cost basis. In limited cases where additional facility-specific cost information was not available, costs were allocated to separate entries based on the total project cost and the cost as a ratio of the relative treatment capacity, as summarized in the following formula. This approach provides a consistent way to split combined project costs among facilities where facility-specific costs were not available, but may not fully reflect shared costs or efficiencies associated with bundled project delivery.

$$\text{Individual facility cost} = \text{total project cost} \times \frac{\text{individual facility capacity}}{\text{total project capacity}}$$

4. Reviewed entries for major inconsistencies between project description, estimate class, project scope, cost year, treatment capacity, and reported cost basis. Additional follow-up with

respondents was completed where needed to clarify the information before retaining the data point in the analysis.

5. After completing the data processing steps above, a total of five data points were removed where the reported cost basis could not be sufficiently confirmed or adjusted for comparison. This included limited number of entries where reported costs included major non-PFAS project components that could not be separated from the PFAS treatment scope, or where the available information was insufficient to support a comparable PFAS treatment implementation cost.

6. When a reported cost did not include one or more cost components needed for comparison on a total project cost basis, relevant cost adders were applied to account for those missing components. The cost adders used are summarized in Table 2-2. The cost adders shown in the table were applied, where applicable, to account for cost components not included in a reported cost basis and support a consistent total project cost comparison across the study dataset. The selected percentage adders were based on typical industry ranges for each cost component.

7. Escalated or de-escalated costs to a common 2029-dollar basis using the following formula and a constant annual escalation rate of 4%. 4% is the 10-year average of annual increase to producer price index by commodity for domestic water systems machinery and equipment, excluding the large observed jump between 2024-2025, as referenced in section 2.0 (FRED, 2026). The 4% rate was used as a consistent normalization assumption, rather than a year-specific inflation estimate, to compare costs reported in different dollar years. This adjustment was completed after incorporating the indirect construction and non-construction cost adders.

$$Project\ Cost\ (2029\ dollars) = Project\ Cost\ (Year\ X\ dollars) \times (1 + inflation)^{2029-X}$$

Table 2-2 Cost Adders Used for Cost Normalization

Cost Category	Cost Components	Applied Adjustment (%)
Indirect Construction Costs	General contractor overhead	3.5%
	General contractor profit	10.0%
	Mobilization, bonds, and insurance	4.0%
	Contingency	Varies by class estimate (Note 1)
Non-Construction Costs	Permitting	1.0%
	Engineering (Note 2)	8.0%
	Legal and administrative costs	0.5%
	Construction phase services (Notes 2, 3)	10.0%

Cost Category	Cost Components	Applied Adjustment (%)

Notes:

1. When a data point indicated contingency was excluded, the following contingency allowances were applied based on estimate class. For Class 1 final constructed costs, no additional contingency was applied because these values represent completed or actual construction costs.

AACE Estimate Class	**Contingency Applied**
Class 1 – Final constructed cost (−3% to +5%)	0%
Class 2 – Bid or procurement cost (−5% to +15%)	10%
Class 3 – Engineer’s estimate (−10% to +20%)	12%
Class 4 – Budgetary or vendor quote (−20% to +30%)	20%
Class 5 – Conceptual estimate (−30% to +50%)	30%

2. When a data point indicated engineering was excluded, markups for engineering and construction phase services were added. Piloting/preliminary engineering work was also included in the engineering markups and may cover a wider range than presented herein based on scope of demonstration testing performed.
3. Only five of the 101 facilities in the dataset indicated they excluded construction phase services, with facility sizes ranging from 0.7 mgd to 30 mgd. While the construction phase services fee may vary based on system size, a constant factor was applied for all treatment capacities for consistency and to avoid improper data manipulation.

For Black & Veatch project reference data, available direct construction costs were used where appropriate and adjusted to include the indirect construction and non-construction cost components as summarized in Table 2-2 for consistency since those sometimes vary from project to project.

3.0 Summary of Results

The 2029 cost data generated as described in Section 2.2, were categorized by treatment technology and class of cost estimate for each facility.

- Granular Activated Carbon (GAC) – 69 facilities
- Ion Exchange (AIX) – 32 facilities

To provide context on the geographic distribution of the study dataset, Table 3-1 summarizes the 15 states containing the highest number of PWSs with MCL exceedances for PFOA or PFOS within the national UCMR5 dataset and the state distribution of retained study data points for this analysis. The table is limited to the top 15 states to provide a focused comparison and does not represent the full geographic extent of either dataset; UCMR 5 included 53 states and territories, while the study dataset included responses from 19 states.

Table 3-1 Comparison of Top 15 UCMR 5 States by Share of National PWS Exceedances and AWWA #123 Study Dataset Distribution

State	UCMR 5 Occurrence Distribution	AWWA #123 Study Dataset Distribution
California	9.7%	18.4%
Florida	9.2%	1.9%
New Jersey	9.0%	19.4%
Pennsylvania	6.9%	6.8%
North Carolina	6.8%	4.9%
Massachusetts	6.3%	8.7%
Texas	6.2%	2.9%
Alabama	4.7%	0.0%
South Carolina	3.8%	1.0%
Ohio	3.5%	1.9%
New York	2.9%	21.4%
Georgia	2.6%	1.9%
Tennessee	2.2%	0.0%
Connecticut	2.0%	0.0%
Washington	2.0%	0.0%
Total (Note 1)	**77.7%**	**89.3%**

Notes:

1. UCMR 5 distribution reflects each state's share of total national PWS exceedances for PFOA or PFOS above the MCL within the top 15 states considered. The AWWA #123 study dataset distribution reflects the relative distribution of retained usable cost data points within those same states. Percentages are not expected to match directly because the study dataset was based on available cost information, utility participation, and data usability after screening.

California, New York, and New Jersey accounted for a larger share of retained AWWA #123 study data points than their relative share of top 15 UCMR 5 exceedances. This likely reflects the pace of PFAS treatment implementation already underway in those states, where utilities have faced greater regulatory and implementation pressure. California established notification and response levels for four PFAS including PFOA and PFOS in 2025, while New York and New Jersey established state MCLs for PFOA and PFOS in 2020 (CA State Water Resources Control Board, 2026) (New Jersey Department of Environmental Protection, n.d.) (New York State Department of Health, 2024). PWSs in these states have, in many cases, progressed far enough to generate usable cost information. In addition, once treatment is in place, exceedance rates for PFOA and PFOS may decline over time as systems move into compliance. Because 11 of the top 15 UCMR 5 states are represented in the AWWA #123 study dataset, the retained study dataset does not indicate a regional bias for national PFAS implementation costs.

The results of this study are presented as capital cost versus PFAS treatment capacity (MGD) for GAC and AIX treatment systems. Separate plots were developed by treatment technology and estimate class to show the distribution of costs across project maturity levels and facility sizes.

Cost plots were developed for selected treatment capacity ranges to support comparison across small, mid-sized, and large facilities. In addition to the full dataset for each technology (150 MGD for GAC and 45 MGD for AIX), capacity-limited plots were prepared for facilities up to 7.5 MGD and 15 MGD. These thresholds were selected to represent PWS size categories of 6, 7 and 8 based on approximate PWS population equivalents using an assumed water consumption rate of 150 gallons per capita per day (Black & Veatch, 2023). Table 3-2 summarizes the number of retained data points, the approximate population, and the size category for each of the evaluated capacity ranges and each treatment technology.

