CRA Charles River Associates

Benefits of Private, PUC-Regulated Water Utilities in Pennsylvania

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Prepared for

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DEP	Department of Environmental Protection
EPA	Environmental Protection Agency
FMV	Fair Market Value
IIJA	Infrastructure Investment and Jobs Act
MCL	Maximum Contaminant Level
NIAC	The President's National Infrastructure Advisory Council
NPDES	National Pollutant Discharge Elimination System
PFAS	Per- and Polyfluoroalkyl Substances
PUC	Public Utility Commission
PWS	Public Water System
SDWA	Safe Drinking Water Act
SDWIS	Safe Drinking Water Information System
WIFIA	Water Infrastructure Finance and Innovation Act

1. Summary

The delivery of safe, reliable, and affordable drinking water and the proper handling and treatment of wastewater are essential services for a well-functioning and healthy society. Given their importance and the natural monopolistic structure of the industries that provide them, the water and wastewater sectors in the US are highly regulated and driven by policy. However, the regulation and policy frameworks vary significantly by state, leading to notable variation in the performance of systems across many dimensions, including their abilities to confront growing challenges that require vast amounts of investment and expertise. The challenges range from the need for infrastructure replacements, upgrades, and expansions, to reducing PFAS and lead in drinking water.

As states across the US, including Pennsylvania, consider how to position their drinking water and wastewater sectors to best confront challenges, many are examining the roles for privatization and consolidation. These are tools espoused in a recent report from the President's National Infrastructure Advisory Council (NIAC) that highlighted the many needs of drinking water and wastewater systems in the US. Privatization and consolidation can bring great benefits, from improving access to capital, to economies of scale, to the development and application of expertise. While there has been significant anecdotal evidence of these benefits at the system and company level, aggregate analysis has been limited. Most studies have focused on rate comparisons, which are fraught with over-simplification and bias.

This study examines the benefits of privatization and consolidation of drinking water and wastewater systems in Pennsylvania using public data on system performance and the application of statistics and economics. Benefits are considered across four main categories: consumer, environmental, safety, and economic impact. For most categories, comparisons are made between systems based on ownership types, differentiating private, municipal, and other systems. The main findings are summarized below:

- **Consumer Benefit: Drinking Water Quality** – Data on water quality violations suggest that private, PUC-regulated systems deliver higher quality water than systems with other ownership types. This result holds across various system sizes.

- **Consumer Benefit: Cost** – Consolidation brings economies of scale and privatization brings proactive investment that can lower overall costs over time, as well as better performance. Data is currently insufficient for a full analysis of the relative costs per value delivered by different ownership types in Pennsylvania.
- **Consumer Benefit: Reliability** – Privatization and consolidation can deliver new investment and expertise that improve reliability of drinking water and wastewater services. Private, PUC-regulated owners have developed more robust and resilient supply chains and have advanced comprehensive approaches to cybersecurity.
- **Environmental** – Data on wastewater contaminant violations suggest that private, PUC-regulated systems have much lower violations than systems owned by other ownership types.
- **Safety** – Private systems are subject to more safety enforcement and face potentially greater consequences for not delivering safe work environments.
- **Economic Impact** – Private, PUC-regulated water and wastewater utilities in Pennsylvania directly employ over 2,000 people and spend over $800 million in the Pennsylvania economy annually through operations and maintenance and capital expenditures. These direct benefits multiply to over 13,000 jobs and over $1 billion in annual GDP contribution in Pennsylvania. Private, PUC-regulated drinking water and wastewater utilities directly contribute more than $70 million per year in taxes within Pennsylvania, supporting many functions of state and local government.

The opportunities for these benefits to be realized in Pennsylvania is significant. Despite being one of the more progressive states in supporting transactions through legislation and regulation, private companies that are PUC-regulated (a proxy used in this study to represent consolidation) represent only a small share of systems: 10% of community water systems and 2% of wastewater systems. Many barriers to privatization and consolidation remain, including at the federal level.

There are two main sections of this report. The first section is an overview of privatization and consolidation in Pennsylvania, including the theoretical underpinnings, the degree to which it has occurred to date (including data and maps), the supporting legislation that has been enacted, and the barriers to further

transactions. The second section includes the assessment of the benefits of privatization and consolidation across multiple categories.

2. Overview of Privatization / Consolidation in Pennsylvania

2.1. Background on Water Utility Regulation and Ownership

Two of the primary needs for a well-functioning society include the provision of clean, affordable drinking water to the public and the treatment of wastewater to support environmental quality and public health. Failure to provide such services has severe negative outcomes, with issues ranging from disease to environmental degradation to economic damage. Given this importance, federal, state, and local governments take an active role in regulating the industries that provide these services and developing policies that support necessary investments in the infrastructure and operational activities that ensure safe and affordable water services.

This has been done to varying degrees and with varying levels of success across the United States. The federal government has historically played a role in supporting investments through direct support and regulation. In addition, national policymakers have brought forth seminal legislation that drives the water industry to meet public health and environmental challenges, though not always at pace with emerging challenges nor corrective of underinvestment issues. In general, federal support has not kept pace with societal needs.

The states have approached regulation and policymaking quite differently from each other, though mostly within the frameworks required by the federal government. Individual states have developed regulatory frameworks and policies to meet their states' specific challenges, with varying levels of success. Examples of ways in which regulation and policy seem to vary across states include the stringency of regulation, level of policy support for investment in infrastructure, and the support for or discouragement of private ownership and consolidation of water systems. Some states have migrated toward similar regulatory and policy environments.

An important concept when considering the water industry is that modern economic theory identifies drinking water and wastewater utilities as likely natural monopolies within their geographic footprints. This means that the benefits to consumers in a defined region are likely greater from a single system treating and delivering water and wastewater than from multiple systems with redundant infrastructure. This is

because the cost of serving customers is driven by the cost of infrastructure built to serve them . Having multiple providers building competing reservoirs and treatment plants in the same area and constructing redundant pipeline systems throughout a community simply does not make sense.

Industries with natural monopolies carry specific needs for regulation and oversight that are unique from other industries. One approach is to form government-owned and operated utilities that are theoretically overseen through the political process by the constituents, who are also the users of the drinking water and wastewater services. The predominant form of this in many states is municipal ownership, whereby a local government provides drinking water and wastewater services with some form of governance by elected officials. Such entities have seen drastically different levels of success across the United States, with some thriving, but many more struggling to provide adequate service and, in many cases, to simply remain solvent. Common reasons for issues include lack of scale and political constraints on collecting the revenues required to cover the costs of needed infrastructure investments.

Another approach is to support private ownership and operation of drinking water and wastewater systems and to oversee their activities, services, and rates through regulators that are accountable to the citizens of the state. This approach brings the resources and ingenuity of the private sector while ensuring reasonable investments and operations that best serve the interests of stakeholders, particularly the consumers. Oversight by a dedicated regulator, referred to in many states as a public utility commission (PUC), allows for consistent and rigorous economic regulation and rate review that is not common in other forms of utility oversight. Regulators can oversee rates charged, evaluate infrastructure investments, and control profits.[1] Of course, benefits of regulation are only conferred on the systems that are privately owned AND overseen by a regulator, such as the Pennsylvania PUC. According to a 2018 policy brief, 45 states regulate private water rates.[2] Many states, including Pennsylvania, do not have specific utility commission oversight of smaller private systems, such as community

[1] National Research Council; Division on Earth and Life Studies; Water Science and Technology Board; Committee on Privatization of Water Services in the United States, *Privatization of water services in the United States: An assessment of issues and experience* 2002)

[2] Janice Beecher, Department of Political Science and Institute of Public Utilities, Michigan State University, "Michigan at a Crossroads: Potential for Economic Regulation of Michigan's Water Sector," A policy brief for the incoming 2019 Gubernatorial Administration, prepared at the direction of Michigan State University Extension Center for Local Government Finance and Policy (Lansing, Michigan: Nov. 7, 2018).

systems owned and operated by homeowners' associations or mobile home parks, or certain types of systems, such as the majority of systems owned and operated by municipalities.

Other forms of ownership and operational control include federal, state, tribal, and a variety of other types that are generally irregular or uncommon. There can also be mixed ownership and operations, such as municipal systems that are operated by private entities through contracted services.

2.2. Motivations for Privatization and Consolidation

It is well publicized, but not necessarily widely understood by the public, that there are a series of emerging water crises developing in the United States. The President's National Infrastructure Advisory Council (NIAC) recently published a report on this topic at the culmination of a series of meetings under the direction of the National Security Council (NSC).[3] They identified the following concerning themes: unsustainable use of water, issues with water quality, water inequity and unaffordability, fragmentation of water, climate change, workforce challenges, barriers to innovation and implementation of new capabilities, and emergency management. Most water issues can be assigned to one or more of these themes, which are interrelated. Each is present to some extent in nearly every state, including Pennsylvania, but the degree of threat varies by region and even by community in many cases.

Confronting these challenges will not be easy. It will require coordination across an extremely diverse industry, involving regulators, policymakers, water consumers, and the entities providing water and wastewater services. While approaches to the various themes will vary, one reality is clear – there will be extensive investment required to not just upgrade systems to meet new challenges (such as PFAS and climate change impacts), but to replace the existing systems over time before they deteriorate to dangerous levels of functionality. In fact, the US EPA estimates that "the capital cost of wastewater and drinking water infrastructure needed to meet federal water quality and safety requirements and public health objectives exceeds

[3] "Preparing United States Critical Infrastructure for Today's Evolving Water Crises," National Infrastructure Advisory Council, August 2023.

$744 billion over 20 years."[4] By many measures, the water and wastewater industries are the most capital-intensive utility services provided to the public.

To bring forth the necessary investment in a well-regulated and coordinated manner, the federal government and many states are recognizing the benefit of engaging and supporting privatization and consolidation, which includes regionalization.

- **Privatization** – Private sector companies are well-positioned to bring vast expertise, access to the necessary capital, and economies of scale that are simply not available to many municipal systems, many of which are underfunded and/or nearing insolvency. Many municipalities have struggled to adequately maintain their systems for many years and require transfers from general funds to simply remain operating, let alone make necessary investments. Privatization involves the transfer of ownership or operations to "private" entities, but it is important to note that these entities can be either privately held (owned by individuals or privately-owned companies) or publicly held (owned by investor-owned companies). The majority of public water systems in the US that are considered "private" are owned by non-profit entities (e.g. homeowner associations) or non-public for-profit companies (e.g., individuals, real estate firms, hospitals, mobile home park operators), rather than by investor-owned utilities. However, the investor-owned utilities tend to own larger systems and are the owners most active in consolidation and regionalization.
- **Consolidation** - There are major benefits to not just privatization, but also consolidation. Consolidation of the water sector occurs when two or more distinct legal entities become one under the same governance, management, and financial functions. This may include interconnecting physical assets, or the assets may remain separate while operational and management control are combined. Consolidation can be the source of economies of scale (such as lower costs) and bring other scaled benefits (such as expertise) to the many systems that are not large enough to bring scale on their own. Most municipalities do not have large enough systems to support the robust supply chains and in-house expertise that have been

[4] Elena Humphreys, Jonathan Ramseur; U.S. Congressional Research Service. "Preparing United States Critical Infrastructure for Today's Evolving Water Crises," (R46892; Jan. 4, 2022), Text in: ProQuest® Congressional Research Digital Collection; Accessed: October, 2023.

developed by some large private companies and some very large municipal systems.

- **Regionalization** - One form of consolidation is regionalization, in which multiple systems serving multiple communities within the same region are consolidated. This can bring additional benefits from shared infrastructure and resources. While the term is often used interchangeably with consolidation, this study identifies regionalization as specific to systems within the same region. However, the definition of a "region" can vary, ranging from systems in adjacent communities to systems within the same state. Regardless, some benefits are enhanced when consolidated systems are near each other, but disparate systems under the same owner can also benefit without being in close proximity.

Privatization and consolidation in the water industry is a longstanding but slow-moving trend with benefits that are obvious to most industry analysts and observers. According to the NIAC report, benefits of consolidation and regionalization include economies of scale, operational efficiencies, and greater financial stability and access to capital.[5] Many of the issues facing water and wastewater systems will require not just major financial investment, but the application of new technologies and novel initiatives that are best delivered across many systems by organizations that can manage complex and capital-intensive solutions.

With over 150,000 public water systems in the United States (about 50,000 of which meet the more restrictive threshold of "community water systems") and many forms of ownership and regulation, consistency in performance has been a clear challenge. Regulating more systems but fewer entities would be a beneficial development. Privatization and consolidation are keys to making this happen.

Many states have made progress on this front, with the overall number of systems declining and private ownership generally increasing, though fairly slowly relative to the number of operating systems. For example, the EPA's main drinking water database showed a 10 percent decrease in the number of community water systems from 2006 to 2020.[6] This includes Pennsylvania, which enacted supportive legislation that has provided opportunities for privatization and

[5] "Preparing United States Critical Infrastructure for Today's Evolving Water Crises," National Infrastructure Advisory Council, August 2023.

[6] EPA SDWIS, according to GAO report. Community water systems are defined in Section 2.3.1 of this report.

consolidation. The benefits of the private, PUC-regulated water utilities in Pennsylvania are the subject of Section 3 of this report. The following section describes the progress made to date and is followed by a section on enabling regulation and policies employed to date.

2.3. Status of Privatization and Consolidation in Pennsylvania

This section of the report provides insight into the degree of privatization and consolidation in Pennsylvania. It provides an overview of current ownership types for water and wastewater systems, with information on the relative size and scale of the various systems. Maps are provided for context on geographic distribution by ownership type.

For this study, systems that are considered privatized, consolidated, and PUC-regulated are those that are owned and/or operated by companies that are members of the National Association of Water Companies (NAWC). The NAWC is an association of companies that own, operate, or partner with water utilities. This designation was selected as a proxy for privatization and consolidation because the NAWC members are non-public entities (private), generally own multiple systems (consolidated), and their systems are PUC-regulated, which is a distinction from many of the systems owned and operated by other private owners. Many of the benefits evaluated later in this report confer mostly when there is consolidation and PUC regulation, as is the case for NAWC member systems. The following are the four categories used throughout this report when referring to ownership types:

Table 1: Ownership Types Evaluated in this Study.

Type	Description
Municipal	These are water treatment facilities owned and operated by municipal or county-level governments.
NAWC Members	These are systems that are owned and/or operated by private companies that are members of the National Association of Water Companies (NAWC).
Private, Non-NAWC	Water treatment systems that are owned by private (non-government) entities that are not affiliated with the NAWC.
Other	Include all systems that fall outside of the specified parameters. These include facilities owned by the federal and state governments, tribal governments, or local school districts.

In general, Pennsylvania has progressed farther in privatization and consolidation in drinking water systems than wastewater, but there is clearly significant opportunity for much more private sector participation in both segments. NAWC members own and operate systems on many scales, but they tend to have systems that are larger on average than other ownership types. The exceptions are some very large municipal systems that represent the largest facilities in the Commonwealth. Drinking water and wastewater systems are addressed separately in the following subsections.

2.3.1. Drinking Water System Privatization and Consolidation

A public water system is defined by the EPA as a system that "provides water for human consumption through pipes or other constructed conveyances to at least 15 service connections or serves an average of at least 25 people for at least 60 days a year." The term public water system refers to who is being served – the general public – and does not suggest a specific ownership type – they can be either publicly or privately owned. There are over 148,000 public water systems in the US, with over 7,600 in Pennsylvania (about 5% of the total system count nationwide).

There are three main designations for public water systems: Community Water Systems (CWS), Non-Transient Non-Community Water Systems (NTNCWS), and Transient Non-Community Water Systems (TNCWS). [7] Community water systems are defined by the EPA as public water systems that supply water to a fixed population year-round. Non-community water systems are either non-transient, meaning they regularly supply water to at least 25 of the same people at least six months of the year (e.g., schools, factories, office buildings, and hospitals which have their water systems), or transient, meaning they provide water to places where people do not remain for long periods of time (e.g., gas stations and campgrounds). Table 2 shows the number of public water systems in Pennsylvania that fall into each designation.

