America's Water Infrastructure Act (AWIA) – Section 2003 Report to Congress

Study on Intractable Public Water Systems Serving Fewer Than 1,000 People: Compliance with National Primary Drinking Water Regulations, Barriers, and Case Studies

In accordance with Section 1459C of the Safe Drinking Water Act, as amended by Section 2003 of the America's Water Infrastructure Act

Office of Water
EPA 815-R-19-005
July 2022

Foreword

Ensuring that all people have access to safe and reliable drinking water is a principle inherent in the mission of the U.S. Environmental Protection Agency (EPA) and the Office of Water. Although 96 percent of the 127,190 public water systems (PWSs) serving fewer than 1,000 people (small PWSs) had no violations of the National Primary Drinking Water Regulations (NPDWRs) in 2020, there is still work to be done to ensure safe and reliable drinking water is available to all customers across the country. There is a subset of small PWSs in "significant noncompliance," which are defined as PWSs with a reported violation of an NPDWR for at least three quarters of the year for three consecutive years.

One important aspect of improving access to safe and reliable drinking water is to ensure compliance with health-based standards. In order to accomplish this sustainably, EPA focuses on improving technical, managerial, and financial capacity development for water systems, and on understanding the unique challenges these systems face.

As part of the America's Water Infrastructure Act of 2018 (AWIA), Congress directed EPA to prepare this report, which focuses on small water systems serving fewer than 1,000 people with persistent violations of health-based standards, referred to as "intractable water systems" in the Act. This report serves as an opportunity to gain a deeper understanding of the challenges faced by these systems as well as to highlight programs that may assist these programs in improving compliance.

The report focuses on the health-based violations (i.e., maximum contaminant level and treatment technique) that occurred from 2016 through 2018 among 334 water systems serving fewer than 1,000 people. By focusing on this set of systems, representing less than a quarter of one percent of all PWSs, the report prioritizes those communities where safe drinking water is least reliable according to federal data. In addition, the report discusses non-health-based violations (i.e., monitoring, reporting, and notification to consumers) of 1,547 water systems serving fewer than 1,000 people from 2016 through 2018, representing approximately 1 percent of all PWSs. Persistent violations of monitoring, reporting, and other non-health-based standards may indicate systemic weaknesses in how systems are managed and operated and may mask underlying water quality issues. Addressing these issues is a high priority for EPA, in coordination with our state and water system partners.

In order to better understand the root causes of the health-based violations, this report also presents information on technical, managerial, and financial capacity for each of the 334 evaluated systems. Over 80 percent of the water systems were reported to have at least one barrier to technical, managerial, or financial capacity with multiple barriers identified for most systems. Addressing these challenges and barriers will have a direct impact on improved operations for these water systems, which in turn will help improve water quality and regulatory compliance. Taken collectively, the various trend analyses contained in the report provide a deeper understanding of the challenges faced by small drinking water systems and will support EPA's ongoing efforts to target training and assistance programs to small water systems to improve compliance with drinking water standards and improve public health nationwide.

Table of Contents

Tables

Figures

1. Purpose

The U.S. Environmental Protection Agency (EPA) has developed this Report to Congress as directed by the America's Water Infrastructure Act (AWIA), enacted on October 23, 2018. Section 2003 of AWIA amends the Safe Drinking Water Act (SDWA) by adding Section 1459C – Study on Intractable Water Systems, which defines "intractable water systems" and directs EPA to conduct a study in consultation with the U.S. Department of Agriculture (USDA) and the U.S. Department of Health and Human Services (HHS). This report identifies intractable water systems and describes the barriers to delivery of potable water to individuals served by these systems as specified in AWIA.

Section 1459C of the SDWA provided base criteria for designating a water system as "intractable" (see inset). In order to meet these criteria a multistep approach was taken to identify these systems. First, water systems serving fewer than 1,000 people (criterion (a)(1)), were identified using inventory data from the Safe Drinking Water Information System-Federal Reporting Services (SDWIS-Fed). Next, systems were identified that met criterion (a)(3), a history of significant noncompliance. For the purposes of this report, "significant noncompliance" was defined as a public water systems (PWS) with any reported violation of a National Primary Drinking Water Regulation (NPDWR) for at least three quarters of the year for three consecutive years, 2016 to 2018. This definition was chosen to be consistent with the 2010 EPA report *Public Water System Historical Significant Non-Compliers: National Trends Report* (USEPA, 2010). The years 2016 to 2018 were chosen for analysis as being the most recent three-year period prior to the promulgation of AWIA, consistent with the language in criterion (a)(3) that a system have a history of non-compliance "as of the date of enactment."

Systems that met the criteria of Historically Significant Non-Complier (HSNC) were analyzed under two categories, health-based (HB) violations or non-health-based (non-HB) violations. Finally, for the group of systems in the HB violation category, information on criteria (a)(2) was collected with the support of EPA regions and primacy agencies. Using this process, 334 PWSs were identified HSNCs with HB violations, while 1,547 PWSs were identified as HSNCs with non-HB violations. Of these, 58 PWSs were identified as HSNCs with both violation types.

The primary focus of this report is on the 334 HSNCs with reported HB violations. While HB violations can serve as indicators of risk to

SECTION 1459C. Study on intractable water systems.

(a) Definition of intractable water system. In this section, the term 'intractable water system' means a community water system or a noncommunity water system

(1) that serves fewer than 1,000 individuals;

(2) the owner or operator of which

(A) is unable or unwilling to provide safe and adequate service to those individuals;

(B) has abandoned or effectively abandoned the community water system or noncommunity water system, as applicable;

(C) has defaulted on a financial obligation relating to the community water system or noncommunity water system, as applicable; or

(D) fails to maintain the facilities of the community water system or noncommunity water system, as applicable, in a manner so as to prevent a potential public health hazard; and

(3) that is, as of the date of enactment of America's Water Infrastructure Act of 2018

(A) in significant noncompliance with this Act or any regulation promulgated pursuant to this Act; or

(B) listed as having a history of significant noncompliance with this title pursuant to section 1420(b)(1).

(b) Study Required.

(1) IN GENERAL. Not later than 2 years after the date of enactment of this section, the Administrator, in consultation with the Secretary of Agriculture and the Secretary of Health and Human Services, shall complete a study that

(A) identifies intractable water systems; and

(B) describes barriers to delivery of potable water to individuals served by an intractable water system.