Table 3-2 Data Points Included in Capacity-based Cost Curve Datasets

Treatment Technology	Capacity	Approximate Population Equivalent (Note 1)	Size Category	Number of Data Points
GAC	≤7.5 MGD	≤50,000 people	1-6	51
GAC	≤15 MGD	≤100,000 people	1-7	55
GAC	≤150 MGD	≤1,000,000 people	1-8	69
AIX	≤7.5 MGD	≤50,000 people	1-6	23
AIX	≤15 MGD	≤100,000 people	1-7	26
AIX	≤45 MGD	≤300,000 people	1-8	32

Notes:

1. Population equivalents are approximate and are based on an assumed demand of 150 gallons per capita per day.

Additional plots and data tables are presented in **Appendix B**, including $/MGD cost efficiency plots that illustrate economies of scale and cost variability across the GAC and AIX datasets.

3.1 GAC Treatment System Costs

The GAC cost data were plotted as normalized 2029 capital cost versus PFAS treatment capacity for facilities up to 150 MGD based on cost estimate class, as shown on Figure 3-1. As summarized in Section 3.0, additional plots were generated for facilities up to 15 MGD (Figure 3-2) and 7.5 MGD (Figure 3-3) to provide greater resolution for small- and mid-sized systems. These plots include error bars that reflect the uncertainty range for each class level estimate (AACE International, 2020). Due to differences observed in the fitted power relationships across the evaluated capacity ranges, separate power trendlines were developed for each of the plots to better represent the associated treatment capacity range. Based on the treatment capacity in question, users should consider the plot that most closely aligns with the target production capacity.

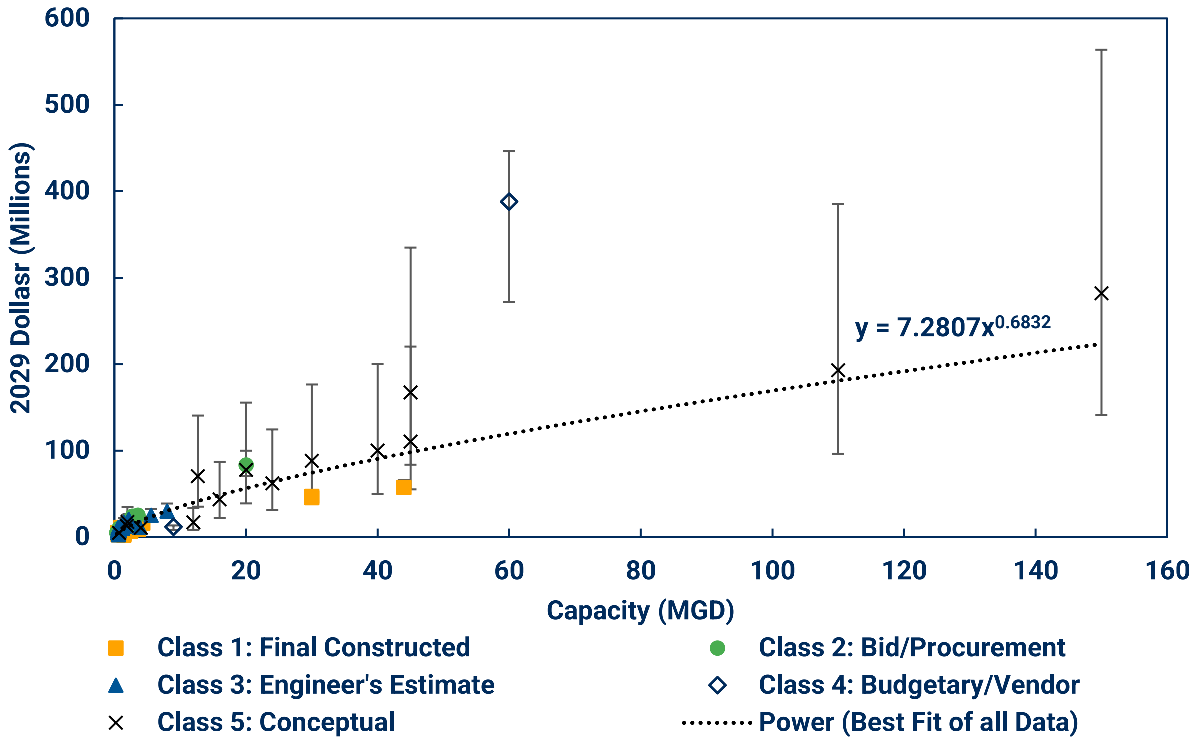

Figure 3-1 **Capital Costs by GAC Treatment System Size and Estimate Class (0.25-150 MGD)**

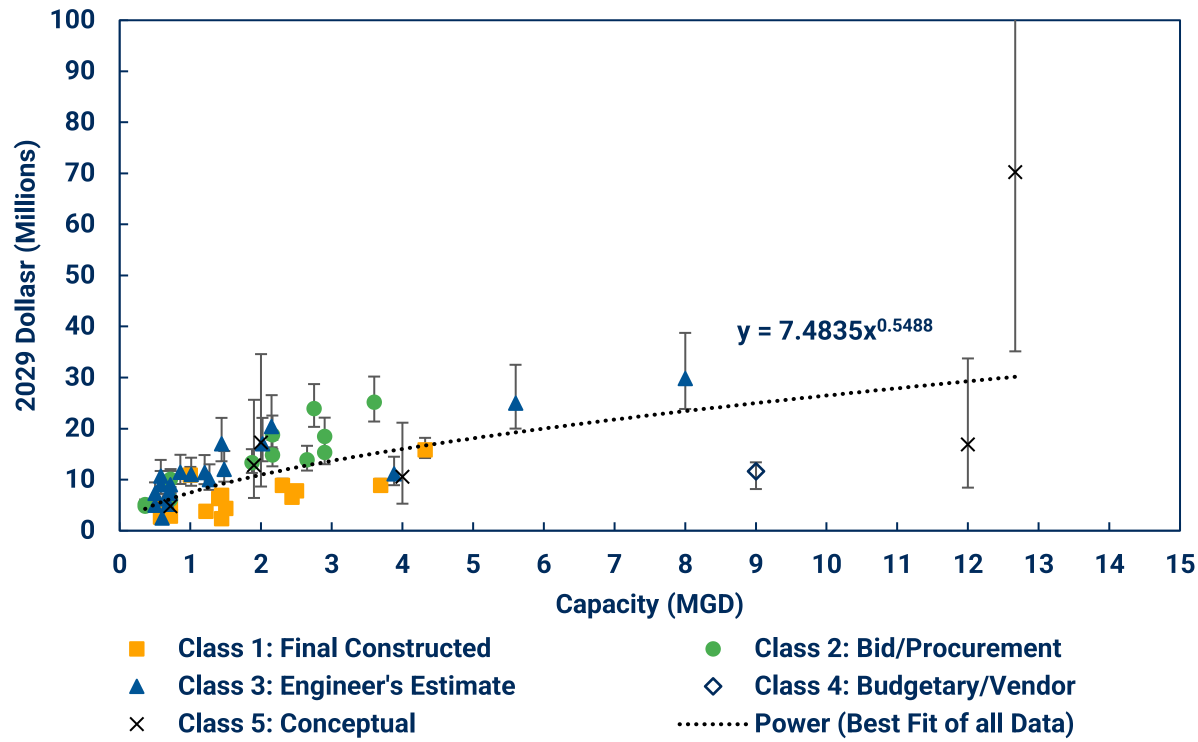

Figure 3-2 Capital Costs by GAC Treatment System Size and Estimate Class (0.25-15 MGD)