Table 2. Distribution of Drinking Water Facilities by System Type (PA, 2023)

Public Water System Type	Active Systems
Community Water System (CWS)	1,835
Non-transient, non-community water system (NTNCWS)	1,162
Transient, non-community water system (TNCWS)	4,672
All active systems	7,669

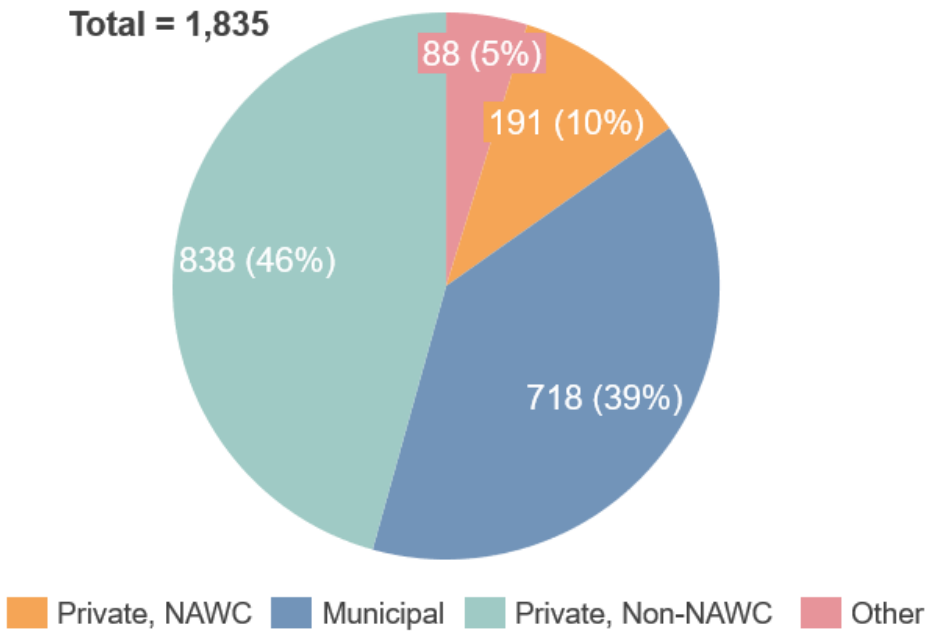
Source: EPA SDWIS, CRA Analysis

This study focuses exclusively on the 1,835 community water systems active in Pennsylvania. It does not include non-community systems since these systems are generally lower-priority opportunities for bringing the benefits of privatization and consolidation and they tend to operate under different environments that make them difficult to compare in performance.

The chart in Figure 1 shows the share of ownership types for drinking water systems active in Pennsylvania as of 2023. NAWC members currently own 10% of drinking water systems in Pennsylvania, while 85% are owned by municipalities or private owners that are mostly not PUC-regulated.

[7] United States Environmental Protection Agency. (n.d.). Information about public water systems | US EPA. Drinking Water Requirements for States and Public Water Systems.

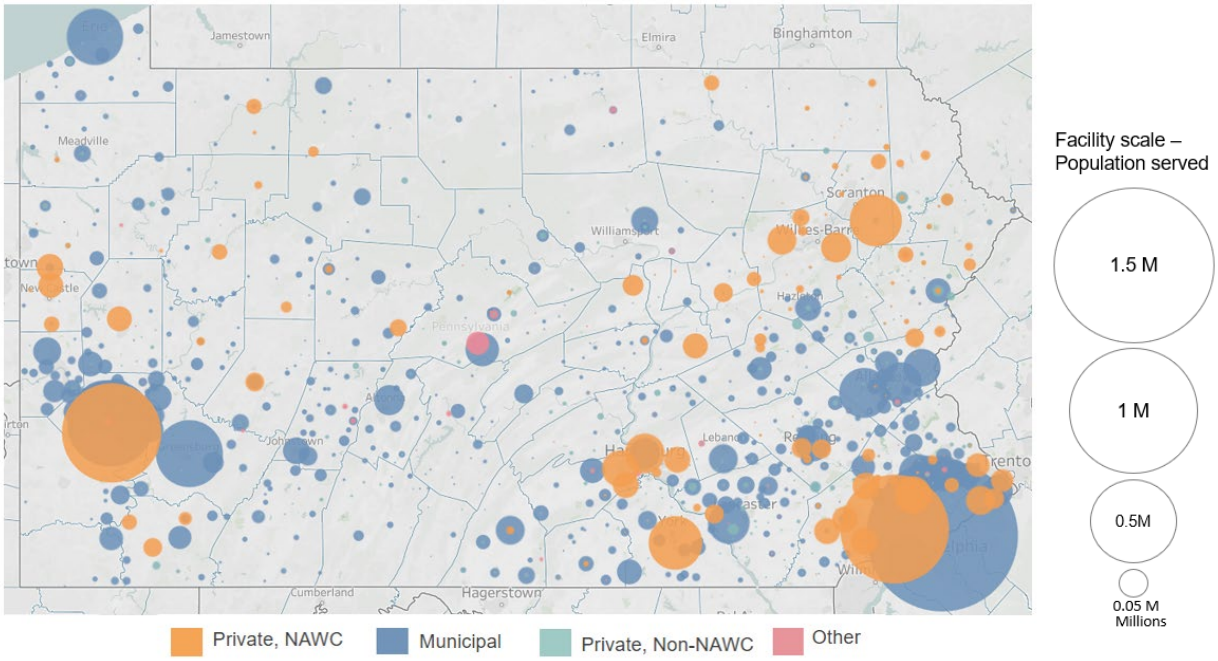
Figure 1. Drinking Water Systems in Pennsylvania, by Ownership Type, 2023



Source: EPA SDWIS, CRA Analysis

The number of drinking water systems can be best demonstrated with a map, as shown in Figure 2. This also provides context on geographic dispersion and clustering near population centers. The size of the bubbles represents the scale of each system in terms of number of customers served.

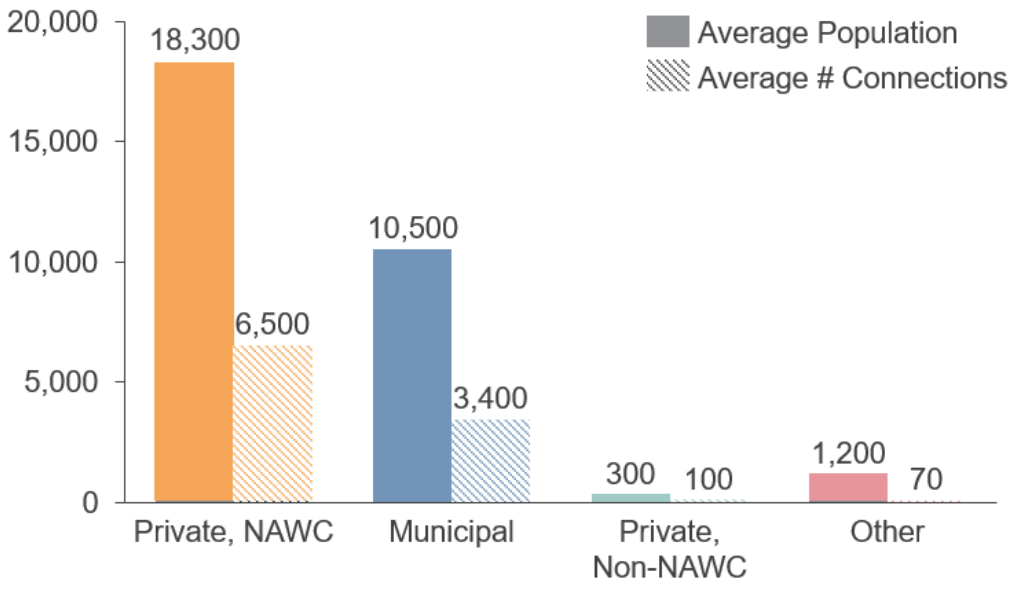
Figure 2: Map of Drinking Water Systems in Pennsylvania, 2023



Source : EPA SDWIS, CRA Analysis

Just looking at the count of systems would overlook the strides made toward privatization and consolidation of drinking water systems in Pennsylvania. Systems owned by NAWC member companies are much larger on average than systems with other ownership types, as shown in Figure 3. Comparisons are made for two metrics: the number of customers (estimated daily population served) and the number of service connections.

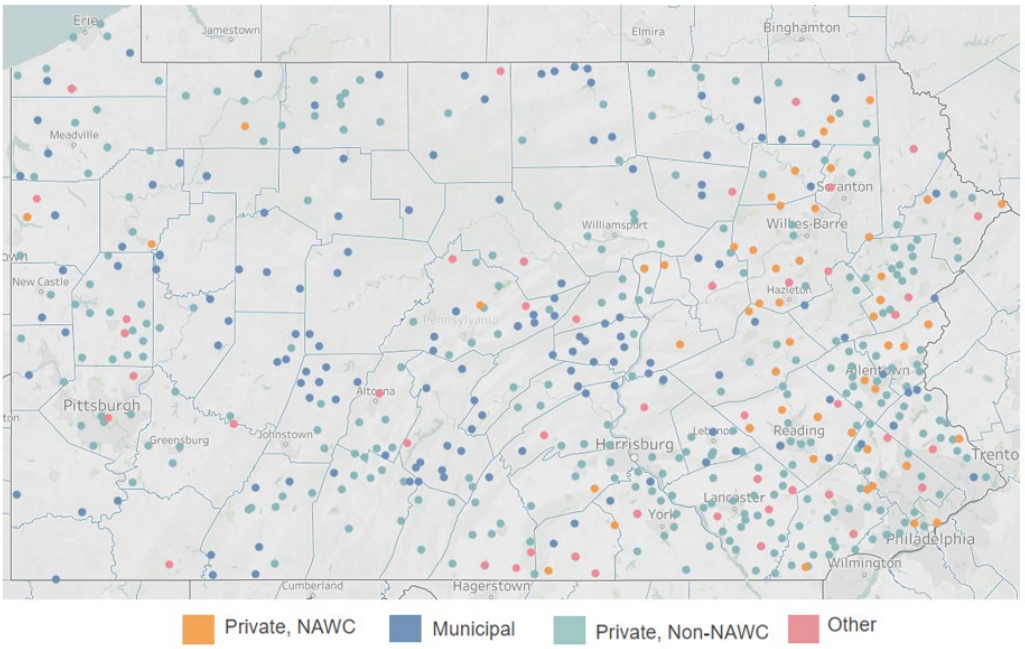
Figure 3. Drinking Water Systems in Pennsylvania, Average Size by Customers and Connections, 2023



Source: EPA SDWIS, CRA Analysis

The map in Figure 4 isolates just the drinking water systems that serve under 1,000 customers. It shows significant dispersion across the state and the low number of NAWC member-owned systems at this scale. In fact, of the 1,198 systems that serve under 1,000 customers, only 94 (8%) are owned by NAWC members. While there are many more systems at this scale than there are larger systems, water systems that serve under 1,000 customers collectively serve only 1.4% of the total population served by community water systems in Pennsylvania.

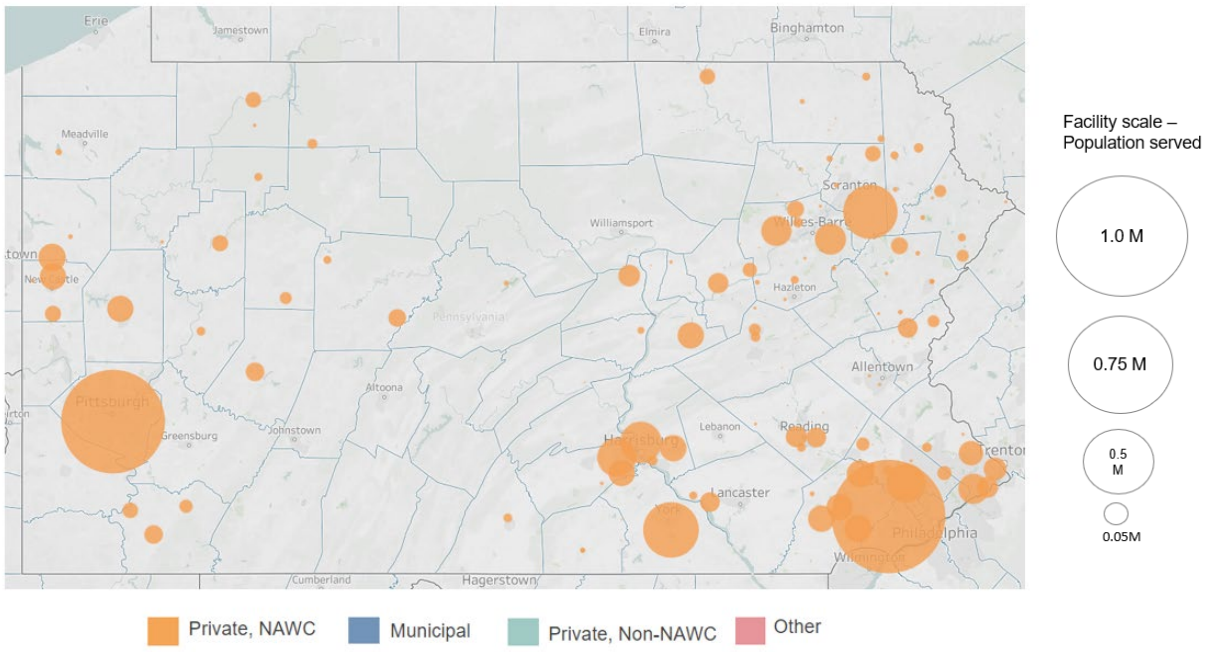
Figure 4: Map of Small Drinking Water Facilities (Serving < 1,000 Customers) in PA



Source: EPA SDWIS, CRA Analysis

Finally, because this report is focused on analyzing and assessing the potential benefits of private systems owned by NAWC members, Figure 5 isolates just those systems owned by NAWC members. It illustrates that many parts of Pennsylvania have yet to experience the benefits of privatization and consolidation.

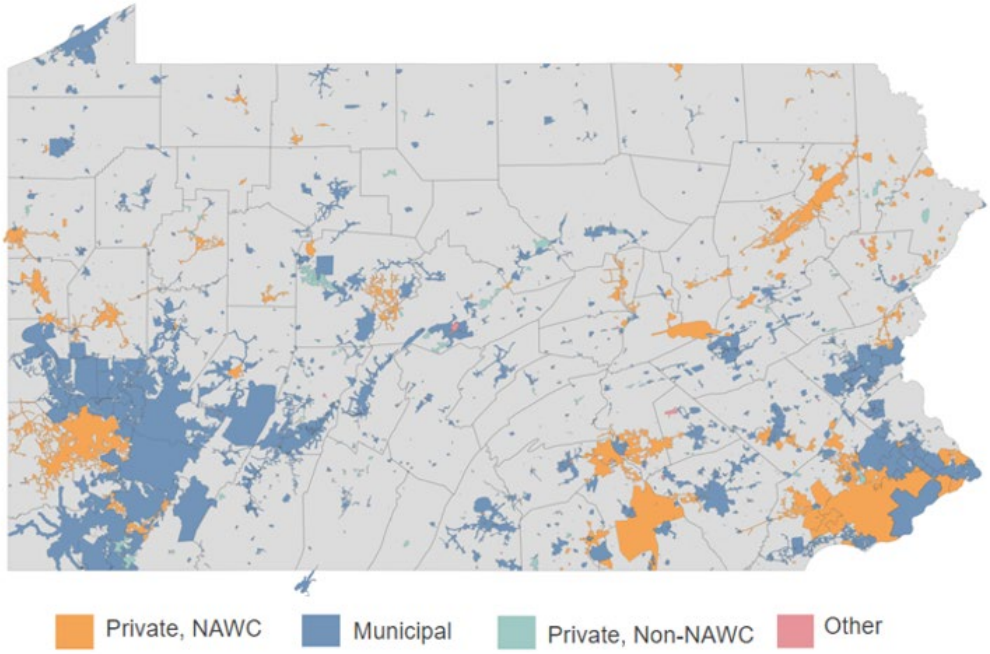
Figure 5: Private, NAWC Member Drinking Water Facilities in Pennsylvania



Source: EPA SDWIS, CRA Analysis

Another view of drinking water systems in Pennsylvania is by service area. Figure 6 shows the service areas of community water systems by ownership type. The systems owned by NAWC members and municipalities are most prominent, as they are in terms of population served.

Figure 6: Service Areas of Drinking Water Systems in Pennsylvania



Source: PASDA Public Water Supplier's Service Areas (2023)

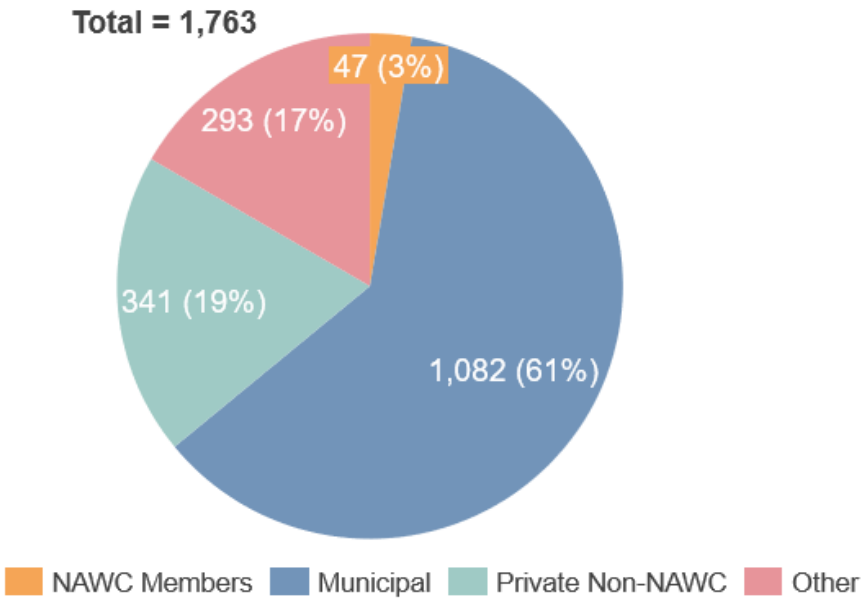
2.3.2. Wastewater System Privatization and Consolidation

Wastewater systems generally involve: 1) collecting sewage and wastewater from homes, businesses, and industries, 2) delivering it to treatment facilities, 3) treating the wastewater, and 4) discharging it to water bodies or land, or reusing it. There are many different types of wastewater systems in Pennsylvania. This study is focused on the systems that, as of 2022, had active point-source discharge permits issued by the EPA or Pennsylvania (NPDES permits) and were classified as "sewerage systems" (SIC Code 4952 – Sewerage Systems - defined as "establishments primarily engaged in the collection and disposal of wastes conducted through a sewer system" or NAICS Code 221320 "Sewage Treatment Facilities"). This analysis excludes industrial and non-sewer wastewater facilities as they are less prioritized for the benefits of privatization and consolidation.