(2) REPORT TO CONGRESS. Not later than 2 years after the date of enactment of this section, the Administrator shall submit to Congress a report describing findings and recommendations based on the study under this subsection.

public health, non-HB violations may mask underlying health-based compliance issues, since the required monitoring or reporting was not performed by the PWS.

Chapter 2 describes PWS and violation types, as well as an overview of the technical, managerial, and financial challenges typically faced by small drinking water systems. Chapter 3 describes the criteria for the water systems selected and how information was collected and analyzed as reported in SDWIS-Fed. Chapter 3 also includes information gained from consultation with the USDA, HHS, and other stakeholder groups. Chapter 4 presents HSNCs with HB violations and provides possible reasons for non-compliance. Primacy agencies identified reasons for non-compliance based on the AWIA defined owner and/or operator characteristics and challenges linked to technical, managerial, and financial capacity. Chapter 5 presents HSNCs with non-HB violations. Chapter 6 presents enforcement approaches and data trends. Chapter 7 presents PWS case studies to illustrate the variability in the challenges that affect small PWSs. The final Chapter 8, presents EPA's recommendations, strategies, and implementation tools to improve small system compliance.

2. Introduction

The Safe Drinking Water Act (SDWA) is the federal law that protects public health by regulating the nations' public water systems (PWSs). Under the SDWA, EPA sets standards for drinking water quality in the National Primary Drinking Water Regulations (NPDWRs). The NPDWRs are legally enforceable primary standards and treatment techniques that protect against both naturally occurring and man-made contaminants that can be found in drinking water. Currently, EPA sets legal limits on over 90 contaminants in drinking water including microorganisms, disinfectants, disinfection byproducts, inorganic chemicals, organic chemicals, and radionuclides. The legal limit for a contaminant reflects the level that protects human health and that PWSs can achieve using the best available technology.

Direct oversight of PWSs for compliance with NPDWRs is conducted by primacy agencies (i.e., states, territories, EPA Regions, or tribes). The SDWA gives states, territories, and tribes the opportunity to set and enforce their own drinking water standards if the requirements are at least as stringent as EPA's national standards. All states and territories, except Wyoming and the District of Columbia, have received primary enforcement authority (primacy) under SDWA Section 1413. Currently, the Navajo Nation is the only Indian tribe that has received primacy. However, even if a state, tribe, or territory has primacy, EPA still has an oversight role and retains its independent enforcement authority. The roles and responsibilities of primacy agencies include requiring PWSs to test for contaminants, reviewing plans for PWS improvements, conducting on-site inspections and sanitary surveys, providing training and technical assistance, identifying and issuing violations, and taking enforcement actions against PWSs not meeting the federal and primacy agency-specific standards.

To ensure that drinking water is safe, the SDWA sets up multiple barriers against pollution to protect public health. These barriers include source water protection, treatment, distribution system integrity, and public information. EPA, along with the primacy agencies, implement various technical, managerial, and financial assistance programs to ensure drinking water safety.

The data analysis presented in this report evaluated violations incurred by PWSs subject to the NPDWRs as reported by primacy agencies. The following types of violations were reviewed.

- **Maximum contaminant levels (MCLs):** The maximum permissible level of a contaminant in water which is delivered to any user of a PWS.
- **Maximum residual disinfectant levels (MRDLs):** A level of a disinfectant added for water treatment that may not be exceeded at the consumer's tap without an unacceptable possibility of adverse health effects.
- **Treatment technique (TT):** An enforceable procedure or level of technological performance which PWSs must follow to ensure control of a contaminant.
- **Monitoring (M):** A requirement to conduct specified monitoring to determine drinking water quality.

> This report presents data trends for these violation types.
> - MCL: maximum contaminant level.
> - MRDL: maximum residual disinfectant level.
> - TT: treatment technique.
> - M: monitoring.
> - R: reporting.
> - O: other.

- **Reporting (R):** A requirement to report information to the primacy agency.
- **Other (O):** Required action(s) a PWS must take to comply with the Consumer Confidence Reporting (CCR) Rule, the Public Notification (PN) Rule, or recordkeeping and monitoring plan requirements.
    - The CCR and PN are "Right-to-Know" rules designed to give drinking water consumers accurate information about the quality of their drinking water. The PN Rule was specifically designed to provide timely information on violations to consumers, and the requirements for different types of PN take into account the seriousness of any potential adverse health effects that may be involved through a tiered process.

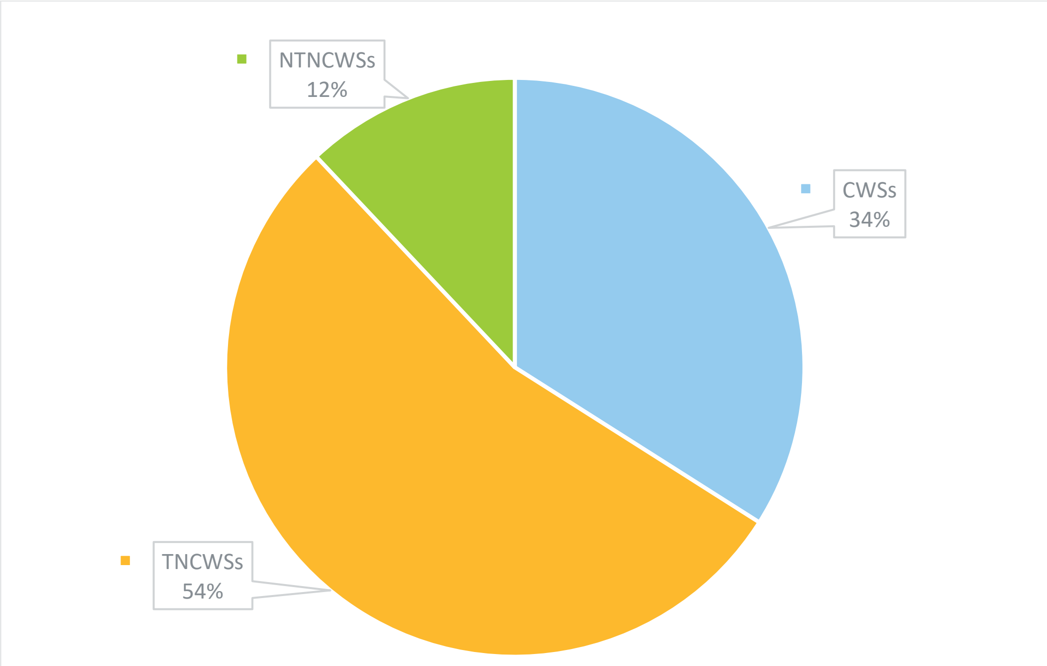
2.1 What is a public water system?