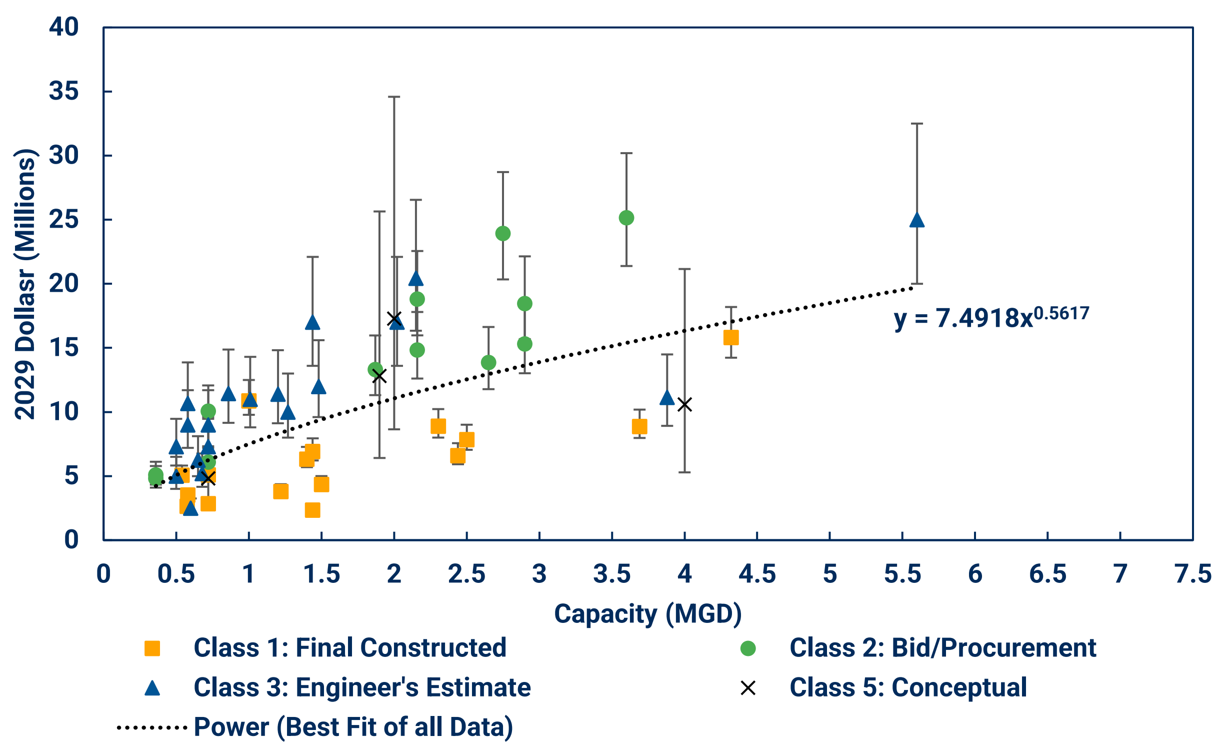

Figure 3-3 Capital Costs by GAC Treatment System Size and Estimate Class (0.25-7.5 MGD)

GAC capital costs generally increased with treatment capacity and followed a power trendline, consistent with the economy of scale. The lower-capacity plots showed more variability between data points, including differences between estimate classes, which is likely influenced by project-specific scope elements and the higher relative impact of ancillary infrastructure at smaller facilities. For example, some of these sites did not previously contain treatment, requiring yard piping to connect wellheads to a centralized location for treatment and ancillary work required for a greenfield site. Alternatively, some of these sites did contain treatment and were able to fit the new unit process into an existing process enclosure, resulting in a lower project cost.

The GAC dataset includes Class 1 through Class 5 estimates. Class 1 final constructed cost data generally plotted lower than the other class estimates at similar treatment capacities. As summarized in Section 1.0, recent market volatility in equipment used for PFAS treatment has been observed, as well as a 20 percent inflation in construction materials for PWS equipment between 2024 and 2025. In review of the GAC data, 63 percent of the data for Class 1 was from 2024 or earlier, whereas 37 percent of all the data included were from 2024 or earlier.

As summarized in Section 2.2, all costs were normalized to 2029 dollars using a consistent 4 percent annual escalation rate. A separate, one-time market adjustment to pre-2024 data to reflect the aforementioned 20 percent inflation trend was not applied to avoid improper data manipulation and forcing trends that may not be realistic. However, the recent market volatility and increases in construction material costs may help explain why some older final constructed costs remain lower than more recent estimates. Additional reasons for the cost disparity between cost class estimates may include higher contingencies used for Class 2-5 data due to uncertainty included in less mature estimates, project-specific differences in scope and site conditions, and value engineering decisions made during detailed design and construction to reduce final project costs.

An apparent outlier in the GAC dataset is a 60 mgd facility with a capital cost of $388 million. This data point included extensive pretreatment that was not required for potable water production, but necessary to protect downstream PFAS media contactors, as well as land acquisition and substantial modifications to treatment residuals handling. This served to drive up the costs but was necessary ancillary treatment for the overall PFAS system. This datapoint was retained to provide an example of how system costs may vary from standard ranges based on site-specific conditions.

As introduced in Section 3.0, the data was presented in terms of $/MGD treated in **Appendix B**. Based on the best-fit power series from the GAC dataset, a summary of the cost across the target 0.25 to 50 MGD treatment capacity range is presented in Table 3-3.

Table 3-3 GAC Project Cost in $ Million per MGD Treated

Treatment Capacity, MGD	Cost, $M/MGD
0.25	10.9
1	7.0
2	5.6
4	4.5
6	4.0
8	3.6
10	3.4

Treatment Capacity, MGD	Cost, $M/MGD
20	2.7
40	2.2
50	2.0

3.2 AIX Treatment System Costs

The AIX cost data were plotted as normalized 2029 capital cost versus PFAS treatment capacity for facilities up to 45 MGD, as shown in Figure 3-4. Additional plots were generated for facilities up to 15 MGD and 10 MGD, as shown in Figure 3-5 and Figure 3-6, respectively, to provide greater resolution for smaller-capacity systems.

The AIX data included one apparent outlier (30 MGD facility at $200 million). This data point is for a PWS with historical conservative design trends and in a geographic region with high price escalation, so accuracy of this datapoint was confirmed. This datapoint was retained to provide an example of how system costs may vary from standard ranges based on site-specific conditions.

AIX capital costs generally increased with treatment capacity and followed a power trendline, consistent with expected economies of scale. A comparison of the GAC and AIX at a range of treatment capacities using respective best-fit power lines is presented in Table 3-4. Across all evaluated capacity ranges, GAC capital costs were consistently higher than AIX capital costs, with a percent difference ranging from 41 to 62 percent. Despite the potentially large number of pressure vessels required for AIX at larger treatment capacities, observed GAC costs are consistently higher across the treatment range evaluated, which is primarily driven by the larger footprint required (the upper end of standard design surface loading rate for GAC is 6 gpm/sf as compared to 16 gpm/sf for AIX resin beds) and current construction costs associated with excavation and heavy site civil for concrete basin construction.

Table 3-4 Relative Difference Between GAC and AIX Capital Costs Across Evaluated Capacity Ranges

Treatment Capacity, MGD (Note 1)	AIX, $Million	GAC, $Million	Percent Difference
2	7.3	11.1	41%
4	9.3	16.3	55%
6	10.8	20.5	62%
8	13.5	23.4	54%
10	14.9	26.5	56%
15	17.8	33.1	60%
20	33.7	56.4	50%
30	44.5	74.4	50%

Treatment Capacity, MGD (Note 1)	AIX, $Million	GAC, $Million	Percent Difference
40	54.3	90.5	50%
45	58.9	98.1	50%

Notes:

1. The fitted power curves for the 0-7.5 mgd plots were used for data below 7.5 mgd. The fitted power curves for the 0-15 mgd plots were used for data between 7.5 and 15 mgd. The fitted power curves for the full dataset plots were used for data between 15 and 45 mgd. 45 mgd was the highest capacity evaluated since that is the end of the AIX dataset.