The chart in Figure 7 shows the share of ownership types for wastewater systems in Pennsylvania as of 2022. The chart shows that over 60% of the wastewater facilities in Pennsylvania are owned by municipalities. Privatization and

consolidation have been slower to emerge in wastewater treatment than in drinking water service. Some of this is due to restrictions on which wastewater facilities can be purchased by private entities, but there are other constraints to be discussed later in this report.

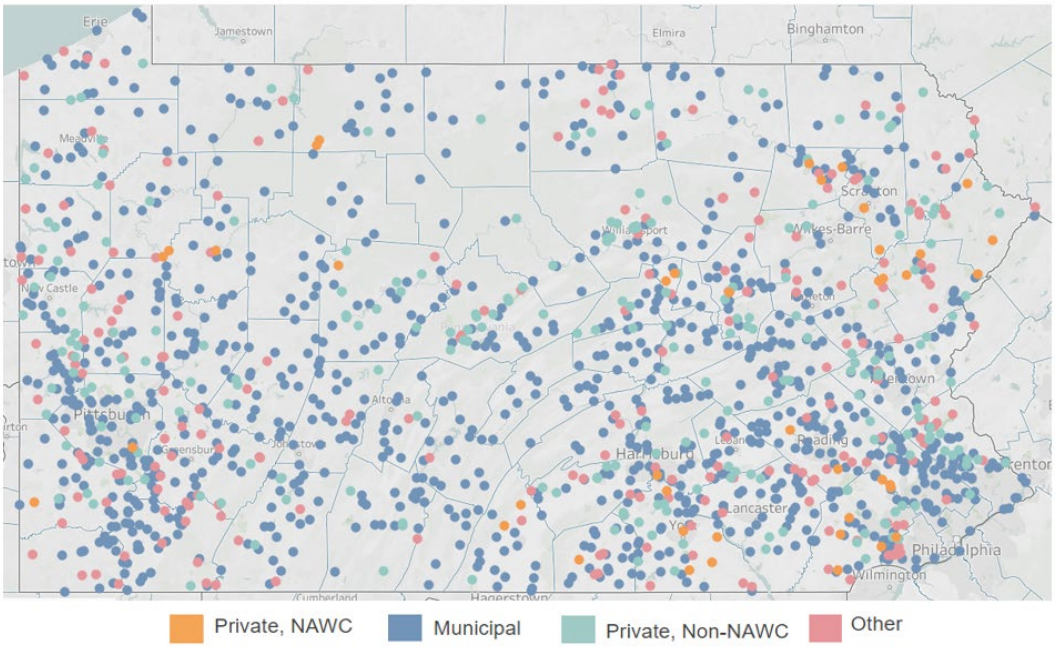
Figure 7. System Counts by Ownership Type, Pennsylvania Wastewater, 2022



Source: SDWIS, CRA Analysis

The current geographical balance of systems by ownership type is shown in the map in Figure 8 below. The map shows that wastewater treatment facilities are dispersed throughout the state but are also clustered in population centers as expected.

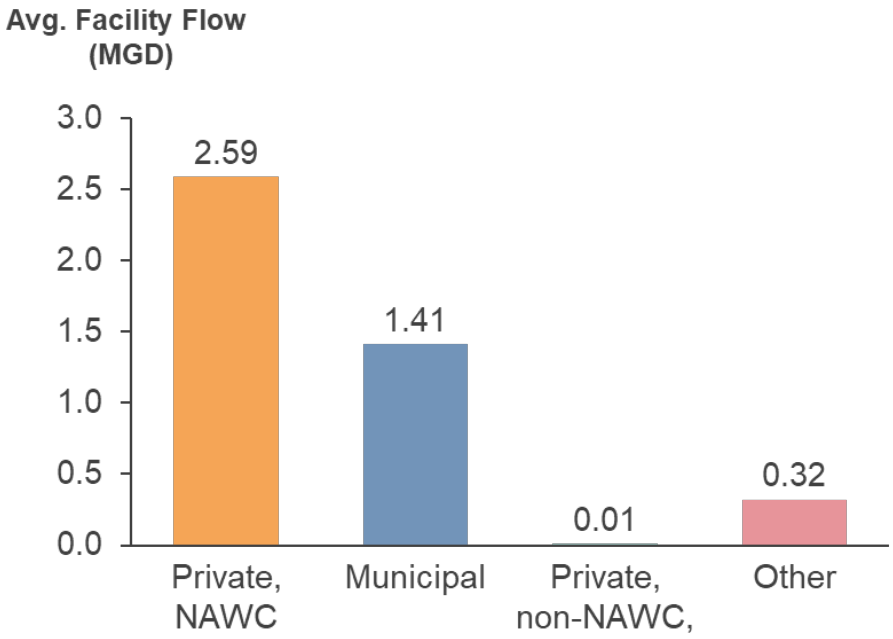
Figure 8. Pennsylvania Wastewater Facility by Ownership Type



Source: ECHO NPDES Permit Loading Tool (2022), CRA Analysis

While there are far fewer NAWC member-owned systems than systems with other ownership types, the average size is nearly twice that of municipal systems, eight times greater than "other" systems, and over 250 times greater than small private systems. Figure 9 shows the average size of wastewater facilities by ownership type in terms of million gallons of wastewater (MGD) treated per day. To get a sense of scale, an average Olympic-sized swimming pool holds about 650,000 gallons of water (0.65 million gallons) while an average backyard pool holds about 10-20,000 gallons of water (0.01 to 0.02 million gallons). This context applied to the chart below shows the variation in scale of the systems with different ownership types.

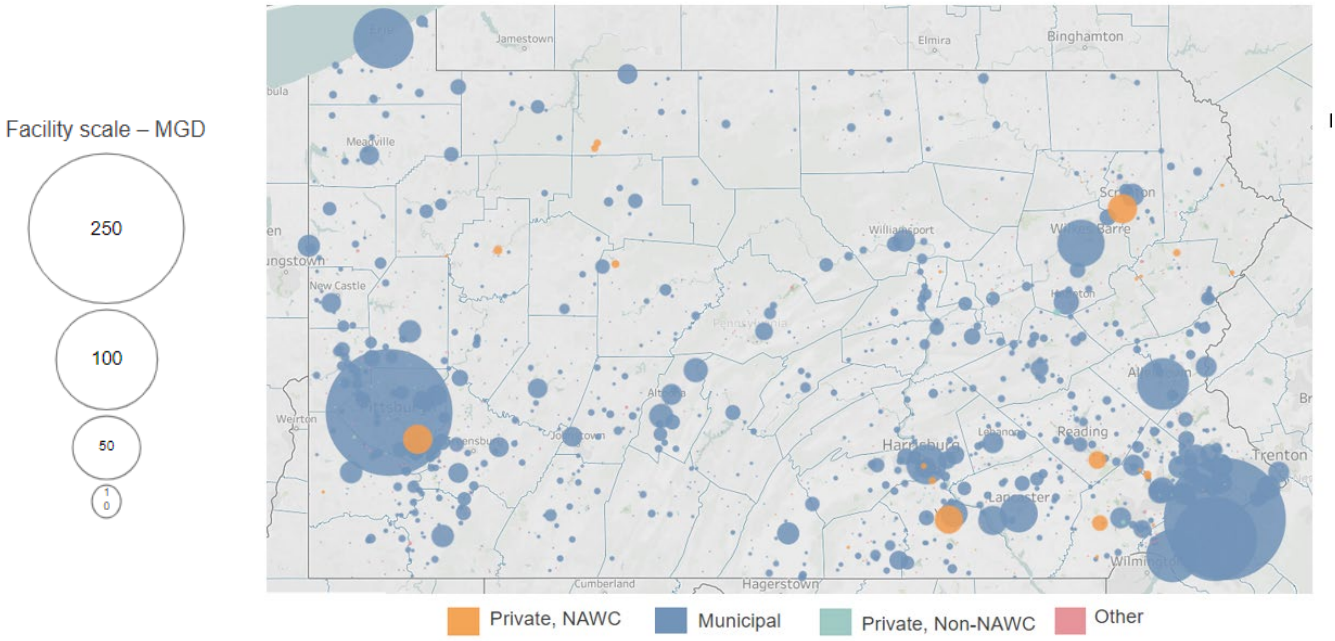
Figure 9. Average Facility Flow, Pennsylvania Wastewater Systems, 2022



Source: ECHO NPDES Permit Loading Tool (2022)

Adding average system size to the map of wastewater facilities can provide a more complete view of the ownership distribution in Pennsylvania, as shown in Figure 10. Several extremely large municipal systems in the Philadelphia and Pittsburgh areas should be considered when reviewing any analysis comparing facilities. The top 10 municipal wastewater facilities average 65.7 MGD of treatment. Despite the top 10 only representing 1% of the system count, their removal from the municipality average would decrease that average from 1.41 MGD to 0.77 MGD.

Figure 10. Wastewater Facilities (scaled by Average Daily Flow MGD)



Source: ECHO NPDES Permit Loading Tool (2022), CRA Analysis

2.4. Supporting Privatization and Consolidation in Pennsylvania

While the maps and statistics above show that Pennsylvania has experienced some privatization and consolidation in the Commonwealth, there is clearly room for more private investment to address Pennsylvania's water and wastewater infrastructure needs. To consider the path forward, it is helpful to review the federal policy context in which state initiatives are formed. It is also helpful to understand the types of policies and incentives available to states to advance privatization and consolidation. After providing this context, we provide a review of Pennsylvania's efforts to date.

2.4.1. Federal Context

The importance of providing clean water and ensuring public and environmental health has caused the federal government to develop a regulatory and policy framework for the entire water sector. While much deference is given to states on specific regulatory initiatives and compliance monitoring and enforcement, the federal backdrop is an important consideration when evaluating possible options for state-level actions.

Through a series of landmark legislation and amendments, the federal government established water quality requirements, set pollution limits, determined regulatory oversight, allocated vast amounts of funding, and built ongoing data repositories to inform decision-making. A summary of this legislation can be found in Table 3. This is not a comprehensive list of all federal legislation and policy that impacts the water sector.

Table 3. Major US Water-Related Legislation

Water Legislation	Year	Description
Federal Water Pollution Control Act	1948	Established a basic structure for regulating discharges of pollutants into waters of the US and set quality standards for surface waters
Clean Water Act (CWA) Amendments	1972	Assigned authority to implement pollution control programs to the EPA, established permitting rules for point-source discharge into navigable waters, and provided federal funding for sewage treatment infrastructure under the construction grants program
Safe Drinking Water Act (SDWA)[8]	1974	Required the EPA to establish minimum drinking water standards and rules for source water protection, operator certification, and water system improvement funds
SDWA Amendments	1986	Intended to increase the pace of the EPA regulation of contaminants and to protect groundwater sources
SDWA Amendments	1996	Requires that the EPA consider a detailed risk and cost assessment when developing standards
Water Quality Act	1987	Guidance from the EPA requiring states to regulate stormwater runoff and establish non-point source management programs
Lead Contamination Control Act (LCCA)[9]	1988	Guidance from the EPA to identify and correct contamination in drinking water
Reduction of Lead in Drinking Water[10]	2011	Reduced the maximum allowable lead content to a weighted average of 0.25% for pipes, pipe fittings, plumbing fittings, and fixtures; and 0.2% for solder and flux

[8] United States Environmental Protection Agency. (n.d.). Summary of the safe drinking water act | 42 U.S.C. §300f et seq. (1974). Laws & Regulations.

[9] United States Environmental Protection Agency. (n.d.). Module 4: Developing a sampling plan. Office of Ground Water and Drinking Water.

[10] United States Environmental Protection Agency. (n.d.). Basic Information about Lead in Drinking Water. Ground Water and Drinking Water.

Water Infrastructure Finance and Innovation Act (WIFIA)	2014	Five-year pilot loan guarantee program to promote increased development of, and private investment in, large water infrastructure projects
Water Infrastructure Improvements for the Nation Act (WIIN)[11]	2016	New grant programs to help public water systems serving small or disadvantaged communities meet SDWA requirements, support lead reduction projects and establish a voluntary program for testing lead in drinking water at schools
America's Water Infrastructure Act of 2018 (AWIA)[12]	2018	Over 30 mandated programs, including funding for existing programs and a variety of required plans, strategies, and assessments for systems and states
Bipartisan Infrastructure Law (BIL) / Infrastructure Investment and Jobs Act (IIJA)[13]	2021	Allotted >$55 billion in investments in drinking water, wastewater, water reuse, conveyance, and water storage infrastructure, including dedicated funding to address lead service lines and PFAS

As the table above shows, the federal legislative activity over the past few decades has mostly focused on bringing funding to the industry as it confronts major issues, such as lead in drinking water, and several emerging issues, such as PFAS. Despite the focus on funding, the amount of funding has been deemed inadequate by a variety of studies and analyses. There have been few "new" water quality or environmental standards since 2011, other than those promulgated by the EPA under existing statutory authority. One of the more prominent recent developments has been the EPA's attempts to understand and regulate PFAS.

Despite many reports suggesting the benefits of regionalization, the US government has not passed specific legislation to drive privatization and consolidation. The closest it has come has been legislation that required EPA to issue regulations that are supportive of consolidation. A provision of the AWIA required EPA to issue regulations that, through states, mandates owners of non-

[11] United States Environmental Protection Agency. (n.d.). The Water Infrastructure Improvements for the Nation Act (WIIN act ... Building the Capacity of Drinking Water Systems.

[12] America's Water Infrastructure Act of 2018. (n.d.-a). America's water infrastructure act of 2018 (AWIA) | US EPA. Ground Water and Drinking Water.

[13] The White House. (2022, May). Building a Better America Guidebook. Washington, DC.

compliant systems to assess options for consolidation or transfer of ownership.[14] The EPA has provided other supportive guidance, including a March 2020 update to its Water System Partnerships Handbook for states' drinking water programs to "help identify, assess, and implement water system partnerships, including consideration of consolidations," which includes direct acquisitions by private utilities.[15] The lack of significant legislation on privatization and consolidation is likely in deference to state-level decision-making.

There are also many federal government policies that have presented unnecessary barriers by restricting federal funding to public entities or favoring public ownership in the tax code. The main federal funding approach for drinking water and wastewater involves providing grants to states' Drinking Water and Clean Water State Revolving Funds (SRF). The Government Accountability Office (GAO) estimated that private utilities were allocated only 2% of the $26.5 billion spent in the EPA's Drinking Water SRF program from January 2010 through June 2020. EPA's Drinking Water SRF program, created under the Safe Drinking Water Act, provides grants to states for low- or no-interest loans or grants to drinking water utilities for infrastructure projects.[16] The EPA does not restrict private entity access to Drinking Water SRF funds. However, Clean Water SRF funds are currently restricted from private wastewater facility owners. This restriction biases the allocation of government funding only to the benefit of customers that happen to be served by government-owned utilities.

The President's NIAC report suggests that one way to aid infrastructure owners and operators is to remove barriers to funding for water projects – specifically allowing privately-owned water companies access to Water Infrastructure Finance and Innovation Act funds and other federal grants.[17] The IIJA/BIL designates $55 billion in drinking water, wastewater, water reuse, conveyance, and water storage infrastructure. It also includes money to replace lead service lines and to address PFAs.[18] Most of the funds go to the state revolving funds. In November 2023, EPA

[14] GAO-21-291, private water utilities: Actions needed to enhance ... United States government Accountability Office. (2021, March). (codified at 42 USC. § 300g3(h)).
[15] Environmental Protection Agency, How to Support Water System Partnership: Water System Partnership Handbook, EPA 810-B-19-002 (Washington, D.C.: March 2020)
[16] GAO-21-291.
[17] "Preparing United States Critical Infrastructure for Today's Evolving Water Crises," National Infrastructure Advisory Council, August 2023.
[18] The White House. (2022, May). Building a Better America Guidebook. Washington, DC.

announced that it had awarded Pennsylvania over $396 billion.[19] These funds are distributed differently state by state, but a common interpretation of the IIJA/BIL language suggests that the funds mostly go to public water utilities.