In accordance with the SDWA Section 1401(4) and 40 CFR 141.2, a PWS 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. A PWS may be publicly or privately owned. EPA classifies water systems according to the number of people served, the source of their water (e.g., ground or surface water), and whether the PWS serves the same customers year-round or on an occasional basis.

As of the last quarter of 2018 there were approximately 146,000 PWSs in the United States (Figure 1). EPA has defined three types of PWSs.

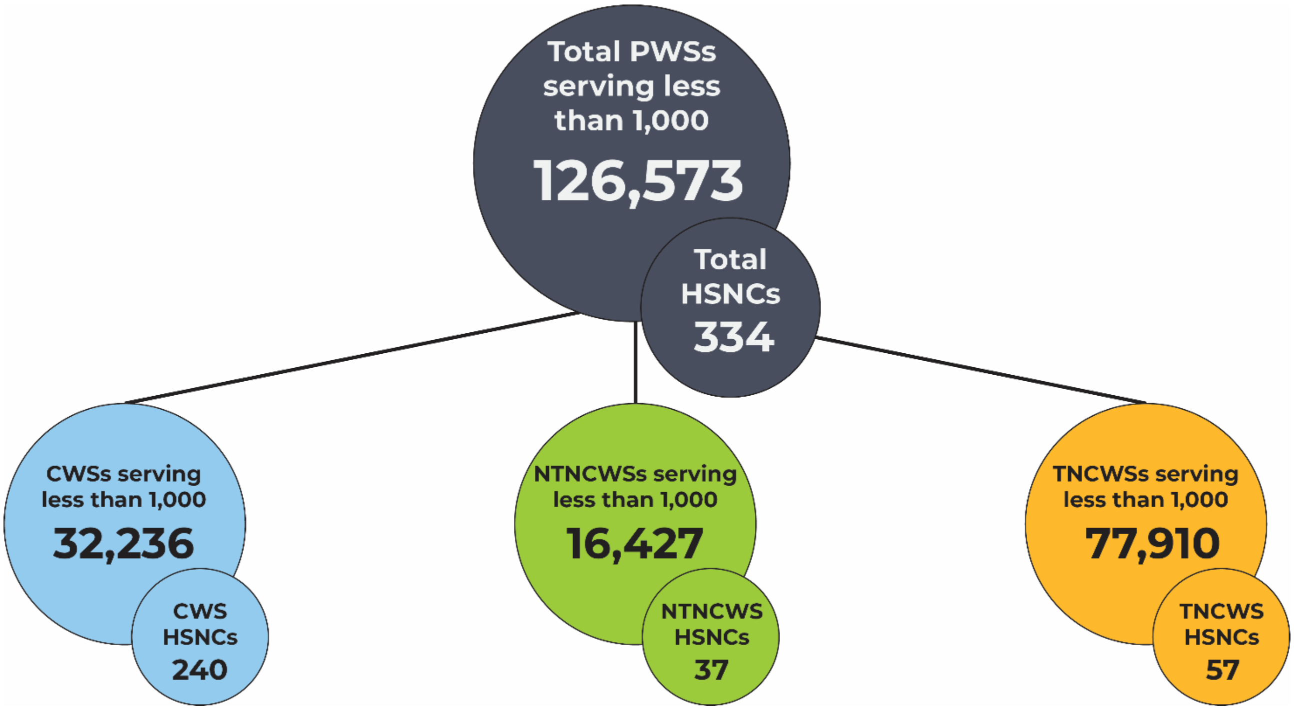
- **Community water system (CWS):** A PWS that supplies water to the same population year-round.
- **Non-transient non-community water system (NTNCWS):** A PWS that regularly supplies water to at least 25 of the same people at least six months per year. Some examples are schools, factories, office buildings, and hospitals which have their own water systems.
- **Transient non-community water system (TNCWS):** A PWS that provides water in a place such as a gas station or campground where people do not remain for long periods of time.

Figure 1: Percent of all PWSs by System Type



As defined by AWIA, intractable systems or HSNCs are small systems which serve fewer than 1,000 people with a history of significant non-compliance. EPA classifies “small” PWSs as those serving 3,300 or fewer people per year, so the HSNCs analyzed in this report represent a subset of these systems. The 334 HSNCs with reported health-based (HB) violations are the primary focus of this report. These 334 HSNCs with HB violations represent less than a quarter of a percent (0.23%) of all PWSs in the United States and serve approximately 86,000 people. Figure 2 provides the breakout of PWS type to HSNC type.

Figure 2: Total Number of PWSs Serving Less Than 1,000 by Type and HSNCs Reported with HB Violations, as of December 2018



2.2 Defining Technical, Managerial, and Financial Capacity

Capacity development provides a framework through which primacy agencies and PWSs can ensure compliance with the requirements of SDWA. Through this framework, PWSs can acquire and maintain the knowledge, tools, and resources needed to provide safe, reliable, and cost-effective drinking water now and into the future. The three components to capacity are technical, managerial and financial (TMF). Inadequate capability in these areas can affect compliance with drinking water regulations.

- **Technical capacity** is the physical and operational ability of a PWS to meet SDWA requirements. Technical capacity refers to the physical infrastructure of the PWS, including the adequacy of source water and the adequacy of treatment, storage, and distribution infrastructure. It also refers to the ability of PWS personnel to adequately operate and maintain the system and to otherwise implement requisite technical knowledge.

- **Managerial capacity** is the ability of a PWS to conduct its affairs in a manner enabling the system to achieve and maintain compliance with SDWA requirements. Managerial capacity refers to the system's institutional and administrative capabilities, including staffing, planning and recordkeeping.

- **Financial capacity** is a PWS's ability to acquire and manage sufficient financial resources to allow the system to achieve and maintain compliance with SDWA requirements, including the ability for income from rates, fees and other sources to equal or exceed current and future expenses.