Less variability was observed for the Class 1 AIX estimates in comparison to the results for GAC, with the exception of approximately 13 data points between 4 and 7 mgd that fell below the best-fit curve. In review of the AIX data, 94 percent of the data for Class 1 was from 2024 or earlier, whereas 61 percent of all the data included were from 2024 or earlier. As summarized in Section 3.1, the consistent 4 percent contingency applied across the board to escalate costs to 2029 dollars, regardless of the 2024-2025 jump in PWS equipment costs, is assumed to be the justification for the data points with lower total project costs for Class 1 cost data in comparison to the others. Additional reasons for the cost disparity may include higher contingencies used for Class 2-5 data due to uncertainty included in less mature estimates, project-specific differences in scope and site conditions, and value engineering decisions made during detailed design and construction to reduce final project costs.

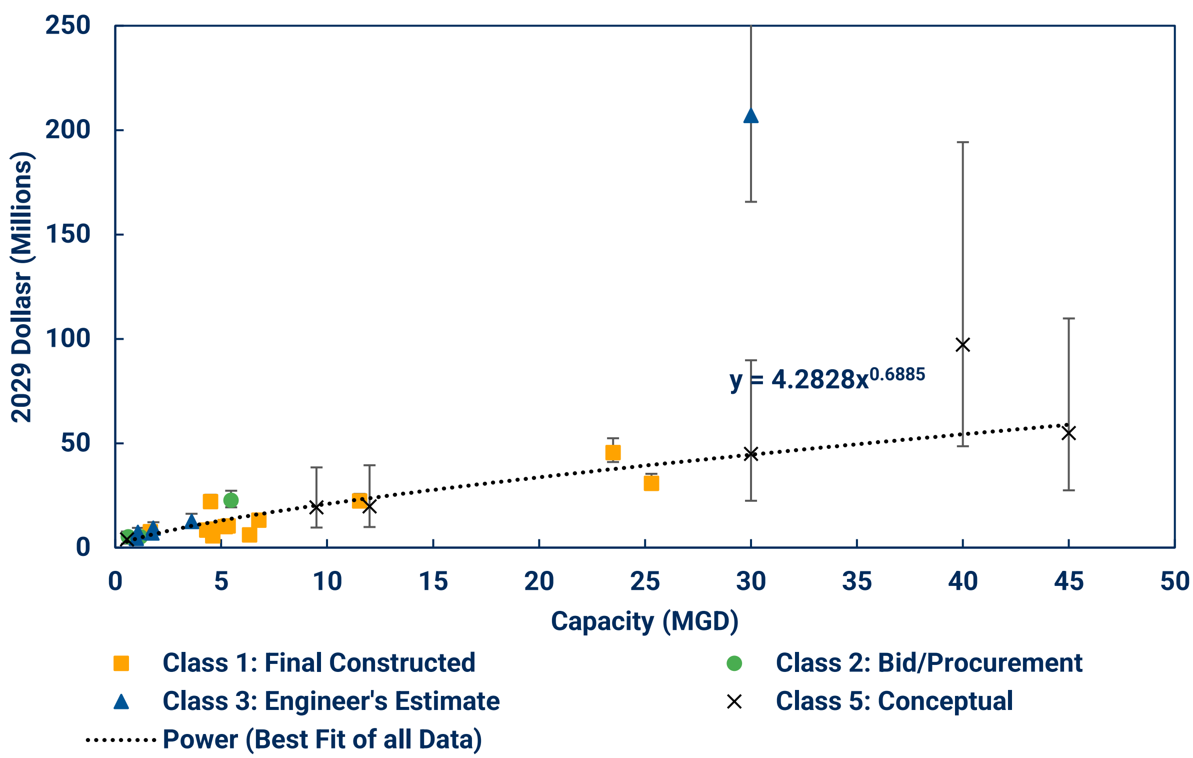

Figure 3-4 Capital Costs by AIX Treatment System Size and Estimate Class (0.25–45 MGD)

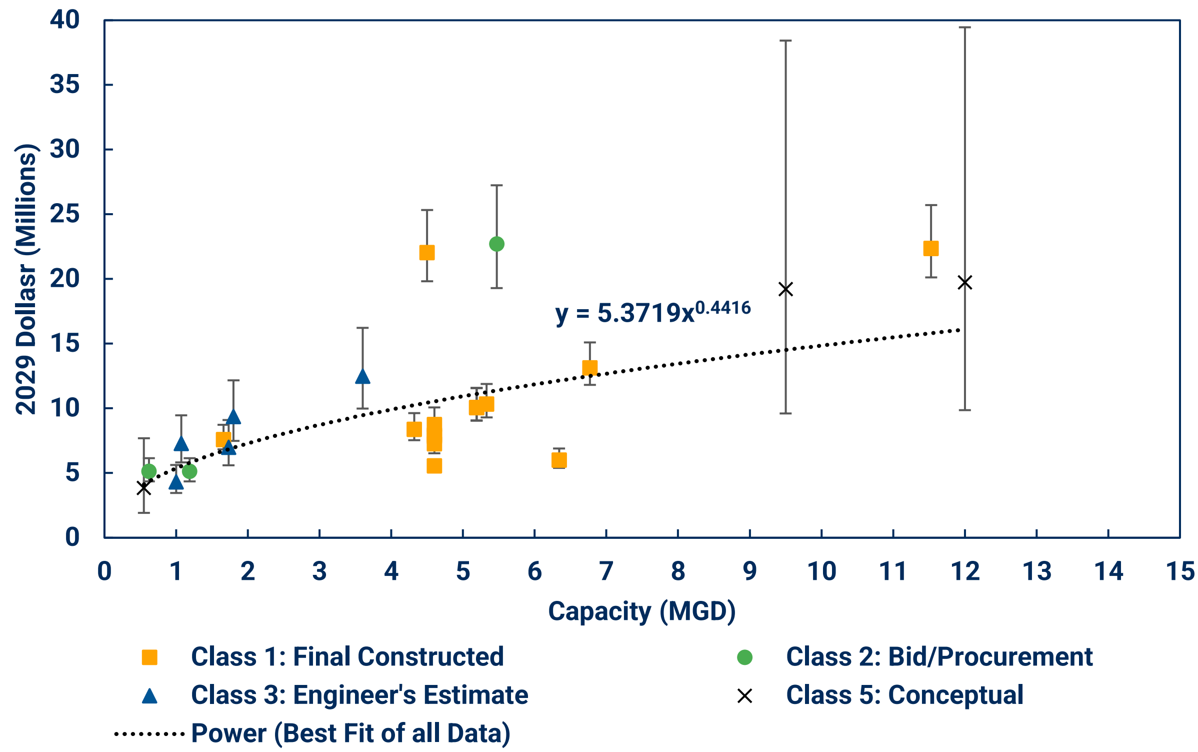

Figure 3-5 Capital Costs by AIX Treatment System Size and Estimate Class (0.25–15 MGD)