Beyond funding-focused policy, increased federal regulation will also be an impetus for increased privatization and consolidation. Examples include the EPA's draft PFAS regulations and the draft Lead and Copper Rule Improvements (LCRI), both of which the EPA intends to finalize in 2024. These regulations will require actions by drinking water providers that, in many cases, will involve significant infrastructure investments and the application of specific expertise that may be best provided by private owners across consolidated systems.

2.4.2. State-Level Support Options

Given the deference by the federal government to states on ownership types, many states have developed state-specific legislation and regulations to support water privatization and consolidation.[20] Much of this has been focused on ensuring that there are mechanisms and proper incentives in place to allow privatization and consolidation. These may involve removing barriers to potential transactions, supporting the transfer of benefits to customers, and supporting the establishment of rate structures that represent full cost of service customer rates.

The following are examples of state-level legislative tools that can support privatization and consolidation:

- System valuation laws – One of the most widely adopted and impactful policy approaches to removing barriers to acquisitions of municipal systems involves water system valuation laws. The most common example is Fair Market Value (FMV) legislation. It was well described in a 2020 GAO report: "Regulators traditionally use original book cost less depreciation to set the value for acquired assets on which utilities earn a return. Fair market value laws generally permit private companies to acquire [public] water utilities at higher than book value and allow those companies to factor the acquisition value into the rates they charge for water."[21] FMV laws and similar policies

[19] EPA, "EPA Region 3 Awards Nearly $387M for Clean Water and Drinking Water Infrastructure Upgrades in Pennsylvania," November 2023.

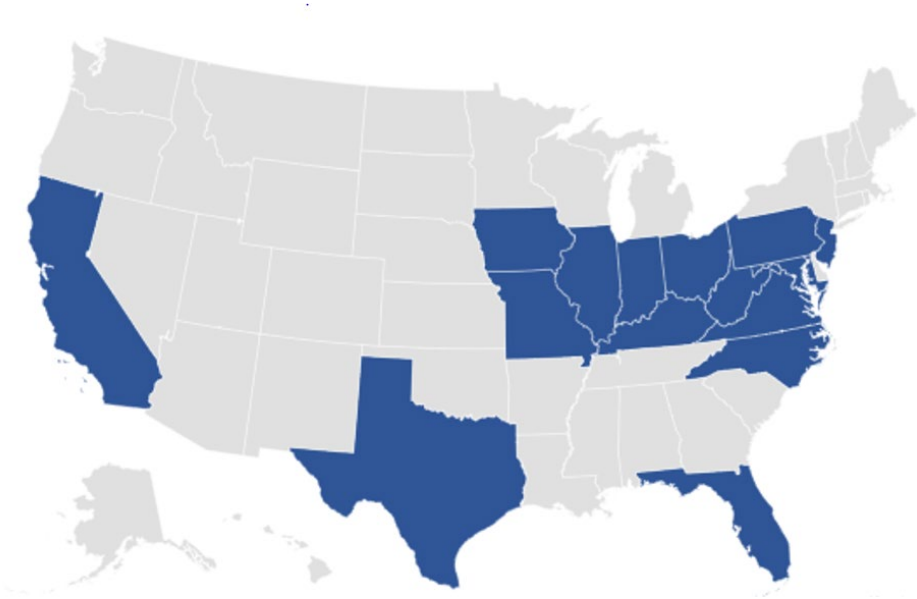
[20] Larimore, G., & Dewey, D. (2018, October 31). State Level Policies to Promote Water Utility Consolidation. National Governors Association.

[21] GAO-21-291, p.37

allow the purchase price to better reflect value, thus ensuring reasonable compensation to the communities selling the systems.

While not limited to "distressed systems, this policy solution helps investor-owned utilities acquire water systems when municipal owners seek relief from existing financial burdens of investing in depreciated systems and the proceeds of the transaction can be used for other local priorities. [22] The laws generally include detailed provisions for how a fair market value is determined. As of 2023, 15 states have passed FMV laws or similar laws that reform utility valuations to further support transactions. These states are shown in Figure 11 below.

Figure 11: States with Utility Valuation Reform Laws



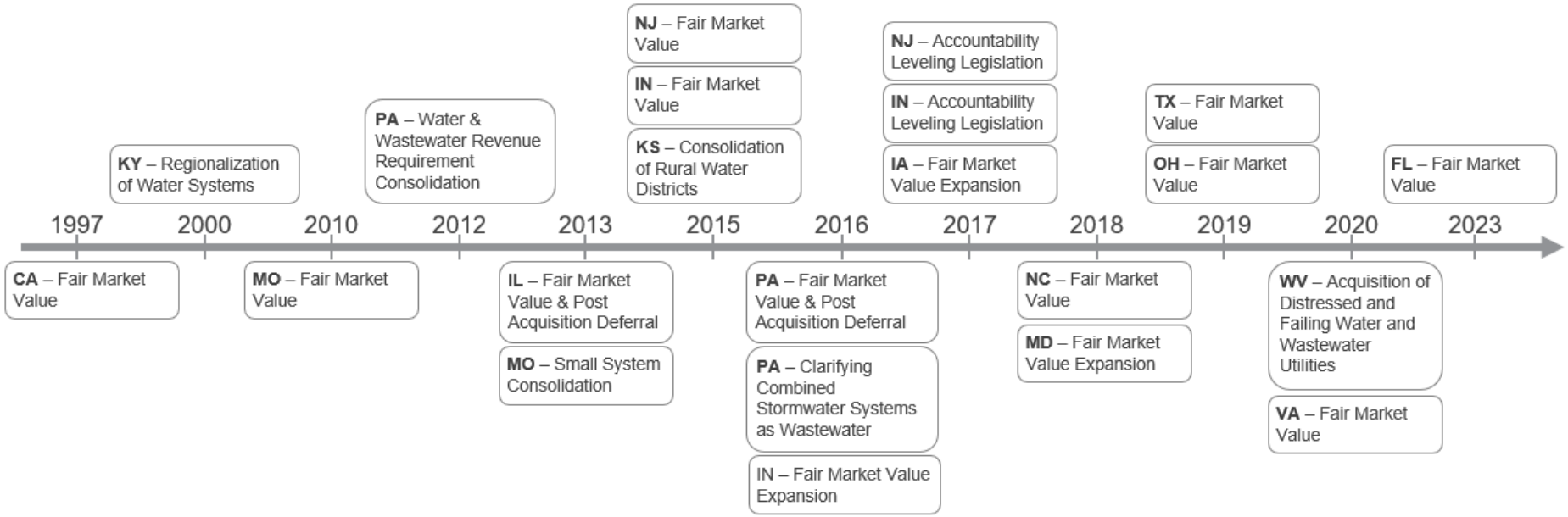
- Regulating rates – States can influence the rate-setting mechanisms and policies that can impact post-transaction water and wastewater customer rates, thus either encouraging or discouraging privatization and consolidation. Examples that fall in this category include rate stabilization mechanisms, single tariff / consolidated tariff pricing, infrastructure replacement charges, distribution system improvement charges, and fixed price increases. Each of these can be applied in ways that allow acquirers to structure rates to best benefit customers post-transaction, often through engagement with the PUC.

[22] Fair market value: Key policies, acquisition trends, and companies. Bluefield Research. (2023, November 21).

- Other – There are many other ways to encourage consolidation through state policy. Some policies simply involve ensuring that systems are compliant with best practices and are fulfilling their missions of providing proper drinking water and wastewater services to their customers. Another example is ensuring consistent regulatory enforcement across ownership types.

Figure 12 shows a timeline of selected policies that various states have passed to support privatization and consolidation.

Figure 12. Timeline of state-specific legislation, 1997 - present [23],[24],[25],[26],



[23] Norriss, J., Cunningham, M., DeRosa, A. R., & Vedachalam, S. (2021, December). Too small to succeed: State-level consolidation of Water Systems. American Water Works Association.
[24] West Virginia State Legislature. (n.d.). West irginia code 24-2H-2. West Virginia Code. https://code.wvlegislature.gov/24-2H-2/
[25] Larimore, G., & Dewey, D. (2018, October 31). State Level Policies to Promote Water Utility Consolidation. National Governors Association.
[26] Krumholtz, M. (2023, November 28). Fair market value acquisitions for water and Wastewater Facilities. Walden.

The following are three examples of states that have made efforts to support the privatization, consolidation, and regionalization of their water systems. This is not a complete list of state policies to support privatization and consolidation, and many more exist across various states.

1. **North Carolina** – The State Water Infrastructure Authority published a state water infrastructure strategy. The state also passed a bill to create a merger/regionalization grant to study this feasibility.[27] Since then grant funding has prioritized small populations who would benefit from regionalizing water service and decentralizing smaller water systems.
2. **Kentucky** – The Area Water Management Councils were created in each district to discuss infrastructure needs and planning.[28] Reports submitted to their centralized information system have allowed them to prioritize DWSRF funding across the state. This also allows them to study the feasibility of consolidation across districts. In some cases, a merger or consolidation may be ordered by the PSC.
3. **California** – The State Water Resource Control Board incentivizes and mandates consolidation of failing water systems through SB 88, SB 552, and SB 508. SB 552 aimed at drought relief for small water systems to ensure safe drinking water or allows the board to order an extension of service which moves them closer to consolidation.[29]

2.4.3. Pennsylvania Support To-Date

Pennsylvania is considered one of the more progressive states in addressing its drinking water and wastewater challenges by supporting privatization and consolidation.. Consolidation has been occurring in Pennsylvania since at least the 1980s. The Pennsylvania PUC has provided supportive tools and incentives since at least the 1990s, when it "expanded its acquisition incentives to include a rate of return premium for the acquiring utility, a debit acquisition adjustment, allowing the

[27] NC Act to Improve the Viability of the Water and Wastewater Systems of Certain Units of Local Government, House Bill 1087, 2019-2020 Session (2019). https://www.ncleg.gov/EnactedLegislation/SessionLaws/PDF/2019-2020/SL2020-79.pdf

[28] Building the Capacity of Drinking Water Systems | Kentucky. United States Environmental Protection Agency. (n.d.). https://www.epa.gov/dwcapacity/kentucky

[29] California, S. of. (2022, October 11). Drought planning for small water suppliers and rural communities (SB 552). Department of Water Resources.

deferral of acquisition improvement costs, and allowing a plant improvement surcharge."[30,31]

Support from the legislature has come in more recent legislation that has better supported transactions when they are reasonable. Pennsylvania has passed both fair market value and combined revenue requirement bills that have helped enable consolidation and privatization in Pennsylvania. These are summarized below:

- 2016 Act 12 – "Valuation of Acquired Water and Wastewater Systems for Ratemaking Purposes" (April 2016) - The act is better known as the 'Fair Market Value' act.[32] Pennsylvania saw the value in providing options and incentives for the acquisition of willing municipal and wastewater systems by larger, well-capitalized, and well-run regulated privately owned utilities. This act enables a private water utility or entity to utilize fair market valuation when acquiring water and wastewater systems located in Pennsylvania owned by a municipal corporation or authority. The process in which this occurs involves the engagement of a licensed engineer to assess the tangible assets of the seller. Independent valuation experts for both the buyer and seller use the engineer's asset report to complete appraisals that are submitted to the PUC for review and approval. The acquired system comes under the jurisdiction of the PUC upon the completion of the application process and PUC approval of the transaction. There are also certain provisions related to post-transaction accounting and the recovery of transaction costs.
- 2012 Act 11 – "System Improvement Charges Act 11" or Combining Water and Wastewater Revenue Requirement (February 2012) – An amendment with multiple changes to the Public Utility Code. It allows for the combining of water and wastewater revenue requirements upon petition by the utility. This can allow the PUC to potentially allocate a portion of a wastewater revenue requirement to the combined water and wastewater customer base when in the public interest. This law also allowed PUC-jurisdictional water and wastewater utilities, city and non-city natural gas distribution

[30] PA Code. (n.d.). Small Nonviable Water and Wastewater Systems - Statement of Policy. Commonwealth of Pennsylvania. 52 Pa. Code § 69.711. Acquisition incentives.

[31] Pennsylvania Bulletin. (n.d.-b). Incentives for the Acquisition and Merger of Small, Nonviable Water and Wastewater Systems. Commonwealth of Pennsylvania. 52 PA. CODE CH. 69

[32] Center, L. D. P. (2016, April 14). Public Utility Code - Valuation of Acquired Water and Wastewater Systems for Ratemaking Purposes. Pennsylvania General Assembly. HB1326

companies, and electric distribution companies to petition the Commission to implement a Distribution System Improvement Charge (DSIC).[33] These charges must reasonably repair, improve, or replace eligible property to ensure and maintain adequate, efficient, safe, reliable, and reasonable services.

- Pennsylvania Infrastructure Investment Authority Act of 1988 (with 1992 amendments) - Established the Pennsylvania Infrastructure Investment Authority ("PENNVEST"), which was created to provide "affordable financing" on projects that ensure that Pennsylvania residents have safe drinking water while also funding businesses within Pennsylvania to create local, well-paying jobs. PENNVEST administers and finances the Clean Water State Revolving Fund (CWSRF) and the Drinking Water State Revolving Fund (DWSRF) pursuant to the federal Water Quality Act of 1987, the American Recovery and Reinvestment Act of 2009 (ARRA) funds, and, most recently, the funds under the IIJA. PENNVEST also "finances, through the issuance of special obligation revenue bonds, water management, solid waste disposal, sewage treatment and pollution control projects undertaken by or on behalf of private entities."[34]

  Related to privatization and consolidation, PENNVEST offers financial assistance to water projects that involve a viable system acquiring a small, non-viable system. PENNVEST's incentives include being able to include excess acquisition costs in the acquiring utility's rate base and amortizing those costs over 10 years, phased-in rate recovery for improvement costs, and surcharges to offset operating costs. The financing priorities include "Whether the project encourages consolidation of water or sewer systems, where such consolidation would enable the customers of the systems to be more effectively and efficiently served."[35]

This is not a complete list of legislation impactful on water and wastewater privatization and consolidation. It also does not include a variety of proposed legislative acts and PUC regulations that could further support privatization and consolidation.

[33] Valuation of and return on the property of a public utility. Pennsylvania Gen Assembly. (n.d.). Title 66 § 1311
[34] PA.gov. (n.d.). Funding programs. PENNVEST.
[35] Pennsylvania General Assembly. (1988, March 1). Pennsylvania Infrastructure Investment Authority Act. 35 P.S. § 751.1

3. Assessing the Benefits of Private/Consolidated Water Companies in Pennsylvania

This section of the report assesses the many benefits of NAWC member companies in Pennsylvania. Benefits are evaluated across the following categories, which are the subsections below: Economic Impacts, Consumer Benefits, Environment, and Safety.

3.1. Consumer Benefits – Drinking Water Quality

Successfully delivering safe drinking water is one of the key services required for enabling a well-functioning, advanced society. Access to safe and readily available drinking water brings a myriad of public health benefits, from reducing disease and infection to avoiding contaminants that cause both known and unknown harms. Most people in the United States are reliant on their drinking water provider to ensure water quality, and thus their well-being. As discussed previously, the federal government and the state governments play active roles in regulating water systems to support drinking water quality. While overall the US provides some of the cleanest and safest drinking water in the world, outcomes are not consistent across the country.

The leading causes of waterborne diseases in the US have led to an estimated $3.3 billion annually in total direct healthcare costs for hospitalizations and emergency room visits.[36],[37] Pathogens such as bacteria, viruses, and protozoa, are a direct and costly threat to human health in the US[38] In 2014, the CDC estimated that 17 waterborne pathogens caused over 7.15 million illnesses and 6,630 deaths in the US alone.[39] Along with waterborne disease, the increased awareness of harmful contaminants such as lead, copper, PFAS, and other industrial/pharmaceutical waste speaks to the need for a drinking water supply that is well-regulated and equipped to address emerging risks to public health. As discussed previously, confronting drinking water challenges will require expertise and significant investment in coming years.

As covered in many studies, privatization and consolidation would be expected to bring water quality improvements to most drinking water systems, particularly those

[36] Collier SA, Stockman LJ, Hicks LA, Garrison LE, Zhou FJ, Beach MJ. Direct healthcare costs of selected diseases are primarily or partially transmitted by water. Epidemiol Infect. 2012 Nov;140(11):2003-13. doi: 10.1017/S0950268811002858. Epub 2012 Jan 11. PMID: 22233584; PMCID: PMC4629238.

[37] Waterborne disease & outbreak surveillance. Centers for Disease Control and Prevention. (2022, March 9).