TMF capacities are interrelated and the components build on each other. For instance, technical and managerial capacity considerations depend on financial resources. Likewise, technical and managerial capacity evaluations inform and affect financial resources and considerations.

As noted in the EPA publication, *Re-Energizing the Capacity Development Program Findings and Best Practices from the Capacity Development Re-Energizing Workgroup* (USEPA, 2011a), the PWSs that are able to acquire and maintain TMF capacity are more likely to achieve long-term sustainability. There are numerous ways to enhance capacity - from implementing asset management programs to developing a workforce plan to establishing PWS partnerships (e.g., equipment sharing, regionalization, system consolidation). PWSs may encounter challenges associated with enhancing capacity, some of which are identified below that were based on primacy agency programs.

- **Some PWSs struggle to obtain and retain knowledgeable operators.** A knowledgeable, dedicated operator is essential to the capacity of a PWS. PWSs without knowledgeable and skilled operators are at higher risk of non-compliance and other capacity issues. While the criteria used to determine certification varies nationally, EPA requires only CWSs and NTNCWSs to have a certified operator. However, under the anti-backsliding provisions of the EPA Final Guidelines (USEPA, 1999), if primacy agencies required TNCWSs to have certified operators prior to (or after) the adoption of the Final Guidelines, it is a federally enforceable requirement that they continue to require that in their regulations and Operator Certification Program.
- **Many PWSs face resource challenges.** These challenges can include small/shrinking/aging ratepayer base, diseconomies of scale, political challenges with raising water rates, and increasing costs when source water is degraded or insufficient for community needs.
- **Managerial and financial capacity are not easily assessed and measured by PWSs.** Some primacy agencies do not have standard indicators or a uniform method for evaluating managerial and financial capacity.

Primacy agencies encounter similar challenges when working with systems to assess capacity. Some of those challenges are outlined below (USEPA, 2011a).

- **A new CWS's or NTNCWS's proposal/application may not provide adequate information to the primacy agency.** In many cases, primacy agencies do not require CWSs and NTNCWSs to submit information on managerial or financial capacity along with their permit application, making it difficult for primacy agencies to determine if proposed CWSs or NTNCWSs have the necessary managerial and financial capacity.
- **Managerial and financial capacity are not easily assessed and measured by primacy agencies.** Many primacy agencies have found that managerial and financial capacity are more difficult to define and measure than technical capacity and, therefore, more challenging to address.
- **Primacy agencies often do not have the staff or resources to conduct follow-up visits to ensure that PWSs are implementing TMF activities.** Staffing shortfalls and budgetary constraints make it difficult for primacy agencies to follow up with PWSs that have received assistance. This creates opportunities for existing PWSs to lose TMF capacity without the primacy agency's knowledge.

2.3 Unique Technical, Managerial, and Financial Challenges Faced by Small Public Water Systems

More than 87 percent of the nation's approximate 146,000 PWSs serve fewer than 1,000 people. Small PWSs can face unique TMF challenges in providing drinking water that meets the NPDWRs. EPA works closely with state, federal, territorial, and tribal partners to assist small PWSs with financial and technical resources to sustainably provide safe drinking water.

PWSs must have adequate capacity to undertake TMF responsibilities to ensure the sustainability of the water system and to maintain compliance with all applicable drinking water laws and regulations (OIG, 2016). Small PWSs face a wide array of challenges in providing safe, reliable, and affordable drinking water to their customers that range from conventional (e.g., technical and financial) to emerging (e.g., population declines, extreme weather events). For example, these challenges may include: a lack of financial resources, the need to upgrade or replace aging infrastructure, source water availability and protection issues, increasing budgetary constraints, management limitations, lack of long-term planning, and difficulty understanding current and future regulations. These challenges can cause major problems to PWSs and the community. For instance, many PWSs can plan for growth and can increase the capacity of the PWS accordingly. However, planning for and responding to the impacts of a declining population and decreases in water supply demands are difficult. A significant decline in the number of people served by the PWS and decrease in water supply demand can result in areas of high-water age in the distribution system, stagnation in storage facilities, and in extreme cases, negative pressure events. This affects the quality of safe water in the distribution system and may result in inadequate disinfectant residuals leading to an increase in microbial growth, a potential for increased levels of disinfection byproducts as well as taste and odor problems.

2.3.1 Technical Challenges

While the vast majority of small PWS are in compliance with NPDWRs (see Figure 2 for breakout of HSNCs), compared with larger PWSs, small PWSs have more technical capacity challenges to properly monitor their water for contaminants, make timely repairs, or replace faulty materials. This can lead to poor water quality, water system unreliability, or failing water system infrastructure, all of which can pose significant public health risks to customers. Small PWSs violate SDWA standards more often than their larger counterparts (OIG, 2016). Customers of small PWSs may face a particularly heavy burden to cover large infrastructure related costs, as the costs are spread over a small customer base. Additional contributing factors for technical challenges faced by small PWSs include difficulties recruiting and maintaining in-house staff with experience addressing technical issues (USEPA, 2018b).

Aging infrastructure is a significant challenge for many systems. EPA's *2015 Drinking Water Infrastructure Needs Survey and Assessment* projected a national 20-year capital improvement need of $472.6 billion, representing Drinking Water State Revolving Fund-eligible infrastructure projects necessary from January 1, 2015 through December 31, 2034, for water systems to continue to provide safe drinking water to the public. Of the $472.6 billion, a total national need of $74.4 billion was noted for small PWSs (the 2015 Assessment defined small PWSs as those serving 3,300 or fewer people) and total needs of $3.8 billion were noted for water systems serving American Indians and Alaska Native Villages. The water systems serving American Indians and Alaska Native Villages are almost all small and are often located in remote rural areas, some in areas with permafrost where conditions for infrastructure maintenance and replacement can be particularly difficult. These conditions present special challenges for providing drinking water service (USEPA, 2018a).