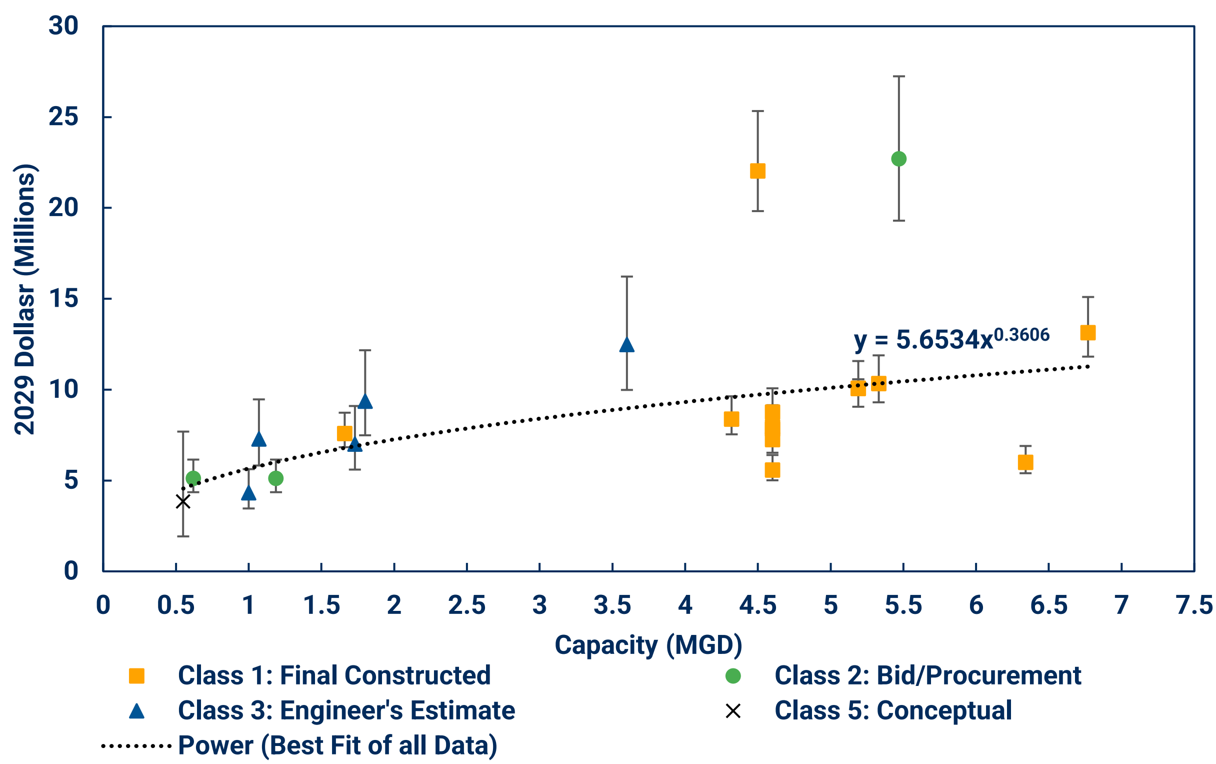

Figure 3-6 Capital Costs by AIX Treatment System Size and Estimate Class (0.25–7.5 MGD)

As introduced in Section 3.0, the data was presented in terms of $/MGD treated in **Appendix B**. Based on the best-fit power series from the AIX dataset, a summary of the cost across the target 0.25 to 50 MGD treatment capacity range is presented in Table 3-5.

Table 3-5 AIX Project Cost in $ Million per MGD Treated

Capacity, MGD	Cost, $M/MGD
0.25	6.2
1	4.0
2	3.2
4	2.6
6	2.3
8	2.1
10	1.9
20	1.6
40	1.3
50	1.2

3.3 Comparison to WITAF Model

The recent AWWA #123 cost data were plotted alongside the data summarized in the 2024 update for the AWWA WITAF 056 Project (which included data from Black & Veatch's PFAS cost model, WITAF 056 case study data, and calculated outputs at varying capacities using EPA's Work Breakdown Structure (WBS) economic model for GAC and AIX treatment systems). These plots are displayed on Figure 3-7 and Figure 3-8 for GAC and AIX, respectively. The EPA WBS model outputs were pulled from **Appendix B** of a March 2024 document published by the EPA (US EPA, 2024). For both GAC and AIX, the AWWA #123 data generally followed the same directional trend ($y = ax^b$) as the previous datasets. The AWWA #123 cost data generally plotted higher than the previously documented WITAF 056 case study data.

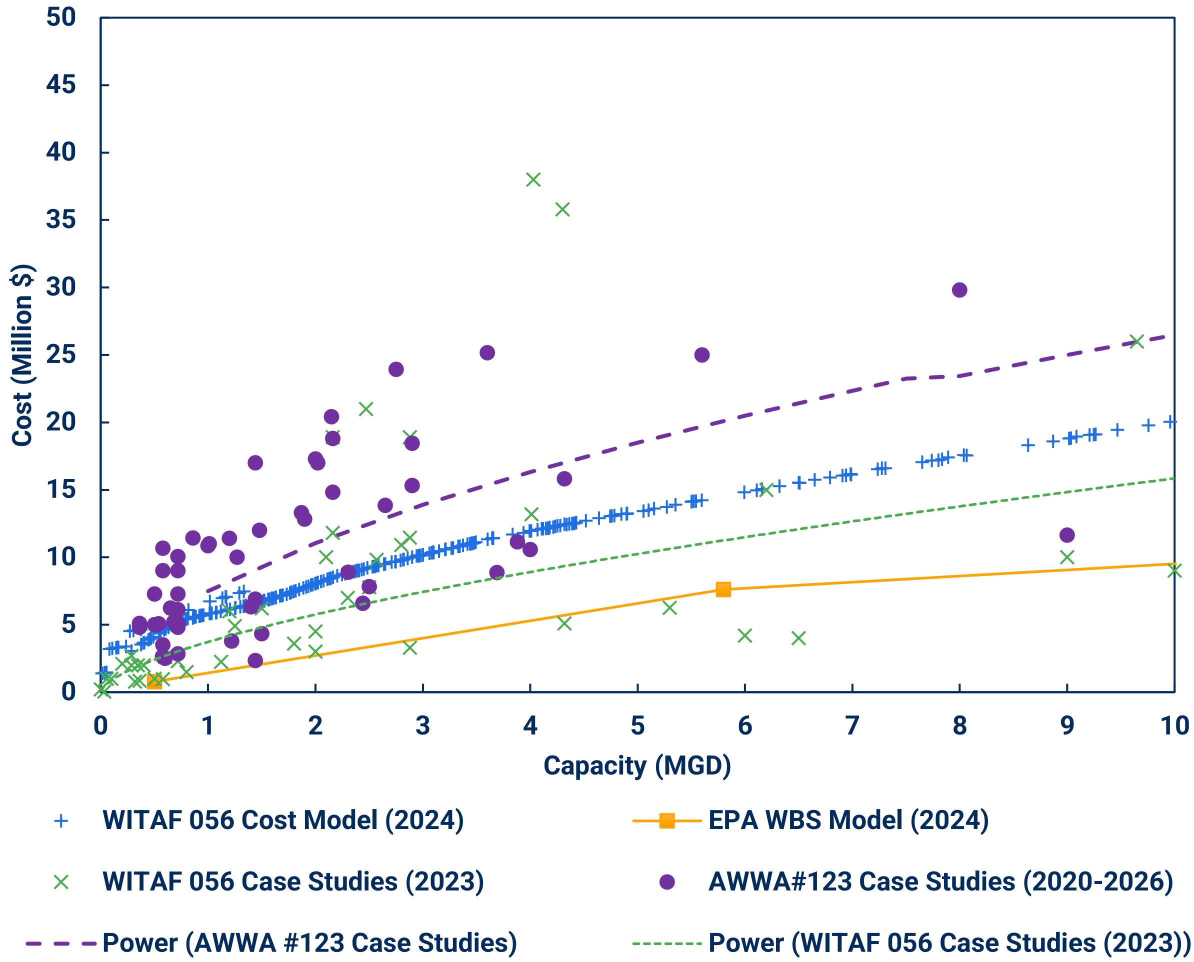

Figure 3-7 Comparison of Capital Costs by GAC Treatment System Size, AWWA #123 and Previous Cost Datasets (0.25–10 MGD)

For GAC, the AWWA #123 cost data plotted higher than the WITAF 056 cost model data. Since the WITAF 056 cost model projections already exceeded EPA's WBS model estimates, which were used to complete the cost-benefit analysis for the NPDWR, the AWWA #123 GAC cost data further diverges from the EPA WBS model outputs, indicating substantial underestimation of PFAS costs for GAC in their initial analysis.