[38] NIAC: Preparing US Critical Infrastructure for Today's Evolving Water Crises – August 2023

[39] Ibid

that are distressed, sub-scale, or dealing with challenges that require expertise and significant investment. Through consolidation, private water utilities can bring operational efficiencies and economies of scale to existing and emerging drinking water challenges. For example, addressing PFAS will involve large capital investments and expertise to test, monitor, and potentially abate PFAS in drinking water systems across the Commonwealth. Compared to independent municipal or private systems, companies with a large portfolio of community water systems will face a relatively smaller marginal cost for each additional upgraded system. Private consolidated companies are also generally in a better position to finance major capital improvements through regulated rates that reflect true costs and by consolidating financing activities.

This section provides both qualitative and quantitative analysis of the quality of water provided by drinking water systems in Pennsylvania, comparing outcomes across different ownership types. It begins with a discussion of the relevant regulations on contaminants and the various data sources that track compliance. An analysis of data is provided for Safe Drinking Water Act violations over time and across ownership types. For emerging contaminants such as lead and PFAS, the discussion focuses on the abilities of various ownership types to confront new obligations. The analysis finds that NAWC member systems in Pennsylvania have, on average, provided higher quality drinking water than systems owned by other owner types, and they are better positioned to continue doing so into the future.

3.1.1. Drinking Water Standards

The Safe Drinking Water Act (SDWA) was originally passed in 1974 to establish long-term regulatory precedence to protect public health by regulating the nation's public drinking water supply. It was amended in 1986, and again in 1996 to expand its scope to water sources – rivers, lakes, reservoirs, springs, and groundwater wells.[40] Under the SDWA, national drinking water standards are legally enforceable. Enforcement is carried out by both EPA and state agencies that can act against water systems not meeting standards.

Under the SDWA, the EPA is given the authority to set national health-based standards for drinking water to protect against contaminants that may be found in drinking water. These threats include:

[40] SDWA does not regulate private wells that serve fewer than 25 individuals.

- Improperly disposed chemicals and industrial waste,
- Animal waste,
- Agricultural waste such as pesticides and runoff,
- Pharmaceuticals,
- Underground injected wastes, and
- Naturally occurring substances that make their way into a public water supply.[41]

While the SDWA initially focused on regulating the treatment of drinking water, amendments in 1996 expanded the scope of the law to include provisions for source water protection, operator training, water system improvements, and public information systems. From these amendments, the SDWA divided the responsibility of ensuring public water systems provide safe drinking water among the EPA, states, tribes, individual water systems, and the public. The EPA became responsible for overseeing and ensuring that water systems test for contaminants and publish the testing results to publicly accessible repositories, encouraging transparency and consumer awareness. [42]

In accordance with the SDWA, the EPA's primary contaminant standards and treatment techniques, National Primary Drinking Water Regulations (NPDWR), are enforceable by law for all public water systems. These regulations set limits on various contaminants based on scientific analysis. A complete list of NPDWRs can be found on the EPA's website. The standards are categorized as microorganisms, disinfectants, disinfection byproducts, inorganic and organic chemicals, and radionuclides. Table 4 shows a select few contaminants along with their health effects, common sources, and limits.

Table 4. A selected list of National Primary Drinking Water Regulations

Contaminant	Category	Health Effects from Long-term Exposure	Common Sources	Limit (mg/L)
Lead	Inorganic Chemical	Adults – kidney problems, high blood pressure Children – delay in physical or mental development	Corrosion in household plumbing, erosion of natural deposits	TT5; Action Level=0.015

41 Understanding the safe drinking water act. United States Environmental Protection Agency. (2004).
42 Ibid

Copper	Inorganic Chemical	Short-term exposure – Gastrointestinal distress Long-term – liver or kidney damage	Corrosion in household plumbing, erosion of natural deposits	TT[5]; Action Level=1.3
Cryptosporidium	Microorganism	Gastrointestinal illness	Human and animal fecal waste	TT[7]
Giardia	Microorganism	Gastrointestinal illness	Human and animal fecal waste	TT[7]
E.Coli	Microorganism	Short-term illness	Human and animal fecal waste	MCL
Arsenic	Inorganic Chemical	Skin damage or problems with circulatory systems; increased risk of cancer	Erosion of natural deposits; runoff	0.010 mg/L
Nitrates / Nitrites	Inorganic Chemical	Infants – in excess can cause serious illness or death	Runoff from fertilizer, leaching from sewage, erosion of natural deposits	10 / 1 mg/L

Secondary standards, or NSDWRs, are not enforceable by the EPA but may cause cosmetic or aesthetic effects on water. There are recommended standards for water systems that states may choose to adopt. These contaminants include aluminum, chloride, copper, fluoride, foaming agents, iron, manganese, silver, sulfate, and zinc.[43] There are also additional standards for pH, color, odor, and total dissolved solids.

3.1.1. Drinking Water Data and Analysis

In 2013, the Safe Drinking Water Information System (SDWIS) became available for public use as a repository for all monitored and reported data gathered on drinking water systems under the SDWA. The system offers the capability to query data on individual water systems, monitored pollutants, and non-compliance violations. The data from SDWIS is sourced by state regulatory bodies, EPA regions, and public water systems in accordance with reporting requirements established by the SDWA and other related regulations. Both the Pennsylvania Department of Environmental Protection (DEP) and the US EPA reference data from SDWIS for water-quality evaluations. These include addressing trends in non-

[43] Drinking water regulations and contaminants. United States Environmental Protection Agency. (2023, Feb 14).

compliance, overseeing state-run drinking water systems, tracking containment levels, responding to public inquiries, and preparing national reports on the delivery of safe drinking water to the public.[44]

This study's analysis of SDWA compliance violations among public water systems (PWS) in Pennsylvania is confined to Community Water Systems as defined by the EPA. This means it excludes Non-Transient Non-Community Water System and Transient Non-Community Water Systems. Definitions of each of these terms are provided in Section 2.3.1. The analysis only evaluates community water systems that were in "active" status in SDWIS as of September 2023.

Ownership Types

The study aims to evaluate four ownership categories: 'Municipal', 'Private - NAWC Members', 'Private – Non-NAWC Members', and 'Other.' Each drinking water system was mapped to one of these categories. This involved using SDWIS ownership categories and facility-level information provided by NAWC members. To include 'Private - NAWC Members' as a breakout category, CRA gathered facility-level data from NAWC members for each active drinking water system and harmonized it with the existing SDWIS facility and violation data. The following table shows the mapping of CRA Study categories to SDWIS categories, with several SDWIS categories spanning several CRA Study categories.

[44] Safe drinking water information system (SDWIS). Healthy People 2030. (n.d.).

Table 5: Ownership Pairings for SDWA Violation Analysis

Ownership Type (CRA Analysis)	Ownership Category (SDWIS)
Municipal	Local government
Other	State government
	Federal government
	Native American (Tribal) government
	Mixed Ownership (with manual re-mapping for certain systems that are mostly Private or Municipal)
Private, NAWC Members	Privately-Owned Systems
Private, Non-NAWC	

Violations

SDWIS violation data was used to compare the quality of drinking water provided to customers in Pennsylvania across different ownership categories. SDWIS violations are issued whenever a PWS fails to meet an EPA-mandated drinking water standard. Drinking water standard violations are sorted into several categories, including:

- Treatment technique
- Maximum residual disinfectant level violations
- Maximum contaminant level violations
- Monitoring and reporting violations
- Reporting violations
- Other

To evaluate changes in violation rates and ownership over time, this study includes annual violation data over a 10-year study period (2013 to 2023 YTD). Customer counts and number of connections are based on annual data from SDWIS. Ownership types are based on the owner types in 2023, except for facilities that

were purchased by NAWC members during the study period. The dates of transactions were collected from NAWC members.

The annual data and transaction dates allowed for a comparison of violation rates before and after NAWC members took ownership of facilities. To accurately reflect the amount of time that it would be expected for an ownership change to have an impact on violation rates, a one-year transition period was assumed in which violation data for a transacted facility was not included in the study for the immediate year of the transaction. The one-year period is based on discussions with NAWC members that expressed corporate expectations that their operators show progress by the second year of ownership. In reality, the transition time would vary based on the characteristics of each facility and the various timelines for owner interventions that would impact outcomes. The transition period assumption is not highly impactful on results.

An analysis simply comparing numbers of violations by ownership type would bias the results toward higher violations by Municipal systems simply due to the greater amount of drinking water provided by municipalities. For a proper comparison, violation rates were calculated. A violation rate is the number of violations per unit of a selected variable. Drinking water volume data is not available in SDWIS, therefore the scale metrics used were population served (customers) and number of service connections (connections). Data on each metric are available annually in SDWIS. The selected metrics were “violations per 1,000 customers” and “violations per 1,000 connections.”

Results of SDWA Violations Analysis (2013-2023)

Across the 10-year study period, NAWC member systems consistently have lower average violation rates than systems owned by other entities. (Figure 13). Municipal systems incurred, on average, about one violation for every 1,000 customers served each year. In comparison, NAWC member systems only incurred, on average, about 0.07 violations for every 1,000 customers served each year. The average rate for Municipal systems is therefore 14 times greater than the rate for private NAWC member systems. (Figure 14) When comparing ‘Private - Non-NAWC’ systems to ‘Private - NAWC’ systems, there is an even greater effect. ‘Private - Non-NAWC’ systems incurred an average of 47 violations per 1,000 customers served – over 660 times the violation rate of NAWC member systems. When normalizing violations by service connections, an even greater split between ownership categories is observed. (Figure 16)

General violations include reporting and monitoring violations. Water quality violations are specific violations of contaminant standards and are therefore seen as more impactful in some ways. Across the study period, 'Municipal' and 'Private-Non-NAWC' systems incurred water quality violations at average rates of 0.03 and 0.31 violations per 1,000 customers, respectively. NAWC-owned systems had an average of 0.003 water quality violations per 1,000 customers, which is 10 times lower than Municipal systems and nearly 100 times lower than non-NAWC private systems. (Figure 15) This scale of outcome holds when evaluating water quality violations by service connections. Rates for 'Other' systems were also much higher than rates for NAWC systems, but are not as comparable given small average sizes and extreme variability.

Figure 13. Violation Rate of Municipal and NAWC Member Systems over observed study period, population normalized (2013-2023)

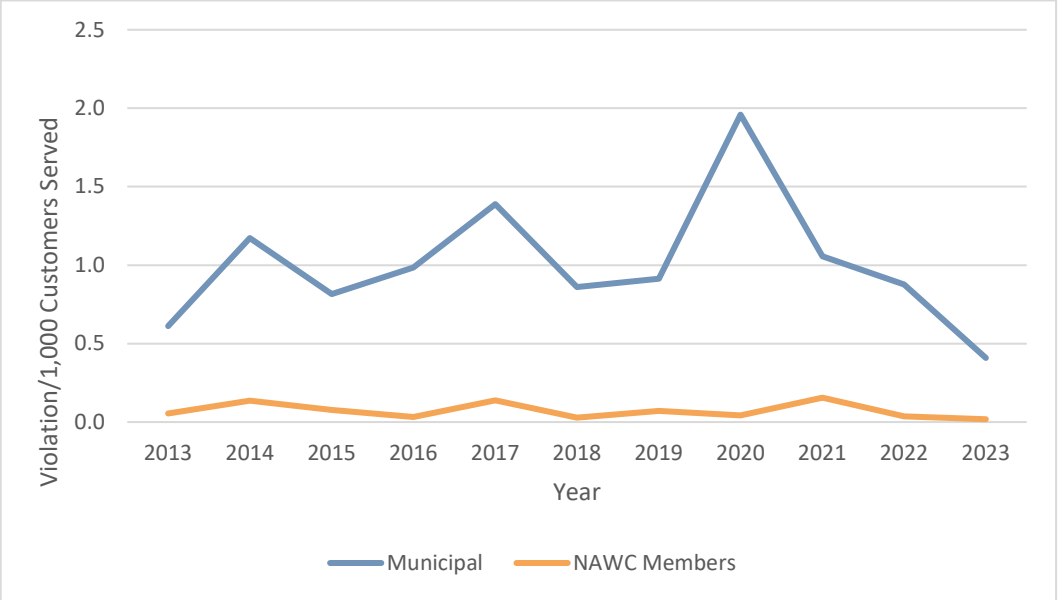


Figure 14. Annual Average Violations per 1,000 Customers by Ownership, All systems (2013-2023)

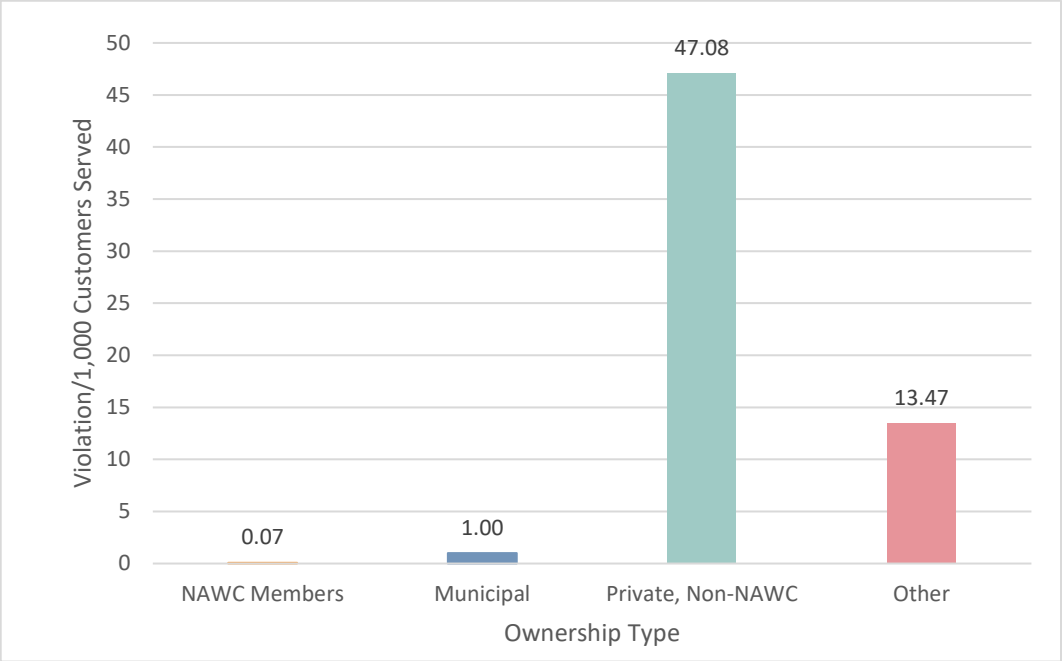


Figure 15. Annual Average Water Quality Violations per 1,000 Customers by Ownership, All systems (2013-2023)

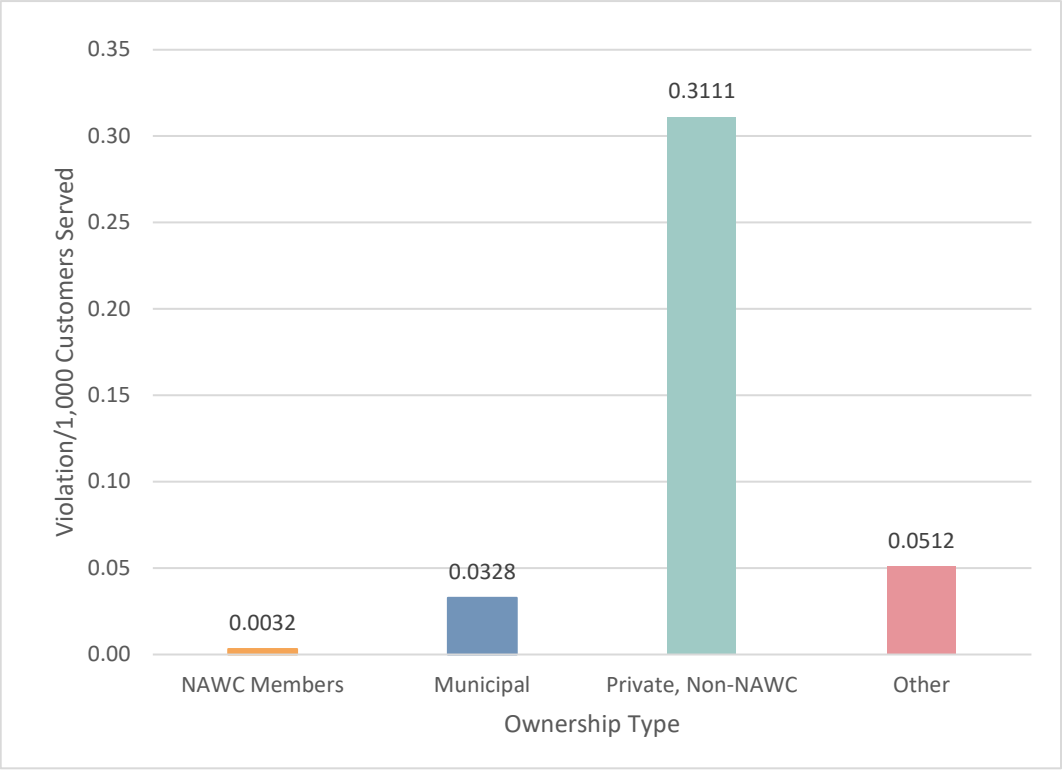


Figure 16. Annual Average Violations per 1,000 Connections by Ownership, All systems (2013-2023)