2.3.2 Managerial Challenges

Due to limited resources, small PWSs may not have the managerial capacity to ensure the safe and reliable delivery of drinking water (OIG, 2016). Small PWSs may be run by owners and operators with limited experience and expertise, and most work on a part-time basis. A part-time system manager may have another job, and therefore, not have the time to train and gain full working knowledge of water system operation or the regulatory requirements. A lack of strong management may also result in poor operating and/or maintenance of the system's assets that can lead to an increase in operating costs. For example, a water system that does not have a process in place for placing orders may run out of a treatment chemical, leading to problems with the operating the system and, potentially, non-compliance. Small PWSs that lack strong managerial capacity might not be identifying future infrastructure needs, nor the resources needed to make these capital improvements. Weak system management can result in poor compliance, a lack of long-term planning and inadequate communication with customers. It is difficult for many small PWSs to find skilled operators because the position is not viewed as a long-term career opportunity and can often pay less when compared to other industries that require personnel with similar sets of skills and knowledge (USEPA, 2011b). In geographically remote communities, it is unlikely that potential operators would be willing to relocate for a part-time position. Without qualified managers, the task of understanding the complexities of operating a water system is the responsibility of town management, elected officials, or operations staff. Collaboration and partnerships with service organizations, other local government units, and private companies can improve organizational capacity. Operational and managerial shortcomings reflect the financial limitations small PWSs face (OIG, 2016). Further, according to an EPA and state drinking water program workgroup, convened in 2012 to 2013 to discuss non-community water system (NCWS) challenges, NCWSs are often owned by a corporation or private owner for whom the provision of drinking water is viewed as secondary to the main business of serving food or providing recreational facilities. The working group also noted frequent staff and ownership turnover at NCWSs as often contributing to a lack of knowledge and training in the area of water treatment and operations (including monitoring and reporting) for these NCWSs.

2.3.3 Financial Challenges

The financial health of water systems can depend on their ability to establish water rates that accurately reflect the cost of treating and delivering water. Many small PWSs lack financial capacity because of small customer bases and declining populations, which result in limited revenue (USEPA, 2011b). One of the biggest challenges of small CWSs is establishing rates that provide enough revenue for the CWS to adequately manage its current infrastructure and plan for future needs. For example, small systems may be reluctant to raise rates, especially if the system is managed by an elected board. Small systems are also less able to take advantage of economies of scale with small populations of rate payers. In addition, many states and territories have rate setting requirements and restrictions, which are usually administered by a public utilities commission, also known as public service commissions. These requirements can vary significantly among states and/or territories, including the types of systems that are regulated, the requirements related to customer rates, and the cash reserves a system must hold (USEPA, 2006). Additional challenges can hinder PWSs from accessing grants or other sources of funding, including inadequate book and recordkeeping, outdated water system business plans, insufficient qualified staff, and lack of knowledge of available funding sources and experience to apply. Further, most small PWSs are not credit-worthy enough to obtain loans.

Most NCWSs do not have access to the sources of funding and revenue that traditionally are available to CWSs, such as grants, state revolving loan funds, issuance of bonds, or charging user fees. The ownership type also plays a role in whether a PWS is eligible for loans. For example, whereas a publicly owned CWS would be eligible for loans through a drinking water state revolving fund, a privately-owned CWS serving a mobile home park would not be eligible in some states.

3. Data Sources

3.1 What information did EPA use for this report?

The primary source of data for this report was the Safe Drinking Water Information System-Federal Reporting Services (SDWIS-Fed), the federal database-of-record. SDWIS-Fed contains system inventory information as well as violation data for PWSs in the United States, as reported by primacy agencies. EPA generated a list of systems that met the following criteria for a HSNC.

- Systems serving fewer than 1,000 people (as of the 4th quarter of 2018).
- Systems active during the period of January 1, 2016 through December 31, 2018 (the three-year period that meets the criteria in SDWA 1459C(a)(3)).
- Systems with a reported HB violation (MCL, TT, MRDL) or a non-health-based (non-HB) violation (M, R, M&R, O) with a "start date" on or after January 1, 2016.
- Systems with at least one open (i.e., the violation was not returned to compliance) HB or non-HB violation in three out of four quarters (274 days) in each of the three calendar years covering January 1, 2016 through December 31, 2018.
- Note: The SDWIS data used in this report represents the calendar year (January 1 through December 31) for each of the three years.

The final dataset of systems identified as HSNCs with HB violations was 334 PWSs (details in Chapter 4). There were 1,547 PWSs identified as HSNCs with non-HB violations (details in Chapter 5). Of these two groups, 58 HSNCs had both types of violations.

The primary focus of this report is the reported HB violations since they serve as primary indicators of immediate risk to public health. For that reason, the final list of HSNCs with HB violations was shared with EPA Regions and primacy agencies to review and provide additional information related to the water systems' TMF capacity.

3.2 How did EPA use data from the U.S. Department of Agriculture and U.S. Department of Health and Human Services?

To meet the AWIA mandate to consult with the U.S. Department of Agriculture (USDA) and U.S. Department of Health and Human Services (HHS), EPA worked with the USDA Rural Development (USDA RD) and the Centers for Disease Control and Prevention (CDC) Waterborne Disease Prevention Branch. These two programs within USDA and HHS work on issues related to drinking water systems and have a history of collaboration with the EPA Office of Ground Water and Drinking Water.

USDA RD offers loans and grants to PWSs to improve infrastructure and build capacity. USDA RD also offers technical assistance to PWSs to improve their operation and water quality. Because of these two functions USDA RD frequently interacts with small drinking water systems such as those identified as HSNCs.

The final list of HSNCs with HB violations was shared with staff at USDA RD to compare the list of HSNCs with their Water and Environmental Program database of water systems receiving loans. Of the 334 HSNCs with HB violations, 44 systems were found in USDA's database, with one of these systems identified as having a delinquent status, meaning the system has not made the required repayments. The delinquent system was subsequently recorded by EPA staff as meeting the AWIA criteria of having "defaulted on a loan or financial obligation."

The CDC Waterborne Disease Prevention Branch is responsible for leading coordination and response for preventing and reporting domestic and global water, sanitation, and hygiene-related disease. As part of these responsibilities, CDC tracks waterborne disease outbreaks nationally and compiles information related to each outbreak, including water system information. The list of HSNCs with HB violations was shared with staff from the Waterborne Disease Prevention Branch for comparison with CDC's database of waterborne disease outbreaks related to drinking water. None of the 334 HSNCs with HB violations were identified in the CDC database. However, underreporting of waterborne disease outbreaks is a well-known challenge. Detecting waterborne disease outbreaks in drinking water is challenging because many waterborne pathogens can also be spread in other ways (such as through food, person-to-person, or animal-to-person). People often do not consider drinking water as their source of infection, particularly when illness occurs days after the exposure. In addition to many other factors (e.g., surveillance, investigation, and reporting capacity variabilities across states and localities), linking illness to drinking water is difficult because most people drink water every day and the water does not always come from the same source. As a result, it is possible that there have been outbreaks among small systems that have gone undetected (CDC, 2019).