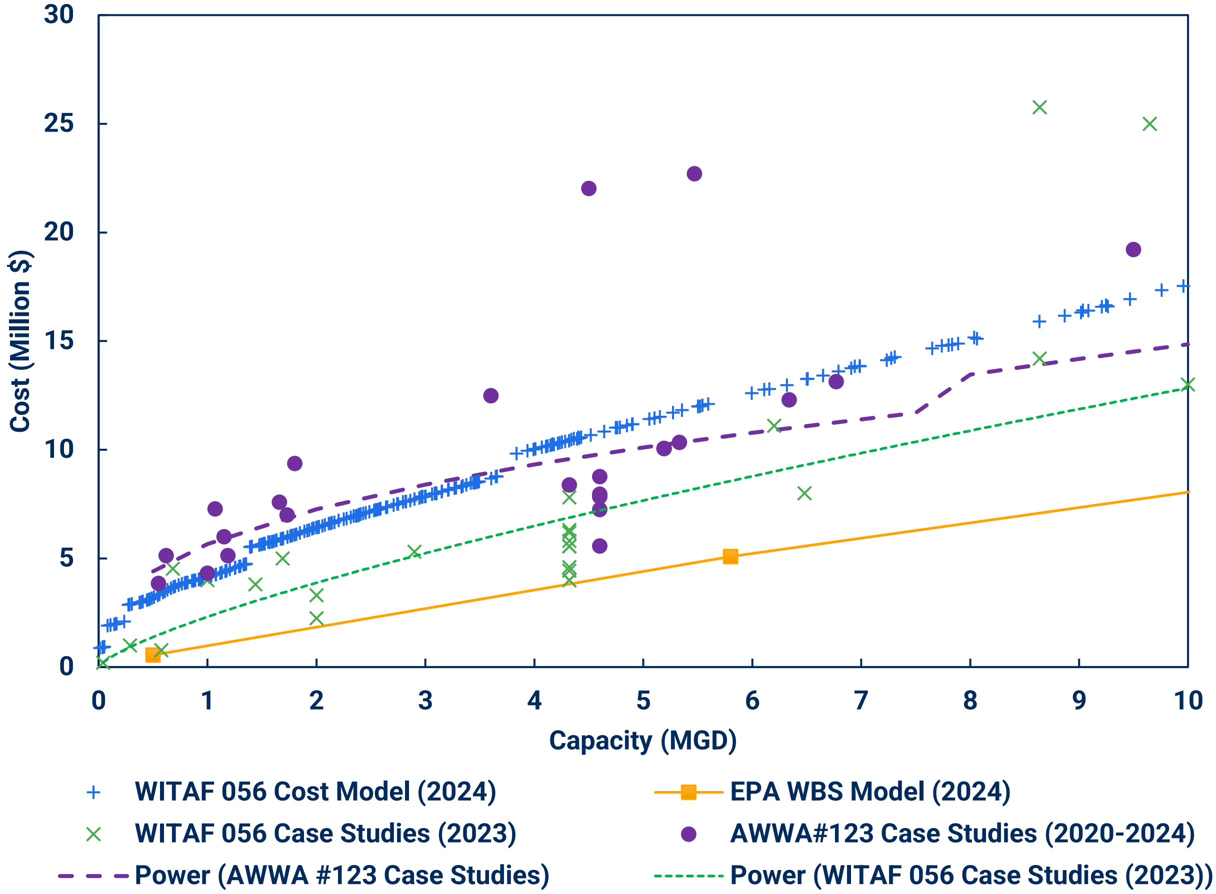

Figure 3-8 Comparison of Capital Costs by AIX Treatment System Size, AWWA #123 and Previous Cost Datasets (0.25–10 MGD)

For AIX, the AWWA #123 data plotted slightly above the WITAF 056 cost study data until approximately 4 mgd, after which the AWWA #123 data plotted slightly below the WITAF 056 cost model data. The AWWA #123 cost data consistently exceeded the EPA WBS model outputs, reiterating underestimation of PFAS costs for AIX in their initial analysis.

Overall, the comparison indicates that the updated dataset is directionally consistent with prior cost model and case study information but reflects higher capital costs than the WITAF 056 case study data for GAC and similar costs for AIX. The percent difference in costs per technology based on the best fit lines from Figure 3-7 and Figure 3-8 summarized in Table 3-6. The costs presented in the WITAF 056 materials covered capital costs and were not inclusive of non-construction costs (potential piloting, engineering, legal/admin, permitting, construction phase services, etc.), which makes up for some of that discrepancy. Additionally, as summarized in Section 1.0, these trends are due to inflation in construction materials costs for PWS equipment, steel market volatility, and supply chain constraints for GAC and AIX. The updated data summarized herein therefore provides a more current basis for evaluating total PFAS treatment implementation project costs for GAC and AIX systems.

Table 3-6 Percent Different in Costs from Best-Fit Line of AWWA 123 data vs. WITAF 056 Model and EPA WBS Model Data

	Best Fit Power Curve from WITAF 056 Cost Model Data		Best Fit Power Curve from EPA WBS Model Data	
Treatment Capacity, MGD	**% Difference in Costs for GAC**	**% Difference in Costs for AIX**	**% Difference in Costs for GAC**	**% Difference in Costs for AIX**
2	26%	6%	215%	266%
4	26%	-10%	262%	173%
6	26%	-19%	272%	123%
8	23%	-15%	260%	115%
10	22%	-18%	252%	93%

4.0 Conclusions

This study was completed to allow for compilation of recent construction cost data for GAC and AIX treatment systems being implemented for PFAS removal at drinking water treatment facilities. The key driver of this study was to reflect recent market conditions due to ongoing market volatility and price escalation and to support AWWA's evaluation of national implementation costs for PFAS compliance. PFAS treatment implementation cost curves were developed for GAC and AIX systems across a range of treatment capacities.

Black & Veatch compiled cost information through water utility outreach, coordination with AWWA and its PFAS Technical Advisory Workgroup, coordination with the Association of State Drinking Water Administrators (ASDWA), review of State Revolving Fund project information, and internal Black & Veatch project data compilation. The collected data were screened and normalized to support comparison. The final retained dataset included 101 facility-level cost data points, consisting of 69 GAC facilities and 32 AIX facilities. The dataset included cost information across AACE Class 1 through Class 5 estimates, ranging from final constructed costs to conceptual estimates. The retained dataset also captured a broad geographic distribution of projects, including representation from most of the states with the highest UCMR 5 public water system exceedances for PFOA or PFOS above the MCL. This distribution provides useful context for the study dataset and does not indicate a regional bias that would be expected to significantly affect the overall PFAS implementation cost trends.

The normalized cost data indicate that capital costs for both GAC and AIX generally increase with treatment capacity and follow power-trend relationships consistent with expected economies of scale. Unit costs expressed on a $/MGD basis generally decrease as treatment capacity increases. Substantial variability was observed among individual projects, particularly at lower treatment capacities, where site-specific scope elements and ancillary infrastructure can have a larger relative effect on total project cost.