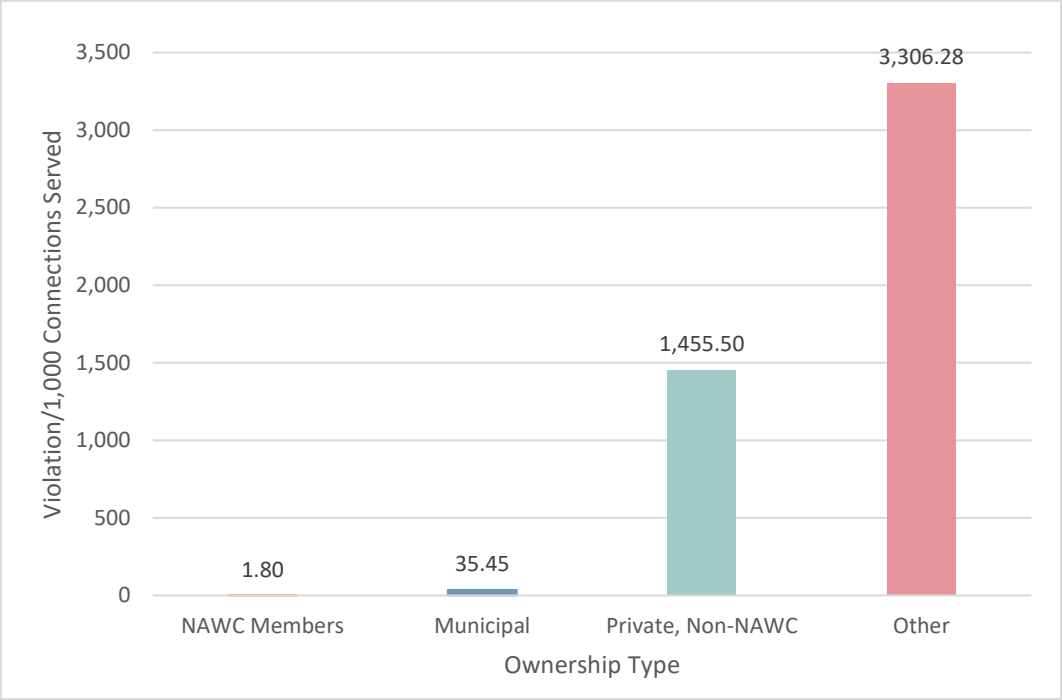
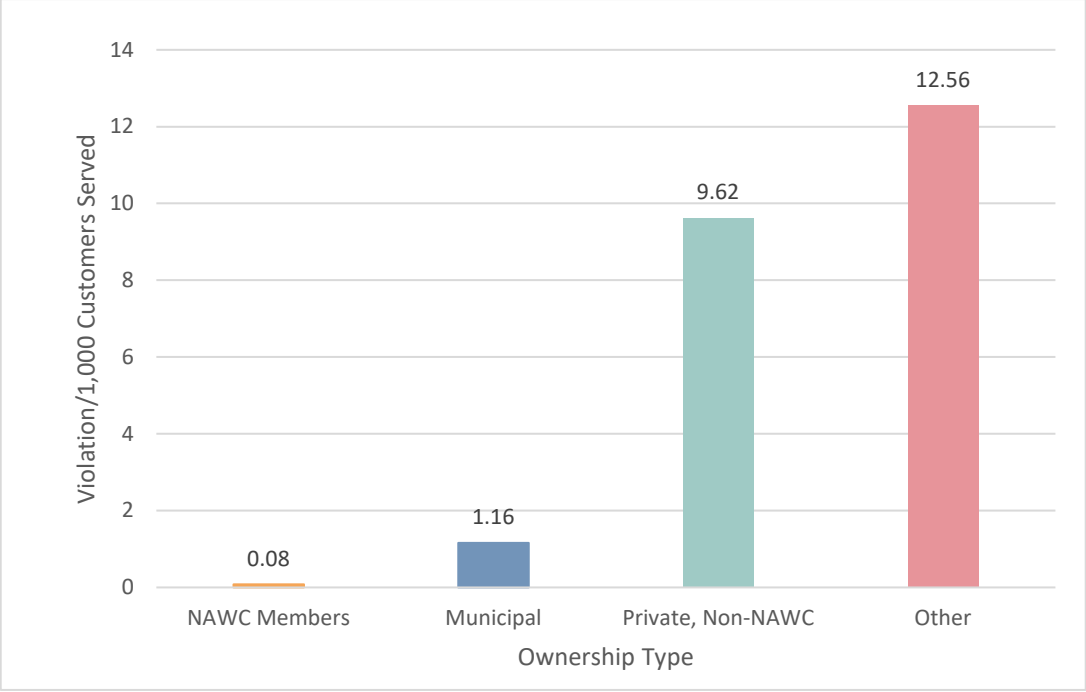


Figure 17. Annual Average Water Quality Violations per 1,000 Customers by Ownership, All systems, service connection normalized (2013-2023)



Considering system size

The analysis described to this point has assessed violation rates across all CWS facilities in Pennsylvania, including all system sizes. There is significant variability in system sizes, so it is reasonable to consider the impact of facility size on the results. To explore this dynamic, the comparative analysis was conducted for both small systems (<1,000 customers) and large systems (>1,000 customers). The results were similar in magnitude regardless of system size, suggesting water quality benefits of privatization and consolidation across system sizes.

Figure 18. Annual Average Violations per 1,000 Customers by Ownership, small systems (<1,000 customers served) (2013-2023)

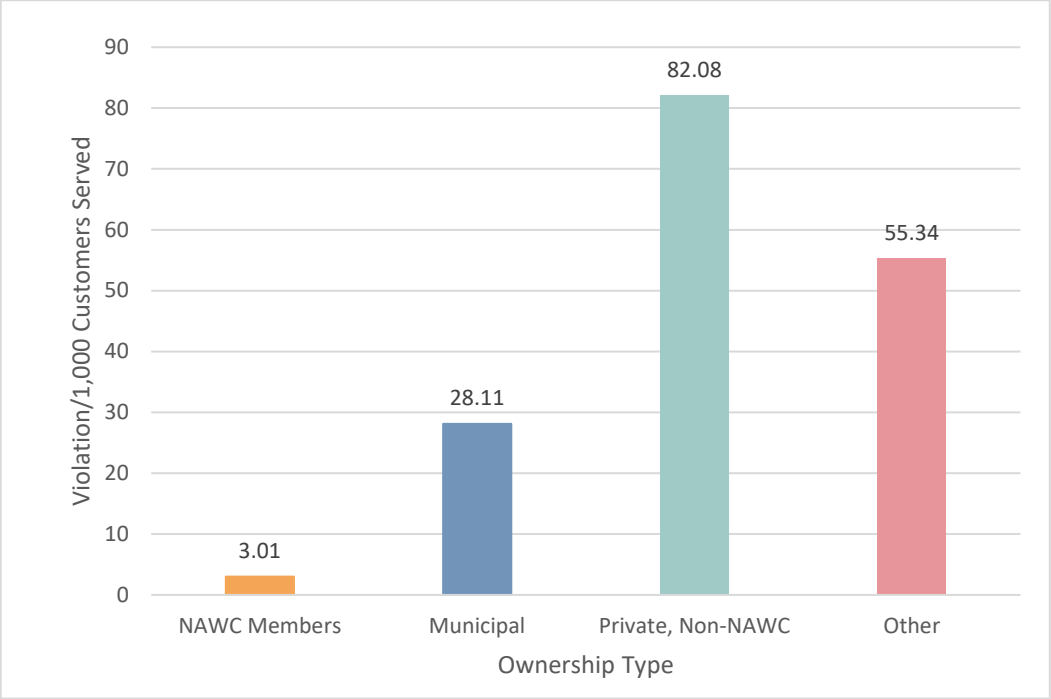
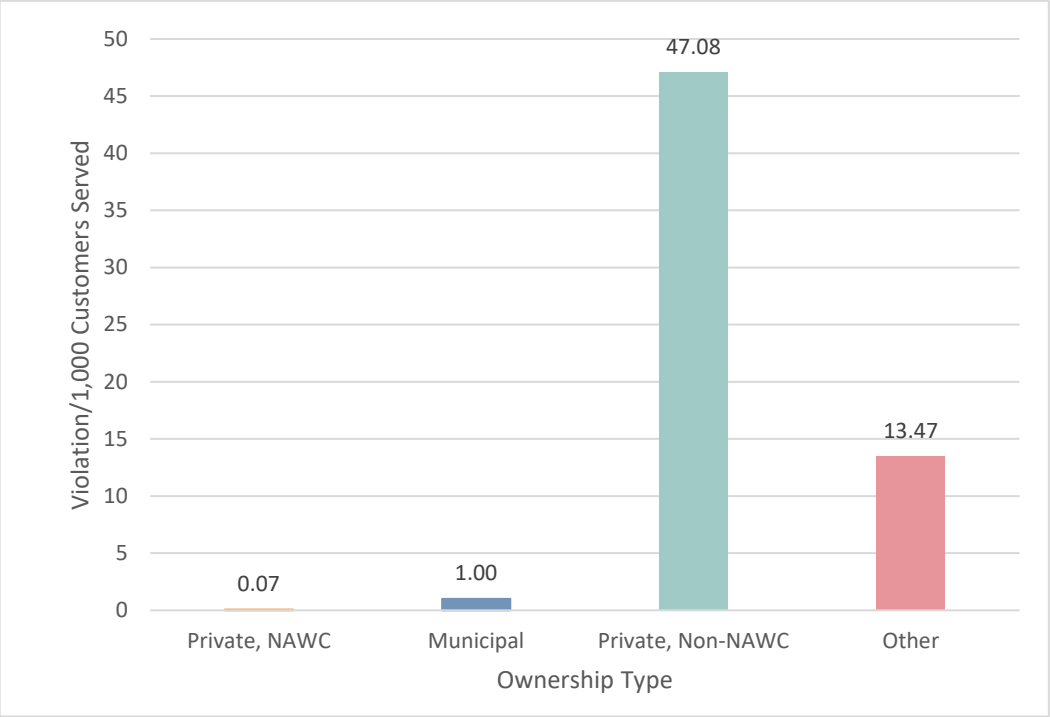


Figure 19. Annual Average Violations per 1,000 Customers by Ownership, large systems (>1,000 customers served) (2013-2023)



Pre- and post-transaction analysis

The time series data allows for a comparison of violation rates before and after acquisitions of systems by NAWC members. Given the limited quantity of transactions, statistical time series analysis is of limited benefit. Rather, the average violation rates before and after transactions can be reported as indicators of likely trends. The weighted average violations incurred by systems purchased by NAWC members decreases from 1,075 each year before acquisition to 30 violations each year after acquisition. This extreme difference is partially driven by several systems with very high violation rates prior to acquisition by NAWC members. Even if those high violation rate systems are removed from the analysis, the violations before acquisition are about five times greater than after acquisition. The results indicate that community water systems purchased by NAWC member companies have historically improved compliance with drinking water quality and monitoring/reporting standards. These historical improvements are consistent with the benefits expected of privatization and consolidation.

3.1.2. PFAS and Other Emerging Challenges

Per- and poly-fluoroalkyl substances (PFAS) are widely used, long-lasting manufactured chemicals with likely harmful health effects that are becoming

increasingly better understood. There are thousands of different PFAS, but all have one characteristic in common—they break down very slowly and build up in humans, animals, and the environment over time.[45] As an emerging public health concern, research continues on the acceptable PFAS exposure levels, ideal testing and removal methods, and proper management, replacement, and disposal approaches. It is important to note that water companies, regardless of ownership type, do not create or produce PFAS chemicals – nor are they used in the water or wastewater treatment processes.

The EPA is working to set timelines for developing nationwide contaminant limits and monitoring requirements for PFAS, with the goal of establishing a standard regulation after pilot testing programs in 2025.[46] In the meantime, enforceable action has been in the hands of state environmental agencies. Pennsylvania's DEP initiated work on the PFAS issue in 2013, with various testing exercises, including an extensive sampling project in 2021. There are multiple known water supplies in Pennsylvania with elevated PFAS levels.

In January 2023, PA DEP published the Commonwealth's first maximum contaminant level (MCL) rule for PFAS. This rule established maximum contaminant levels (MCLs) and maximum contaminant level goals (MCLGs) for two of the most common PFAS detected in the human body. Under this rule, any community water system (CWS) or non-transient, non-community water system (NTNCWS) that has an average annual reported concentration of over 14 nanograms (ng) of PFOA per liter or 18 ng of PFOS per liter will be in violation.[47] These levels are much higher than the 4 ng level recently proposed, but not yet finalized, by the EPA that would require compliance at an undetermined later date. Initial monitoring for Pennsylvania systems serving populations over 350 must commence by January 2024, with the remainder required to commence by January 2025. Corrective actions are not prescribed in the rule, rather they will be determined through consultation with PWS that are found to have elevated PFAS levels.

While the regulatory landscape continues to evolve, it is known that addressing PFAS will be extremely expensive. According to a study commissioned by the

[45] United States Environmental Protection Agency. (2023, June 6). Our current understanding of the human health and environmental risks ... PFOA, PFOS, and Other PFAS.

[46] EPA's pfas strategic roadmap: A year of progress. United States Environmental Protection Agency. (2022, November).

[47] PFAS MCL Rule. Department of Environmental Protection. (n.d.).

American Water Works Association, the estimated national cost to install PFAS and PFOS treatment facilities in US drinking water systems exceeds $47 billion over nine years, with an additional $700 million per year in operating cost. [48] The IIIJA provides approximately $9 billion in funding, leaving a very significant amount of cost to be covered by other sources, generally the water utilities and, in turn, their customers. The expected costs for individual treatment facilities vary by system type and scale. Reported costs in Pennsylvania include systems "from 0.005 million gallons per day (MGD) to 2.88 MGD" and the costs for these systems "ranged from approximately $47,000 to $3,250,000."[49]

Regardless of the precise cost, it is clear there are drastic amounts of capital investment and ongoing operating expenses required to address PFAS in coming years and the capital must be applied to projects conducted by experienced professionals. Privatized and consolidated owners are well-positioned to deliver PFAS solutions given their economies of scale, access to capital, and expertise. With PUC regulation, there are also increased motivations for engaging the PFAS issue aggressively and in a timely manner. In fact, many NAWC member systems are getting well-ahead of regulation. For example, Pennsylvania American Water Company (PAWC) began investing in PFAS treatment at their Frackville facility in 2019 in advance of regulatory requirements in the state. Treatment is likely to be online soon, arriving even before the testing requirements in Pennsylvania are effective. Aqua Pennsylvania began investment in PFAS treatment in August 2016. Since that time, five treatment systems at entry points in southeastern PA have been placed into operation. Other systems are in varying stages of planning, design, and construction.

In addition to PFAS, other contaminants such as pharmaceuticals, pesticides, and microplastics face increasing public concern.[50] It is the shared responsibility of policymakers, regulators, and the owners of community water systems to anticipate and safeguard consumers against these waterborne contaminants. As such, the ability of owners/operators to respond to changes in water standards by investing in capital improvement is critical to the safety and health of their customers.

48 Resource Topics. (2023, March 14). PFAS. American Water Works Association.

49 Pennsylvania Code. (2023, January 14). Safe Drinking Water PFAS MCL Rule. Commonwealth of Pennsylvania . 25 PA. CODE CH. 109

50 Drinking Water Fact Sheet. World Health Organization. (2023, September 13).

3.1.3. Lead and Copper

Contaminants can enter drinking water either at the water source (groundwater or surface water), during distribution from the treatment plant to the customer (water mains and service lines), or from plumbing on customer premises. Pre-treatment sources of contamination include accidental releases, fertilizers and pesticides, runoff from concentrated livestock operations, outflows from manufacturing operations, sewer overflows, stormwater, or can be naturally occurring in groundwater or surface water. The most publicized contamination concern is the introduction of lead into drinking water. Both lead and copper are also known to enter drinking water from the distribution system and customers' internal plumbing systems.

To address lead and copper in drinking water, the EPA established the Lead and Copper Rule (LCR) in 1991, setting limits and establishing corrective actions, including treatment techniques. The rule has been revised multiple times, including a major long-term revision in 2021 that established a requirement for a national inventory of service line materials by October 2024.[51] Utility-level inventories are major undertakings, with progress to-date highly variable across public water systems in Pennsylvania. In addition, there are Pennsylvania-specific policies and regulations addressing lead service lines, including Act 120 of 2018, that addressed customer-owned service lines.