4. Data Analysis of Historically Significant Non-Compliers with Health-Based Violations

4.1 Trends in PWS Type and Ownership of HSNCs with HB Violations

The 334 HSNCs with HB violations were found in all 10 EPA Regions in 35 states, one territory, and three tribal areas. EPA Regions and primacy agencies were asked to identify which of the four owner/operator characteristics of "intractable water system" as defined by AWIA was applicable to each system, and to identify any applicable TMF barriers for HSNCs with HB violations only. Responses from EPA Regions and primacy agencies were provided for 328 of the 334 HSNCs (98%). No response was given for six HSNCs total; three in Arkansas and three in New York.

As discussed previously, a PWS is classified as a CWS, NTNCWS, or TNCWS. Water system ownership varies within a system type and falls into the following four categories.

- Public (e.g., municipality, township, county, non-tribal).
- Private (e.g., homeowner association, investor owned).
- Public/Private (e.g., publicly owned but privately operated).

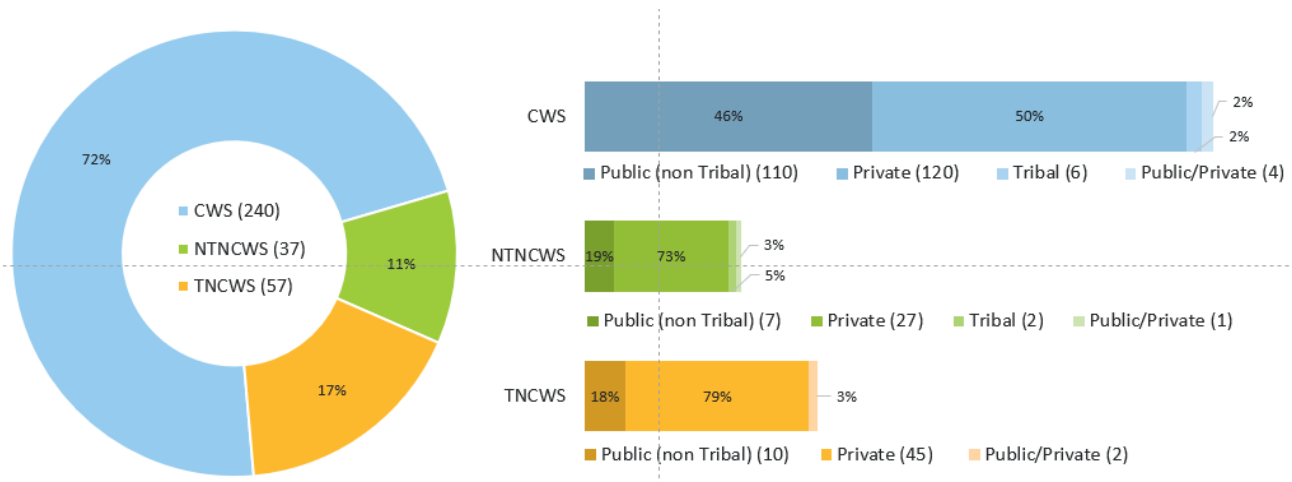
- Tribal (e.g., tribal governments or tribal utilities of federally recognized tribes). Note, tribal systems are a subset of publicly owned and operated systems but are shown separately here due to their unique government to government relationship with the U.S.

334 PWSs were identified as HSNCs with HB violations for ¾ of the year in all three calendar years of 2016-2018.

Seventy-two percent (240 total) of the HSNCs are CWSs, followed by TNCWSs at 17 percent and NTNCWSs at 11 percent. This differs from the overall universe of systems serving fewer than 1,000 people where 25 percent are CWSs, 13 percent are NTNCWSs, and 62 percent are TNCWSs.

More than half of the HSNCs - 57 percent - are privately owned, a smaller proportion than in the overall universe of water systems serving fewer than 1,000 people where 76 percent of systems are privately owned. Within a system type, the ownership classification varies among HSNCs. Whereas 46 percent of CWS HSNCs are publicly owned, and 50 percent privately owned, most NTNCWSs (73%) and TNCWSs (79%) are reported to be privately owned. In comparison to all water systems serving fewer than 1,000 people, most are privately owned within each system type: 63 percent among CWSs, 72 percent among NTNCWSs, and 83 percent among TNCWSs. Of note, approximately 2 percent of HSNCs (8 total) are owned by tribes. Although a small number, this percent is disproportionately high since tribal systems represent less than 1 percent of all PWSs. Figure 3 shows the 334 HSNCs with HB violations classified by PWS and ownership type.

Figure 3: HSNCs with HB Violations by PWS and Ownership Types



Note: Percentages were adjusted manually to account for rounding.

4.2 Trends in HB Violations

Each of the 334 HSNCs had at least one open HB violation for more than three quarters of the year for three consecutive years, however the number of violations varied considerably between the PWSs. In order to better understand the circumstances for each HSNC, the violations themselves were analyzed to identify trends. For example, a water system could meet the criteria based on one continuous violation of one rule or could have multiple violations associated with multiple rules, indicating that this system may face more complex compliance challenges. Similarly, different rules were associated with varying numbers of violations at individual systems, indicating that some rules may pose greater compliance challenges for the PWS. In accordance with the NPDWRs, the primacy agency issues a HB violation if it determines a PWS failed to comply with a mandated TT or has violated an MCL or MRDL. Under the SDWA, all violations are required to be reported to EPA.

HB violations are those that have the potential to produce adverse health effects and are grouped into the following categories for analysis in this report.

- **Maximum Contaminant Levels (MCLs):** Violations occur when the highest concentration of a contaminant allowed in drinking water is exceeded.
- **Maximum Residual Disinfectant Levels (MRDLs):** Violations occur when the highest concentration of a disinfectant allowed in drinking water is exceeded.
- **Treatment Technique (TT):** Violations occur when the PWS fails to perform the required process(es) intended to reduce the amounts of contaminants in drinking water.