Capacity-based cost curves were developed to support comparison across small, mid-sized, and larger facilities. These capacity ranges were tied to three separate public water system size categories. The capacity-based evaluations showed that fitted cost curves can vary depending on the portion of the dataset used, particularly when higher-capacity projects are excluded. As a result, separate best-fit curves were applied for the different capacity ranges for increased accuracy.

GAC costs generally plotted higher than AIX costs across the evaluated capacity range. This trend is consistent with technology-specific differences in design criteria, contactor volume, footprint, and supporting infrastructure requirements. The updated AWWA #123 cost data were compared with prior AWWA WITAF 056 cost model and estimates from the EPA WBS model that was used for the EPA's cost-benefit analysis for development of the PFAS NPDWR. The updated dataset followed the same general relationship between treatment capacity and capital cost as the prior data. In comparison to the WITAF 056 cost model data, the AWWA #123 cost data reflected higher capital costs for GAC and similar costs for AIX. Since the WITAF 056 cost model projections already exceeded EPA's WBS model estimates, which were used to complete the cost-benefit analysis for the NPDWR, the AWWA #123 GAC cost data further diverges from the EPA WBS model outputs, indicating substantial underestimation of PFAS costs for GAC in their initial analysis. The AWWA #123 cost data consistently exceeded the EPA WBS model outputs as well, reiterating underestimation of PFAS costs for AIX in their initial analysis.

5.0 References

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Appendix A - PFAS Implementation Cost Survey

AWWA PFAS Treatment Implementation Cost Survey

AWWA is gathering recent PFAS treatment implementation cost data from drinking water utilities to update cost curves for GAC and AIX systems based on current market conditions. Your response will help improve the accuracy and usefulness of this industry-wide effort. Responses will be compiled by Black & Veatch for this study, and data may be presented anonymously in summary form.

* Required

1. Utility / organization name *

2. Contact name *

3. Contact title *

4. Contact email *

5. How many drinking water treatment facilities or entry points to the distribution system (EPDS) does your utility operate? *

6. How many of those facilities or entry points are impacted by PFAS requiring treatment or planned treatment? *

   If more than one facility is impacted, please submit one response per facility where possible. If costs are only available as one combined package for multiple facilities, that is acceptable; please identify the facilities included.

7. Facility name *

8. Facility location (City, State) *

9. Source water type *

- ◯ Groundwater
- ◯ Surface water
- ◯ Blended
- ◯ Other

10. Facility design capacity (MGD) *

11. PFAS treatment design capacity (MGD), if different

12. PFAS treatment technology *

- ◯ Granular Activated Carbon (GAC)
- ◯ Ion Exchange (IX)

13. Is this response for: *

- ◯ One facility
- ◯ Multiple facilities under one contract / program

14. If multiple facilities are included under one package, identify the facilities covered in this response and indicate whether the costs are combined.

15. Project status *

- ◯ Planning
- ◯ Design
- ◯ Construction
- ◯ Completed (in operation)
- ◯ Other

16. Year the project was estimated, bid, constructed, or completed *

17. Please describe the scope of the PFAS project. *

e.g., New standalone PFAS treatment system, Retrofit into existing facility, Expansion / modification of existing PFAS treatment

18. Did the project include additional work beyond the PFAS treatment process (IX/GAC) that was necessary to implement PFAS treatment? *

e.g., pretreatment for iron/manganese, TOC removal, expanded solids handling for backwash waste, electrical upgrades for new pumps.

- ◯ Yes
- ◯ No
- ◯ Not sure

19. If yes, which of the following were included because they were required to implement PFAS treatment? (Check all that apply)

- ☐ Pretreatment required to support PFAS treatment (e.g., iron/manganese removal, TOC pretreatment)
- ☐ Building / enclosure
- ☐ Site civil improvements
- ☐ Electrical upgrades
- ☐ Instrumentation and controls / SCADA
- ☐ Residuals management (e.g., expanding solids handling capacity)
- ☐ Yard piping / process piping
- ☐ Chemical feed systems
- ☐ General site work
- ☐ Other

20. If project scope includes ancillary work not required for PFAS treatment, please describe the additional work covered.

Specify the nature of any ancillary work included in the cost that was not necessary for PFAS treatment (e.g., increased capacity, etc).

21. Reported capital cost amount ($) *

22. Is this cost: *

- ◯ For all infrastructure improvements (including non-PFAS Elements)
- ◯ For PFAS-only infrastructure improvements

23. If your reported costs include all infrastructure improvements, can you provide a breakdown of costs specific to PFAS-only infrastructure? *

- ◯ Yes
- ◯ No

24. Please provide the reported cost for PFAS-only infrastructure improvements ($) *

Enter the dollar amount specific to PFAS treatment infrastructure only.

25. Select the class of cost estimate provided *

Note: Class 5 is a conceptual estimate; Classes 1–4 include defined accuracy ranges.

- Class 5: Conceptual estimate (−30% to +50%)
- Class 4: Budgetary or vendor quote (−20% to +30%)
- Class 3: Engineer's estimate (−10% to +20%)
- Class 2: Bid or procurement cost (−5% to +15%)
- Class 1: Final constructed cost (−3% to +5%)

26. What dollar year does this estimate reflect? *

Example: 2024 dollars, 2025 dollars, 2026 dollars

27. Which of the following are included, if known? (Check all that apply)

- [ ] Equipment
- [ ] Installation / construction
- [ ] Engineering / design
- [ ] Permitting
- [ ] Legal / administrative
- [ ] Pre-design / pilot / preliminary investigations
- [ ] Electrical
- [ ] Instrumentation / controls
- [ ] Building / structural
- [ ] Contractor overhead / profit / markups
- [ ] Escalation / inflation
- [ ] Change orders
- [ ] Contingency
- [ ] Sales tax
- [ ] Other

Appendix B – Additional Data Tables and Plots

The following tables summarize the cost data received for GAC and AIX, summarized by treatment capacities and costs.

Table B-1 GAC Capital Costs (in $Million) per System Capacity (MGD) Across AACE Class 1-5 Ranges

Class 1		Class 2		Class 3		Class 4		Class 5	
Cap., MGD	Project Costs, $M	Cap., MGD	Project Costs, $M	Cap., MGD	Project Costs, $M	Cap., MGD	Project Costs, $M	Cap., MGD	Project Costs, $M
1.44	6.9	20	83.2	1.01	11.0	60	388.1	1.9	12.8
0.72	5.0	0.72	6.1	0.58	10.7	9	11.7	4	10.6
1	10.6	2.9	15.3	1.44	17.0			12.67	70.3
0.72	2.8	2.9	18.5	2.02	17.0			2	17.3
0.576	2.6	2.16	14.8	0.86	11.4			0.72	4.8
4.32	15.8	3.6	25.2	0.6	2.5			20	77.8
1.44	2.3	0.72	10.1	3.88	11.1			45	110.2
2.44	6.6	0.36	4.8	0.72	7.3			12	16.9
0.58	3.5	0.36	5.1	0.58	9.0			24	62.2
1.4	6.3	2.65	13.9	0.5	5.0			45	167.4
30	45.6	1.87	13.3	5.6	25.0			40	100.0
0.54	5.1	2.75	23.9	0.5	7.3			150	281.9
1.22	3.8	2.16	18.8	1.27	10.0			110	192.7
3.69	8.9			0.68	5.2			30	88.2
2.5	7.8			0.65	6.2			16	43.6
1.5	4.3			0.72	9.0				
44	57.1			1.48	12.0				
2.304	8.9			8	29.8				
30	46.8			2.15	20.4				
				1.2	11.4				