Addressing lead contamination is another public health need with a high capital cost. A recent study from the American Water Works Association (AWWA) suggests that removing and replacing the estimated 9 million service lines that are driving lead contamination in the US would cost water utilities a combined $60 billion in capital improvement costs.[52] While provisions in the 2021 Infrastructure Investment and Jobs Act (IIJA) towards lead service line replacement would offset these costs by $15 billion, that would leave water utilities expected to source $45 billion to address lead service line replacement (assuming AWWA's estimates are correct).[53]

Lead service line replacement is another topic for which privatization and consolidation is likely to bring benefits, such as economies of scale, ability to apply

[51] Ground Water and Drinking Water. (2023, December 1). Proposed lead and Copper Rule Improvements. US Environmental Protection Agency.
[52] Resource Topics. (2023, March 14). PFAS. American Water Works Association.
[53] US Congress. (2021, November 15). Public law 117–58 117th Congress. Infrastructure Investments and Jobs Act | 23 USC 101 note.

expertise, and access to needed capital. It also brings PUC regulation, which has already resulted in replacement programs. For example, Aqua Pennsylvania and PAWC have PUC-approved lead service line replacement programs that allow for cost-effective replacement of service line and customer-side materials. The programs allow private utilities to replace service lines and broadly recover those costs, reducing the costs for individual homeowners. Aqua Pennsylvania and PAWC each have an established approach to developing an inventory for replacements of lead service lines to protect the health of their customers. They also provide public-facing websites that contain information in advance of regulatory deadlines. [54] In many public systems, the cost of replacing the customer side service line will likely be borne by the individual homeowner. This will likely increase the cost to the consumer as most replacements will be done by contractors on a home-by-home basis.

3.2. Consumer Benefits – Cost

As essential public services, the costs of the provision of drinking water and the collection and treatment of wastewater are extremely important considerations, particularly in a period of inflating costs across the economy. With good reason, costs are often the subject of public discourse on the performance of water utilities and are highlighted in discussions of preferred ownership types and structures. This discourse often devolves into simple rate and bill comparisons, either over time for a privatized system (such as comparing rates pre-and post-transaction) or across utilities (such as comparing rates between disparate utilities).

These comparisons are fraught with over-simplification and inappropriate conclusions. Proper comparisons need to control for many variables for which data is generally insufficient, such as water sourcing costs, states of existing infrastructure, investment needs, local service conditions, population density, level of service provided, subsidization from sources beyond water bills, and more. They also tend to focus on near term rates rather than expected rates over time. Rates can be held artificially low in the near term through deferring maintenance and delaying asset replacement, despite the potential impact on service in the long term, including increased risk of system failure. After transactions, it is common for significant new investment to address issues that motivated the transaction. This investment could very well obviate the need for more expensive investments in the

[54] Lead, What you should know about lead and drinking water. Aqua. (n.d.).

future (planned investments are often lower cost than accumulated “quick fix” costs or responses to catastrophic infrastructure failures). Without controls for these variables and considering the long term, the many cost benefits of privatization and consolidation are likely undervalued or ignored.

This study does not endeavor a detailed quantitative analysis of rates and bills. The econometric tools exist to develop a “cost per level of service” metric, but existing data is insufficient. Rather, this section examines various cost aspects of water and wastewater service, and the likely impacts of privatization and consolidation on each aspect. It shows that privatization and consolidation can lead to greater cost efficiencies, more cost transparency, and more equitable rates. Such outcomes are supported by PUC rate regulation of NAWC member systems.

3.2.1. Cost Efficiencies

For a given level of service for a specific water or wastewater system, the level of consolidation can significantly impact the cost of service. Greater consolidation can lead to economies of scale in a variety of areas that can lower the overall cost of service. One reason is the ability of larger buyers to obtain lower costs for materials and services given the larger quantities purchased. For most goods (such as equipment, tools, and chemicals) and services, costs decrease with the amount purchased. Another reason is the ability to spread certain service costs across multiple systems. Examples include billing, customer service, testing/monitoring, and construction and maintenance services, as well as planning, design, and management services.

3.2.1. Transparent Rates

Economic principles suggest that prices/rates for goods and services should reflect their costs and should do so in a transparent manner. While there may be exceptions where society prefers subsidizing certain services to certain consumers, the benefits of prices/rates reflecting costs in a transparent manner are numerous. The most direct benefit is that consumers can make educated decisions about the consumption of the goods or services. In drinking water, this means that customers can decide their consumption patterns based on the costs of the water they consume, thus encouraging efficient consumption and proper resource allocations. If rates do not sufficiently reflect costs, either costs must fall, such as through disinvestment in water systems, or subsidization must occur. Subsidization is common in many municipal systems that draw from general funds rather than reflecting full costs in water and wastewater rates.

Private companies are, by definition, required to at least recover their costs through their rates. Their rates are regulated to ensure this happens, while also limiting the rates, through cost-of-service regulation, to only include reasonable costs and a reasonable return on investment. It is also common regulatory practice to ensure rates are not distorted to hide costs of service. Most municipal, state, federal, and tribal systems, as well as many private systems that are not consolidated, are not PUC-regulated and thus are less beholden to cost pass-through and transparency. It is common for municipal systems to not include all costs in customer bills, and rather attempt to recover those costs through other local government revenues. Many municipal systems do not charge certain government facilities for drinking water and wastewater service.

In Pennsylvania, the state PUC has jurisdiction over rates for privately owned water and wastewater companies, with certain exceptions such as mobile home parks.[55] PUC-regulated entities must go through a formal rate case process to adjust rates. The PUC assures fair rates for safe and adequate services. On the other hand, municipal owners are granted by legislation the ability to fix, alter, charge, and collect rates of their own accord.[56]

PUC regulated utilities may only modify customer rates after completing a rate case application and only upon approval by the PUC. The rate case application process includes public notices, mailers to all customers, and public hearings in which customers and concerned parties can learn more about the application and can share any concerns or support. Participants involved in the process also include representatives of the Office of Consumer Advocates, Office of Small Business Administration, and others.

3.2.1. Equitable Rates and Service

The factors in the previous sections contribute to affordability across populations served. There is also an additional rate-related benefit of PUC-regulation, privatization, consolidation, and certain supportive policies that also contribute to equitable rates – ensuring that costs are recovered in a manner that respects societal views on the proper distribution of costs across the population. In other words, rates can be set with a view of “fairness” and variable abilities to pay in mind.

[55] Title 66 - Commission Powers, Duties, Practices and Procedures. PA General Assembly. (n.d.).
[56] Ibid

One tool that has been used by many states in conjunction with consolidation is the use of single tariff pricing across systems. When used properly, this tool can enhance equitable service and rates by layering and optimizing investments across a portfolio of systems. This can ensure that the costs for individual systems to upgrade or build new infrastructure are not concentrated on communities that may not be well-positioned to handle the costs on their own. Without this benefit, investment in disadvantaged communities can be constrained by local economic conditions, thus putting the health of the communities at risk. Investments in water and wastewater systems are often "lumpy" – systems go through periods of significant investment followed by years of lower levels of expenditures. Regulated, consolidated providers can smooth rate impacts and ensure equitable investment across larger portfolios. Rate design options include tiered pricing, increasing block rates, lifeline rates, avoiding overreliance on fixed charges, and separating rates for wastewater and stormwater.

3.2.2. Customer Assistance Programs

Despite any measures to contain costs and keep rates as low as reasonable, it is inevitable that there will be members of the community that cannot find the means to cover their water or wastewater bills, either in the short or long term. Water services are essential for public health, and therefore there is great societal interest in ensuring continued service to those that may not be able to afford the costs of their needs. For many utilities, this issue is sometimes addressed through customer assistance programs (CAPs), which are often aimed at customers with low/fixed incomes and disabilities, seniors, military, and other customers in need, such as those experiencing extenuating financial hardships.[57]

There are various forms of CAPs offered by different utilities in different states and across different customer demographics. The following are some of the most common program types:

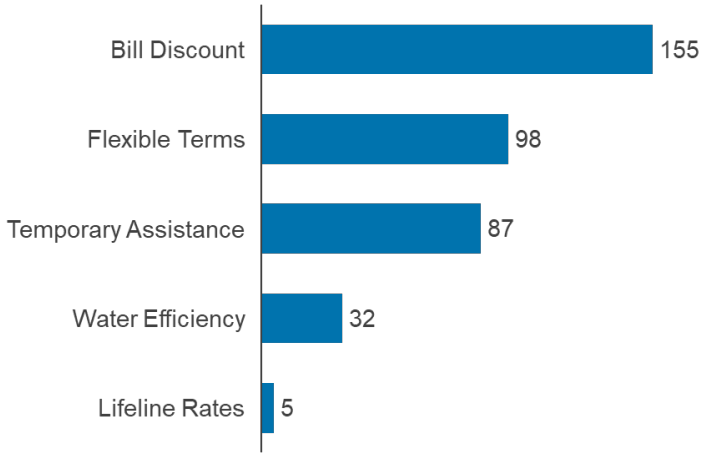
- **Bill Discount** – typically a long-term percent reduction on monthly bills. This can be applied to nearly any type of rate structure.
- **Flexible Terms** – help customers afford their bills through forgiveness, bill timing adjustment, or levelized billing.

[57] Drinking Water and Wastewater Utility Customer Assistance Programs. United States Environmental Protection Agency. (2016b, April).

- **Temporary Assistance** – covers short-term and one-time grants or reductions to avoid customer shutoff or disconnection.
- **Water Efficiency** – or water conservation, subsidizes water efficiency measures to help fund leak repairs and offers rebates for efficient appliances.
- **Lifeline Rates** – subsidized rates for a fixed water volume to cover basic water needs.

In 2016, the EPA reviewed 795 utilities in the US and found that about a third offered some form of the program, with the most popular being a bill discount (Figure 20).

Figure 20. Types of CAPs offered by Drinking Water and Wastewater Utilities as surveyed by the EPA of a total of 795 total utilities.[37]



Privatized and consolidated water utilities are often better positioned to offer financial assistance and have more robust assistance programs. Reasons for this include their level of regulation by entities with responsibilities to consider the availability of essential services, their ability to cross-subsidize across a wider footprint, expertise in identifying those in need and in designing targeted programs, and the corporate social responsibility goals common in the industry. In some cases, private companies have more flexibility in providing CAPs, because government-owned systems may be legally constrained in their ability to "cross-subsidize" rates between and/or across customer classes.

A number of Pennsylvania-based private companies have customer assistance programs. Aqua Pennsylvania, PAWC, York Water, and Veolia each have customer assistance programs that qualify customers based on percentage of federal poverty level and permit rate payment over a period of time and even forgiveness of some past due amounts.

3.3. Consumer Benefits – Reliability

The previous sections described the costs and quality of water and wastewater services from the consumer perspective. Another important consideration is the reliability of the services provided – or whether customers can be assured water services in both normal operating periods and during extreme weather events that are increasing due to climate change and under unique threats to the water infrastructure, such as cyber-attacks. Several ways in which privatization and consolidation can enhance reliability include: ensuring adequate investment for a reliable system, developing robust supply chains that can withstand disruptions, applying dedicated expertise to address topics such as cybersecurity, and PUC regulation of reliable service. A few topics are addressed below.

3.3.1. Supply Chain

Supply chain reliability is fundamental to ensuring consistent and uninterrupted service by the nation's drinking water and wastewater systems. Private and consolidated water systems are well-positioned to develop and ensure robust supply chains and to respond to supply chain disruptions.

Through consolidation, utilities can increase demand for supplies and thus increase influence with suppliers, often developing preferred relationships that include volume discounts and greater certainty of delivery in times of disruptions. The consolidated utilities can also work with a broader range of suppliers, improving supply chain diversity and therefore reliability. These utilities can also invest more in storage infrastructure and manage distribution of supplies across a broad portfolio to protect against supply chain disruptions. For example, increasing on-site storage for chemicals to manage supply chain disruptions, hence boosting supply chain resilience.[58]

Many of the companies involved in privatizing and consolidating water systems bring expertise that supports resiliency. One example is improving the ability for systems to switch between chemicals – which may be required in response to supply chain disruptions. This ability to switch between chemicals, as noted by the EPA, enables facilities to adapt swiftly in the face of supply chain disruptions.[59] In late 2020 and through 2021, some water systems faced chemical shortages due to chlor-alkali production facility shutdowns due to weather, equipment failures, and

[58] Office of Water. (2022b, August). Supply Chain Resilience: Guide for Water and Wastewater Utilities. United States Environmental Protection Agency.
[59] Ibid

changing business priorities of producers, as well as supply chain impacts of COVID-19.[60] Systems worked with suppliers to get prioritized deliveries of important water disinfectants and coagulants. In addition, certain systems conducted advanced compatibility tests for alternative coagulants and received conditional approval from authorities. These systems were able to successfully transition to these alternatives quickly.[61]

3.3.2. Cybersecurity

Cybersecurity of water systems is essential and the threat of cyber-attack on public water systems has proven to be very real. Recent examples include a February 2021 attack on a water treatment plant in Florida and the November 2023 attack by Iran-affiliated hackers on the Aliquippa Municipal Water Authority in western Pennsylvania. The EPA released a memorandum in March 2023 emphasizing the threat of cyber risks and requiring states to audit their local water system practices.[62] Privately owned NAWC members generally have more robust cybersecurity measures in place by devoting resources and making investments to ensure resilient systems in the face of cyber threats. It is difficult to compare efforts across water system owner types since, like many other states, and with good reason, Pennsylvania has enacted a law to exempt security-related infrastructure plans from public release. There are varying levels of protection for information specific to water infrastructure, but it is one way Pennsylvania is helping to protect itself.[63] Therefore, rather than comparing responses to-date, case studies are considered.

NAWC worked with key stakeholders to develop cybersecurity pillars that provide a path forward for member utilities.[64] NAWC member companies have the technical capability and financial capacity to tackle cybersecurity challenges as risks to the water sector continue to grow. Private companies support state and federal cybersecurity initiatives. For example, they support establishing the North American Water Reliability Council to help manage and develop compliance

[60] Understanding Water Treatment Chemical Supply Chains and the Risk of Disruptions. United States Environmental Protection Agency. (2022c, December).
[61] Office of Water. (2022b, August). Supply Chain Resilience: Guide for Water and Wastewater Utilities. United States Environmental Protection Agency.
[62] EPA takes action to improve cybersecurity resilience for public water ... United States Environmental Protection Agency. (2023b, March 3).
[63] 2008 act 3 Section 708. Pennsylvania General Assembly. (n.d.-a).
[64] National Association of Water Companies, NAWC, Washington, DC. (2023, November 7). Cybersecurity. National Association of Water Companies, NAWC.

standards. Continued support of federal legislation and their dedication to setting up additional measures show how private NAWC entities are creating reliable and resilient water systems.

3.4. Environmental Benefits

Water service, in the most basic sense, involves the use of a natural resource, the collection of wastes from the use of the water, and the treatment of the wastewater prior to either re-use or release to the environment. As such, the potential environmental impact is significant. While water is generally more abundant in Pennsylvania than in many other states, limiting its use and reducing its loss has positive environmental benefits. More importantly, the proper collection and treatment of wastewater can prevent environmental pollution of surface and groundwater. This section addresses the environmental benefits of privatization and consolidation, first addressing wastewater treatment.

3.4.1. Wastewater Treatment

Collecting and treating wastewater is critical to public health, the economy, and environmental quality. Untreated waste streams from homes, businesses, and industrial facilities include a wide range of pollutants that each carry unique and concerning potential for harm if released into public bodies of water in impactful quantities. Harms can range from impacting use values (tourism, property values, fishing, recreation, material degradation, etc.), to health (drinking water contamination, swimming exposure, food chain impacts, etc.), to the environment (fish and wildlife, plants, visibility at natural sites, etc.).

Fortunately, the vast majority of wastewater in the US is processed by wastewater treatment plants (WWTPs), which treat water from homes, businesses, factories, and public spaces. Waste from these locations include human and animal waste, food, certain soaps/detergents, chemicals, and other pollutants. Across the US, WWTPs process 34 billion gallons of wastewater every day.[65] However, the existence of WWTPs is not enough to ensure clean water. Discharges from sewerage systems contribute to the issue that one-third of Pennsylvania's streams are considered "impaired," or too polluted for aquatic life, recreation, fish consumption, or to supply drinking water.[66]

[65] Sources and solutions: Wastewater. United States Environmental Protection Agency. (2023c, November 29).
[66] Integrated Water Quality report-2022. Pennsylvania Department of Environmental Protection. (n.d.).

Given the importance of limiting pollution from wastewater systems, federal and state governments have actively regulated the industry for many years. The Clean Water Act (CWA) of 1972 initiated a concerted effort across the United States, often through state administration of federal regulations, to limit the discharge of pollution into the nation's waters. Amendments and regulations in implementing the CWA have led to a variety of requirements for wastewater system owners and operators for controlling pollution.