The following data analyses evaluate non-compliance with the NPDWRs of HSNCs with HB violations. The trend analyses presented are grouped into rule groups, where appropriate.

Most of the HB violations incurred by the 334 HSNCs were MCLs. Out of 4,150 total reported violations, 88 percent (3,670) were MCLs and 12 percent were TTs. As shown in Table 1, regardless of the system type, MCLs were the dominant HB violation reported at the HSNCs. None of the HSNCs had MRDL violations.

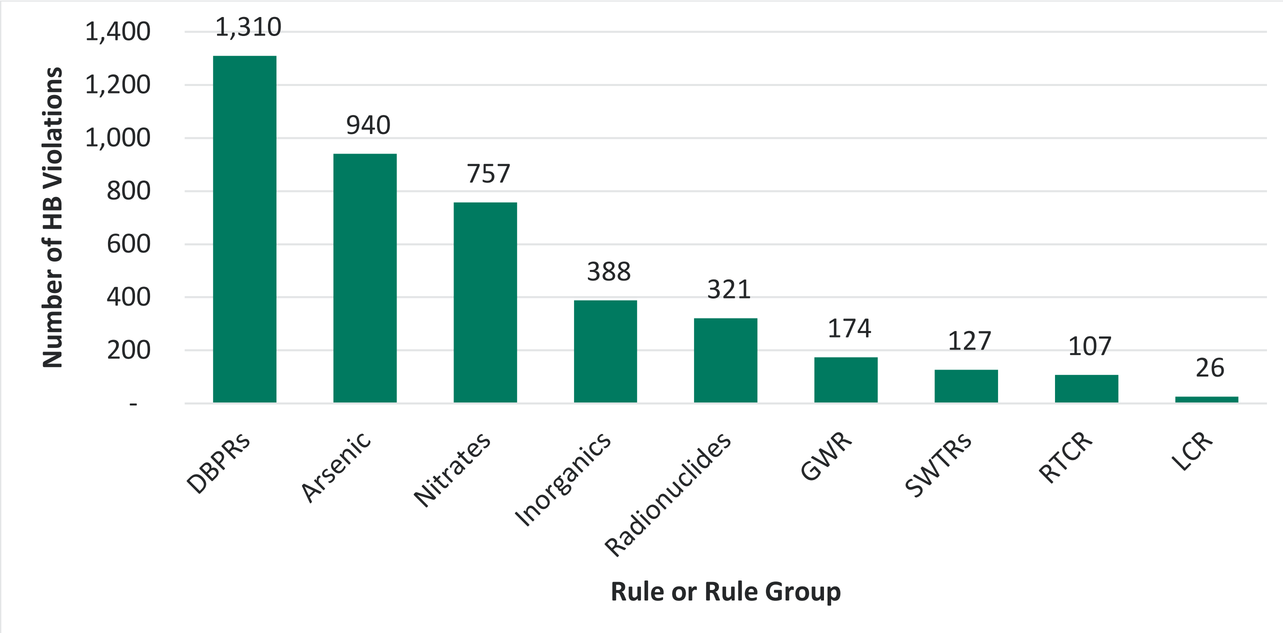
Table 1: 334 HSNCs by Type of Heath-Based Violation

PWS Type	MCL	TT	Total Violations (with system total)*
CWS	3,134 (213 HSNCs)	366 (67 HSNCs)	3,500 (240 HSNCs)
NTNCWS	399 (32 HSNCs)	27 (7 HSNCs)	426 (37 HSNCs)
TNCWS	137 (18 HSNCs)	87 (45 HSNCs)	224 (57 HSNCs)
Total	3,670 (263 HSNCs)	480 (119 HSNCs)	4,150 (334 HSNCs)

*The sum of HSNCs in each row or column may add to more than the total number of HSNCs because some systems have violations of more than one type

Figure 4 shows the number of HB violations reported at the 334 HSNCs categorized by rule groups. The highest number of reported HB violations occurred for Disinfectants and Disinfection Byproducts Rules (DBPRs) (1,310 total), followed by the Arsenic (940 total), Nitrates (757 total), and Inorganic Chemicals (388 total) Rules. Many violations related to the DBPRs can be addressed through operational changes, while addressing the underlying problems causing non-compliance with the Arsenic and Nitrates Rules (the next most persistent violations) require significant infrastructure investment.

Figure 4: Number of HB Violations Incurred by HSNCs by Rule or Rule Group in 2016, 2017, 2018



Of the 240 CWS HSNCs, 52 were consecutive systems (22% of all CWS HSNCs). EPA defines a consecutive system as a PWS that receives some or all its finished water from one or more wholesale system. Primacy agencies may have different definitions for consecutive CWSs. Of these 52 consecutive CWSs, 39 had Stage 2 DBPR violations (75%). The 39 consecutive CWSs with Stage 2 DBPR violations made up 41 percent of the total number of CWS HSNCs with violations of the DBPRs (94 total). The Stage 2 DBPR can be challenging for consecutive CWSs to implement, as they have little control over the treatment of the water they receive, yet they must comply with MCLs for Total Trihalomethanes (TTHM) and Haloacetic Acids (HAA5). Furthermore, the purchased finished water that a consecutive CWS receives may contain high levels of disinfection byproducts precursors (which may continue to react and form additional byproducts in the consecutive CWS with disinfectant added by the wholesale CWS), or even high levels of disinfection byproducts. Because disinfection byproducts may increase as treated water spends more time in pipes (water age), water that meets the MCLs at the system interconnection may later exceed the MCL in the consecutive CWSs distribution system.

Of the 37 NTNCWS HSNCs, two had violations of the DBPRs (5% of all NTNCWS HSNCs). The DBPRs do not apply to TNCWS unless they use chlorine dioxide as a primary disinfectant – none of the 57 TNCWS had violations of the DBPRs. The lower number and proportion of NTNCWS HSNCs with violations of the DBPRs may be related to water age. Many NTNCWS have limited or no distribution systems, so water in many of these systems generally spends less time in pipes.