Table B-2 AIX Capital Costs (in $Million) per System Capacity (MGD) Across AACE Class 1-5 Ranges

Class 1		Class 2		Class 3		Class 4		Class 5	
Cap., MGD	Project Costs, $M	Cap., MGD	Project Costs, $M	Cap., MGD	Capacity, MGD	Project Costs, $M	Cap., MGD	Project Costs, $M	Cap., MGD
23.49	45.6	1.188	5.1	1.8	9.4			0.55	3.8
6.34	6.0	0.619	5.1	1.07	7.3			45	54.9

Class 1		Class 2		Class 3		Class 4		Class 5	
Cap., MGD	Project Costs, $M	Cap., MGD	Project Costs, $M	Cap., MGD	Capacity, MGD	Project Costs, $M	Cap., MGD	Project Costs, $M	Cap., MGD
6.77	13.1	5.47	22.2	1	4.3			30	44.9
4.32	8.4			30	201.8			12	19.7
5.19	10.1			1.73	7.0			40	97.1
5.33	10.3			3.6	12.5			9.5	19.2
5.19	10.1								
5.19	10.1								
11.53	22.4								
4.6	8.0								
4.6	8.8								
4.6	7.3								
25.3	30.7								
4.6	5.6								
4.6	7.8								
1.66	7.6								
4.5	22.0								

The following figures present cost efficiency metrics ($ Million/MGD) as a function of treatment capacity for GAC and AIX technologies, providing insight into economies of scale and cost variability across the dataset.

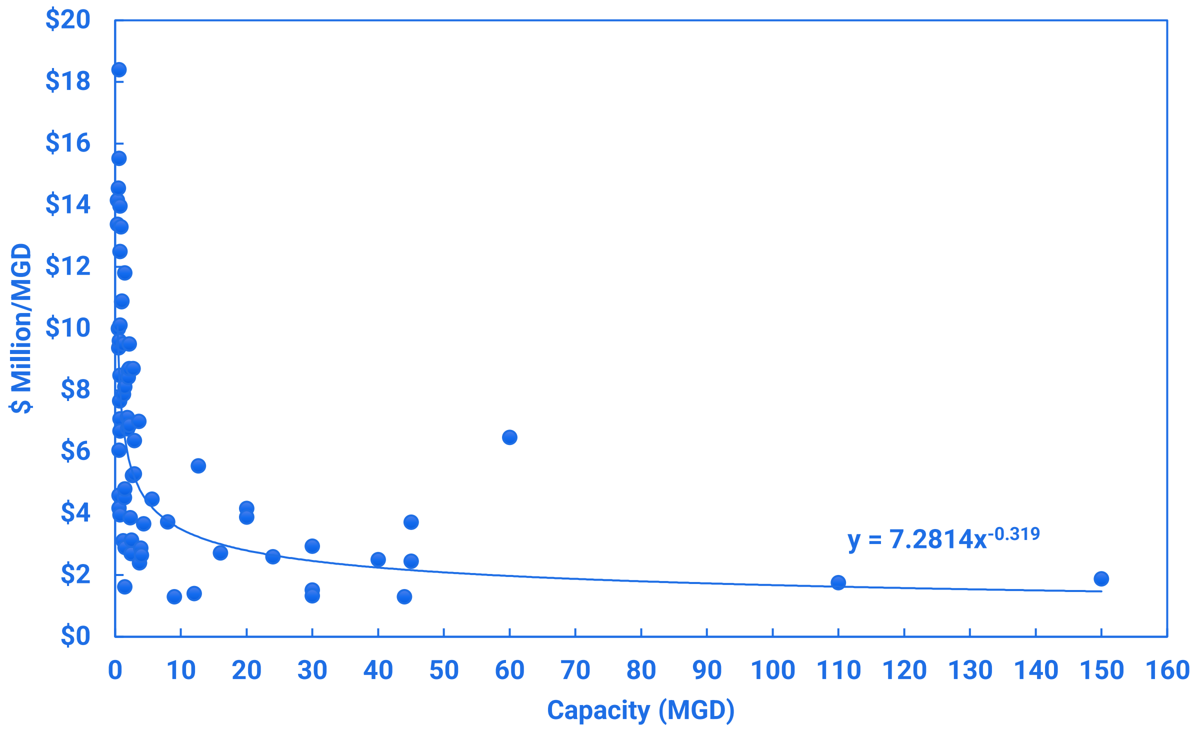

Figure B-1 **Cost Efficiency by GAC Treatment System Size ($/MGD) (0.25–150 MGD)**

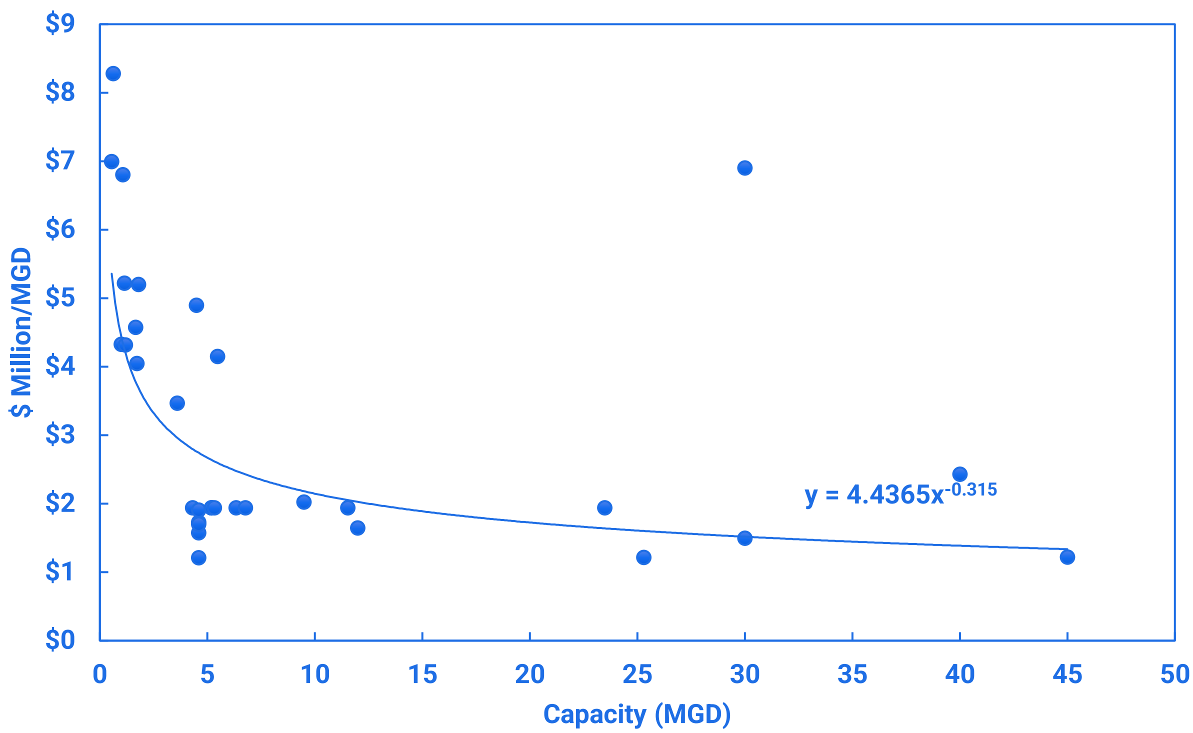

Figure B-2 **Cost Efficiency by AIX Treatment System Size ($/MGD) (0.25–45 MGD)**