The most impactful CWA regulation for wastewater plants is the National Pollutant Discharge Elimination System (NPDES). Under this regulation, all pollution "point sources" that seek to discharge to any body of water must do so under the direct provision of a NPDES permit. NPDES permits are provided to facilities, such as industrials and WWTPs, to discharge a specified amount of pollutants into a receiving body of water. The pollutant levels must be deemed acceptable in any given discharge to ensure a state's mandatory standards for clean surface water are met. In Pennsylvania, the EPA has delegated authority to issue NPDES permits to the Pennsylvania DEP.[67]

Pollutants that are monitored and constrained through NPDES permits are defined broadly in the Clean Water Act, with the purpose of being able to address emerging pollutant concerns.[68] Examples include dredged soil, solid waste, sewage, sewage sludge, chemical wastes, municipal waste, and biological materials. The most common types of monitored pollutants that impact the contaminant levels of surface water are excess nutrients from human waste, food scraps, oils, soaps and chemicals.[69] There is a particular focus on nitrogen and phosphorous, which contribute heavily to the growth of algae blooms that consume oxygen in surface waters and create low-oxygen underwater ecosystems that are unsustainable for marine life and can threaten drinking water.

To verify compliance, NPDES data is collected for all NPDES permitted facilities. Despite each facility having specific limitations by pollutant and a variety of impactful penalties for exceeding limits, compliance is by no means perfect. There are many reasons to expect that, over time, privatized and consolidated wastewater systems will perform better in NPDES compliance. Reasons include the broad application of expertise and the abilities to make capital investment when

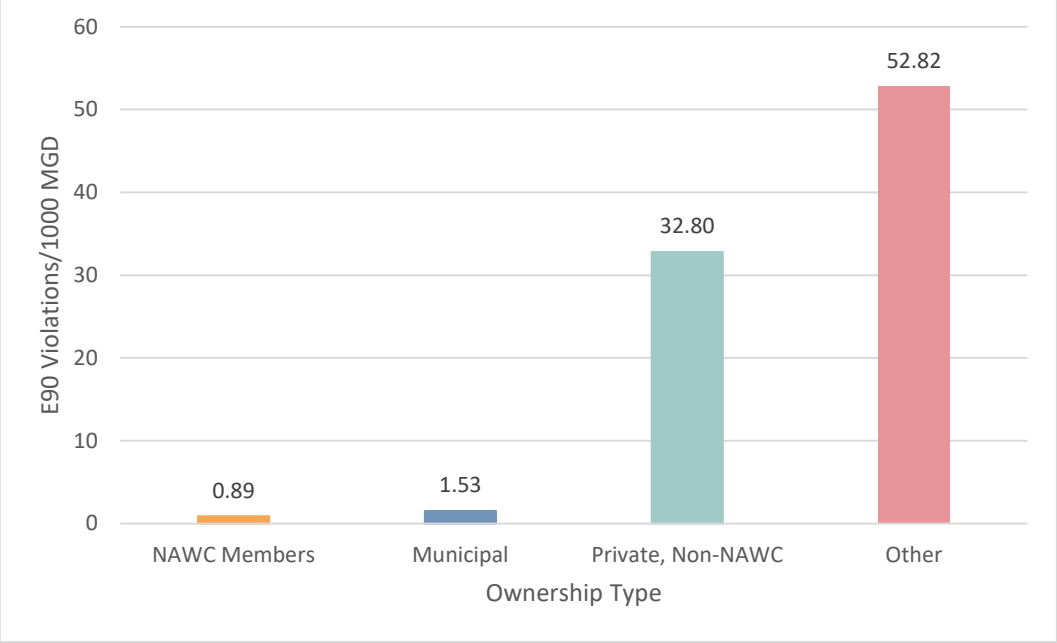
67 Pennsylvania NPDES permits. United States Environmental Protection Agency. (n.d.-b).
68 DMR Exceedances Search Results Help. United States Environmental Protection Agency. (n.d.-b).
69 Wastewater. Chesapeake Bay Program. (n.d.).

needed across facility portfolios. Of course, the state of each system upon privatization will impact the near-term NPDES compliance.

To examine the relationship between ownership types and wastewater system performance, NPDES compliance data was evaluated for all NPDES-permitted sewerage systems in Pennsylvania. Data was collected on NPDES effluent limit exceedances from 2013 through 2023. As with the drinking water data previously described, each NPDES ID was assigned to an ownership category. Data was gathered directly from NAWC members on transaction dates, allowing for a review of pre- and post-transaction outcomes. There are only 25 examples of privatization of wastewater facilities from 2013 to 2023. This makes a pre- and post-transaction analysis challenging and it is therefore not included in this study.

Overall, the findings suggest that NAWC members have lower average exceedance rates per volume treated than most other system types. The following chart shows a comparison of violation rates by ownership types. Violation rate is calculated as the number of effluent violations ("E90 violations") per million gallons treated per day.

Figure 21. Weighted Average Effluent Exceedance Violations per Million Gallons Treated per Day by Ownership type (2013-2023)



There were several steps required to prepare the data for this analysis.

- Data cleaning – There were several extreme anomalies in flow data, such as extremely small systems that for one year report extremely high levels

of flow magnitudes that exceed their capacity. These were clearly input errors and were corrected.

- Size consideration – There are two extremely large municipal systems (Allegheny County Sanitary Authority's Woods Run Wastewater Treatment Plant and the City of Philadelphia's Northeast Water Pollution Control Plantt) that are much larger than any other systems in Pennsylvania and are four times larger than all NAWC systems combined. As such, they are not reasonable comparisons, particularly when attempting to understand the benefits of consolidation, which they are large enough to experience on many levels as-is. Therefore, they were not included. They have low violation rates per volume treated, relative to most other systems.
- Ownership changes – As with water quality data, the analysis accounts for changes in ownership over time. Annual violations and flows for facilities that changed ownership types are assigned to the ownership type in the same year. Also, a one-year "transition" period was included in the analysis to represent the amount of time a new owner could be expected to start having an impact.

3.4.2. Water Use Efficiency

Pennsylvania does not have similar water constraints as many other states in the US, particularly those in the Southwest. However, water use efficiency is still important for the environment. Less water used means less water treated and less infrastructure required in the long term. The benefits that privatization and consolidation bring to water efficiency include cost transparency (where prices reflect actual water costs) and PUC regulation, which often is supportive of efficiency programs. Another benefit is increased infrastructure investment that can reduce water losses, or "unaccounted for water." The Pennsylvania DEP's water use report for 2022 estimated that 22.6% of water use by public water systems in Pennsylvania is "water loss. [70] By bringing investment in water mains and other delivery infrastructure, privatization and consolidation can lead to reduced water loss, and therefore less water use and lower treatment costs.

[70] Pennsylvania DEP, "Water Use Report by Water Supplier - PWS Primary Facility Report." 2022 data, Accessed December 2023.

3.5. Safety Benefits

Constructing, maintaining, and operating water infrastructure carries inevitable safety risks. While nearly all water service providers would consider the safety of their employees highly important, Pennsylvania's privatized and consolidated systems bring some additional safety benefits. By achieving the scale needed to develop expertise and specific safety plans, consolidated companies can bring greater levels of technical skills and training programs that can enhance worker safety. Privatized companies in Pennsylvania also bring the benefit of falling under the jurisdiction of the Occupational Safety and Health Administration (OSHA).

In Pennsylvania, private sector companies must comply with OSHA, while state and local government entities are exempt.[71] OSHA promotes and enforces the safety of workers by setting the "floor" for worker safety plans and actions. Under OSHA's general duty clause, private companies are generally required to provide a safe and healthful workplace for their employees. This includes identifying and addressing hazards that may exist at a facility. For instance, OSHA's Hazard Communication Standard (29 CFR 1910.1200) requires employers to provide detailed information and training to employees about hazardous chemicals, which is particularly crucial in water and sewer facilities where workers encounter various chemicals used for water treatment.

Public sector employees in Pennsylvania are not afforded these same OSHA or OSHA-type protections. There have been multiple legislative attempts to extend workplace safety safeguards to public-sector employees in Pennsylvania, aligning them with the protections already afforded to private sector workers under federal OSHA regulations.[72] However, no legislation has been enacted to-date.

Because the application of OSHA is not consistent across water and wastewater providers in Pennsylvania, it is not possible to compare safety incidents across ownership types. Also, most statistics on worker illnesses and injuries for Pennsylvania are currently aggregated to a general "utilities" category. However, national level statistics are informative. A review of federal data by NAWC found that private water utility workers experienced a rate of injuries and illnesses 34.6% lower than municipal workers between 2011 and 2021.[73]

[71] OSHA State Plans. Occupational Safety and Health Administration. (n.d.).
[72] Bill Information - House Bill 1082; Regular Session 2019-20. Pennsylvania General Assembly. (2019 April 5).
[73] America's Water Companies. Truth from the Tap. (n.d.).

3.6. Economic Impacts

This section reports the economic contributions of NAWC members in Pennsylvania. It is not a comparison with other owner types. Rather, we report the direct and indirect contributions, including "multiplier" effects throughout the economy. The results are not intended to show the benefit of NAWC membership – but can point out that NAWC member companies employ many people living in Pennsylvania, invest significant amounts in operations and maintenance ("O&M") and capital projects, have in-state supply chain benefits, and pay state and local taxes. The only "compare-contrast" with municipal ownership is in taxes paid. That said, the analysis shows that many of the in-state benefits flow from capital investments which, as discussed elsewhere in this study, are often increased under private ownership, and thus can be considered a potential benefit of NAWC member ownership versus other ownership types.

3.6.1. Data and Method

Data for this analysis was gathered directly from NAWC members and from public sources, particularly the Annual Reports filed by each PUC-regulated private utility in Pennsylvania. These sources collectively provided data on the number of direct jobs, employee compensation, expenditures by industry, and taxes paid to various entities. The share of expenditures that were assumed to be made in Pennsylvania is based on data and information provided by NAWC members. CRA confirmed the assumptions were consistent with other sources of in-state expenditure shares for similar industries in Pennsylvania. Data was gathered separately for operations and maintenance (O&M) activities and capital expenditure (CapEx) activities. Data was collected for 2022. CRA confirmed that annual data did not change drastically over the past 5 years.

The data was evaluated using the IMPLAN model to determine impacts throughout the Pennsylvania economy as a result of "multiplier" effects. The IMPLAN model is an input-output economic model that is commonly used for such evaluations. There are three types of impacts estimated:

- **Direct** – Employment directly at the NAWC member companies, including their direct compensation.
- **Indirect** – These are mostly impacts along the supply chain. For water and wastewater utilities, a large share of expenditures flow to Pennsylvania-based contractors. Other indirect impacts include purchases of goods and services from in-state suppliers, manufacturers, and wholesalers.

- **Induced** – These impacts result from employee compensation being spent in the Pennsylvania economy and expenditures of tax and other revenues by the government. A large share of induced impacts tends to fall in the service industries.

In addition to these different levels of impacts, multiple types of impacts were evaluated, including:

- **Employment** – Direct employment is the number of jobs at the NAWC firms in Pennsylvania. The quantity for employment is expressed in Full Time Equivalents (FTEs). One FTE generally represents one employee working for one year or multiple employees working part-time or fractions of a year.
- **Labor Income** – Wages and salaries of employees.
- **Value Added** – Equivalent to a Gross State Product (GSP) contribution. This is a subset of Output.
- **Output** – Total revenues of Pennsylvania-based recipients of expenditures and supply chain impacts.

3.6.2. Economic Impact Results

Table 6 summarizes the overall economic impacts of NAWC member companies in Pennsylvania in 2022. The direct impacts are divided into the direct employment and compensation provided by NAWC companies and the first-level employment and impacts of expenditures, including employment provided by contractors.

Table 6: Economic Impacts of Private, NAWC Companies in Pennsylvania, 2022

Impact	Employment	Labor Income	Value Added	Output
Direct Employment	2,000	$182,500,000		
1 - Direct	6,200	$469,300,000	$486,100,000	$886,500,000
2 - Indirect	1,400	$114,100,000	$176,500,000	$332,300,000
3 - Induced	3,700	$231,500,000	$387,300,000	$655,800,000
Total	**13,300**	**$997,300,000**	**$1,049,900,000**	**$1,874,600,000**

The majority of impacts are driven by capital expenditures. For example, about 68% of employment benefits and 80% of output benefits are driven by capital expenditures. This is due to: 1) the larger reported overall amounts of CapEx (about $1 billion in 2022) than O&M expenditures (about $500 million in 2022), and 2) the larger share of CapEx (70%) being spent within the Pennsylvania economy than

O&M (30%, not including employee compensation), which is due to the tendency to use local contractors and suppliers for capital projects and the importing of many goods used for O&M activities. Employee compensation is almost entirely directed toward in-state employees.

Employment and labor income "multipliers" are high for each of the impact types (~7.6x employment, 6.5x labor income), meaning that there are many indirect and induced benefits relative to direct benefits. This is due to the capital-intensive nature of water and wastewater utilities. While they have high direct employment benefits, the expenditures for O&M and CapEx are high and they tend to use local suppliers, leading to significant "upstream" employment. It is well known that utilities tend to have high employment multipliers, especially those making major investments in their systems and facilities.[74]

Employment and Labor Income

The Private, NAWC member companies directly employ over 2,000 Pennsylvanians in roles ranging from officers to field technicians. Most employment is in water, rather than wastewater, which is consistent with the different levels of privatization and consolidation in each subsector. The employees impacted are well-compensated, with average wages and salaries of over $90,000 per year (close to $100,000 when including benefits). This is significantly higher than the average annual pay of employees in Pennsylvania of about $67,300.[75]

The overall employment impacts are much greater. There are over 13,000 jobs associated with the activities and expenditures of private NAWC companies in Pennsylvania. These jobs are compensated by over $1.18 billion in labor income. The lower average of $77,000 per year is caused by lower average income for induced employment that is mostly in services industries that benefit from employee spending (child day care, real estate, personal care, etc.) and government expenditures (schools, hospitals, etc.).

Value Added and Output

The private, NAWC member companies contribute over $1 billion annually to Pennsylvania's Gross State Product (GSP). This is accomplished through generating over $1.85 billion in output, or sales and revenues within the

[74] The multiplier effect: Which industries are the biggest job creators? Camoin Associates. (2021, November 22).
[75] Statista Research Department, & 3, N. (2023, November 3). Pennsylvania average Annual pay U.S. 2022. Statista.

Commonwealth. A large share of the contributions result from capital expenditures and specifically through payments to in-state providers of construction and related services.

The specific industries that benefit most vary across expenditure categories. For O&M expenditures, the expenditures are spread across a wide range of industries, with the highest-impact industries including facilities maintenance, waste management, certain in-state manufacturers, legal services, and office/business services. For CapEx expenditures, the largest beneficiary is in-state contractors, which receive approximately 45% of the spending (and then recycle it through the economy through their own spending patterns). Other significant CapEx industries include engineering, wholesalers, and certain manufacturers.

3.6.3. Tax Revenues

Private water and wastewater utilities are subject to a wide variety of taxes that, when paid to state and local authorities, are ultimately recycled back into the Pennsylvania economy, either directly or indirectly by offsetting other government revenue sources. Municipal utilities are not subject to most of the taxes applied to private entities, and thus this is a difference in economic impact between ownership types. This study does not include a detailed tax evaluation or comparison of tax dispositions of private versus municipal utilities. However, it can be noted that the taxes paid by private water utilities are significant and can be impactful.

The types of taxes vary by locality and ownership type (investor owned versus privately held), but the main types of taxes are consistent across NAWC members. They include federal and state income taxes, payroll taxes, and various property taxes. They also include several specific taxes charged to PUC-regulated private companies, including a PUC assessment and the Public Utility Realty Tax (PURTA) that is collected by the state and distributed to localities (and only applies to water utilities). In 2022, the total taxes paid in the above categories exceeded $70 million.

The direct tax payments are not the totality of tax impacts of private NAWC water and wastewater utilities. There are taxes paid at many points along the utilities' value chains, including employee income taxes, sales taxes, and all the many other taxes paid by beneficiaries of O&M and CapEx expenditures. The IMPLAN model estimates that these taxes totaled nearly $210 million in 2022.

The estimated taxes paid both directly and through the value chain are presented in the table below:

Table 7: Taxes Paid, NAWC Companies and Value Chains in Pennsylvania, 2022

Impact	Local	State	Federal	Total
Direct	12,000,000	19,000,000	40,000,000	71,000,000
Value Chain	25,000,000	38,000,000	146,000,000	210,000,000
Total	**37,000,000**	**57,000,000**	**186,000,000**	**281,000,000**

4. Conclusion

This study presented the benefits of privatization and consolidation of water and wastewater systems in Pennsylvania. The findings across consumer, environmental, safety, and economic impact categories were consistent – data and analysis align with theory and demonstrate significant benefits. These findings are in the aggregate and therefore do not necessarily apply for every situation under all circumstances, but there are clear indications that privatization and consolidation generally support the delivery of safe, reliable, and affordable drinking water and the proper handling and treatment of wastewater, thus supporting public health, the economy, and the environment of Pennsylvania.