Further analyses show that 249 (75%) of the HSNCs with reported HB violations had HB violations under only one rule group, while 67 HSNCs (20%) had HB violations under two individual rule groups. The remaining 18 HSNCs (5%) had HB violations under three or more rule groups. The largest number of HSNCs had violations under the DBPRs, Arsenic, or Nitrates Rules, following the same trend as the number of individual violations. HSNCs with violations under the Ground Water Rule (GWR) or under the Nitrates and Arsenic Rules tended to have more violations in multiple rules. For the HSNCs, 82 percent of GWR violations (142 out of 174) were given for a failure to address a significant deficiency found in a system assessment, an indication that the system may lack the TMF capacity to address other rule violations as well. Inorganic

Chemical Rule violations for the HSNCs (including Arsenic and Nitrate) were all MCL violations, indicating that they may be related to source water deficiencies. These trends in rule violations among the HSNCs are consistent with historical trends among small systems. Decreasing non-compliance among small systems like HSNCs necessitates addressing the impairment of the source water as the priority. As evident in the TMF data trends "Source water contamination/impairment" was the most commonly identified barrier for HSNCs. See Chapter 4.4 for more information about TMF barriers.

Of note, out of the total 4,150 HB violations incurred by HSNCs for the study period, 229 HB violations (at 100 HSNCs) remained open at the end of 2018, meaning that all reported violations at 234 HSNCs (out of the total 334 HSNCs) had been resolved or closed by the end of 2018. Further, of the 229 violations that remained open, the majority (219) were being addressed through the following enforcement actions:

- State or federal administrative orders were issued for 72 violations.
- Public notification requests, site visits, or formal violation notices or reminders from the state were issued for 147 violations.
- For the remaining 10 violations, other enforcement actions were listed for all but four entries.

4.3 Trends in Owner or Operator Characteristics as Defined in AWIA

EPA Regions and states provided information on the AWIA-specified owner or operator characteristics for each HSNC with known HB violations. These characteristics describe the system owner or operator (from SDWA 1459C).

- Owner or operator is unable or unwilling to provide safe and adequate service to those individuals.
- Owner or operator has abandoned or effectively abandoned the CWS or NCWS, as applicable.
- Owner or operator has defaulted on a financial obligation relating to the CWS or NCWS, as applicable.
- Owner or operator fails to maintain the facilities of the CWS or NCWS.

Figure 5 summarizes the AWIA-specified owner or operator characteristics identified by EPA Regions and primacy agencies for the 334 HSNCs with reported HB violations. As shown, *"Owner or operator is unable or unwilling to provide safe and adequate service"* was the most identified characteristic for 54 percent (174) of HSNCs followed by *"Owner or operator fails to maintain the facilities of the water system in a manner so as to prevent a potential public health hazard"* for 28 percent (93) of HSNCs. Both of these characteristics were identified for 72 of the HSNCs. Only seven HSNCs were characterized as *"Owner or operator has abandoned or effectively abandoned the water system"* and two HSNCs were characterized as *"Owner or operator has defaulted on a financial obligation relating to the water system."* Note that for all criteria there were many PWSs where no response was provided. This may be in part because the characteristics outlined in AWIA do not correspond to categories of information currently collected by primacy agencies and EPA Regions. Therefore, it was difficult for staff to determine if the characteristics were applicable based on available information.

Figure 5: Responses to Applicability of AWIA Characteristics for 334 HSNCs with HB Violations

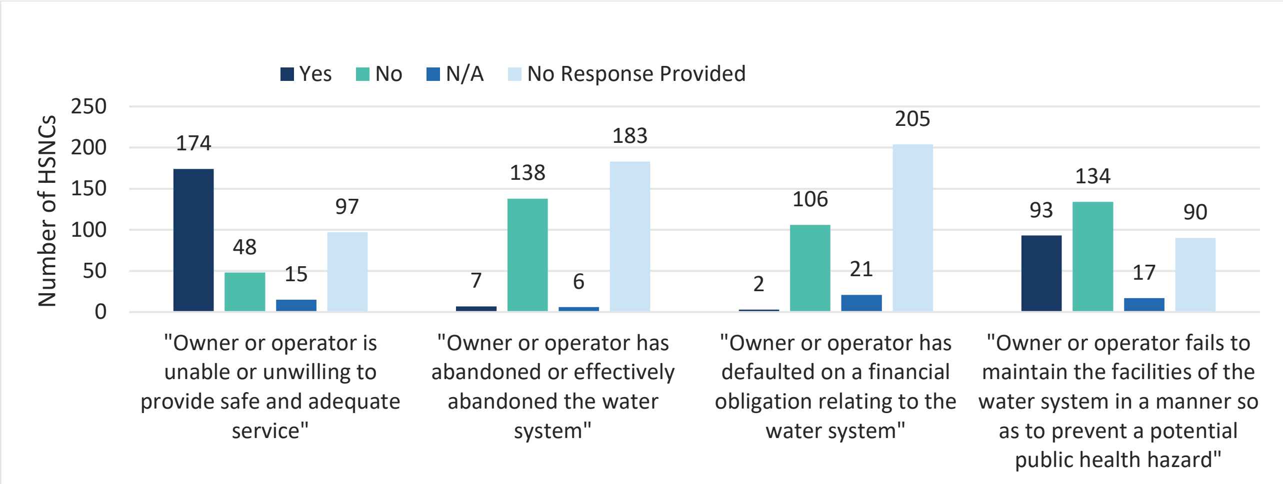


Figure 6 shows the percentage of HSNCs with HB violations for each characteristic proportional to the PWS type.

- "Owner or operator is unable or unwilling to provide safe and adequate service" was the most commonly identified characteristic for all three PWS types. NTNCWSs had more responses – 68 percent (25 out of 37 total NTNCWSs) – than CWSs at 58 percent (139 out of 240 total CWSs) and TNCWSs at 18 percent (10 out of 57 total TNCWSs).
- "Owner or operator fails to maintain the facilities of the water system in a manner so as to prevent a potential public health hazard" was the second most commonly identified characteristic for all three PWS types. NTNCWSs had more responses – 35 percent (13 out of 37 NTNCWSs) – followed by CWSs at 31 percent (75 out of 240 CWSs) and TNCWSs at 9 percent (5 out of 57).
- "Owner or operator has abandoned or effectively abandoned the system" was identified for 3 percent of CWSs (7 total) and no NTNCWS or TNCWS.
- "Owner or operator had defaulted on a financial obligation related to the water system" was identified for less than 1 percent of CWSs (2 total) and no NTNCWS or TNCWS.

Figure 6: Percentage of HSNCs with HB Violations by AWIA Characteristics by PWS Type

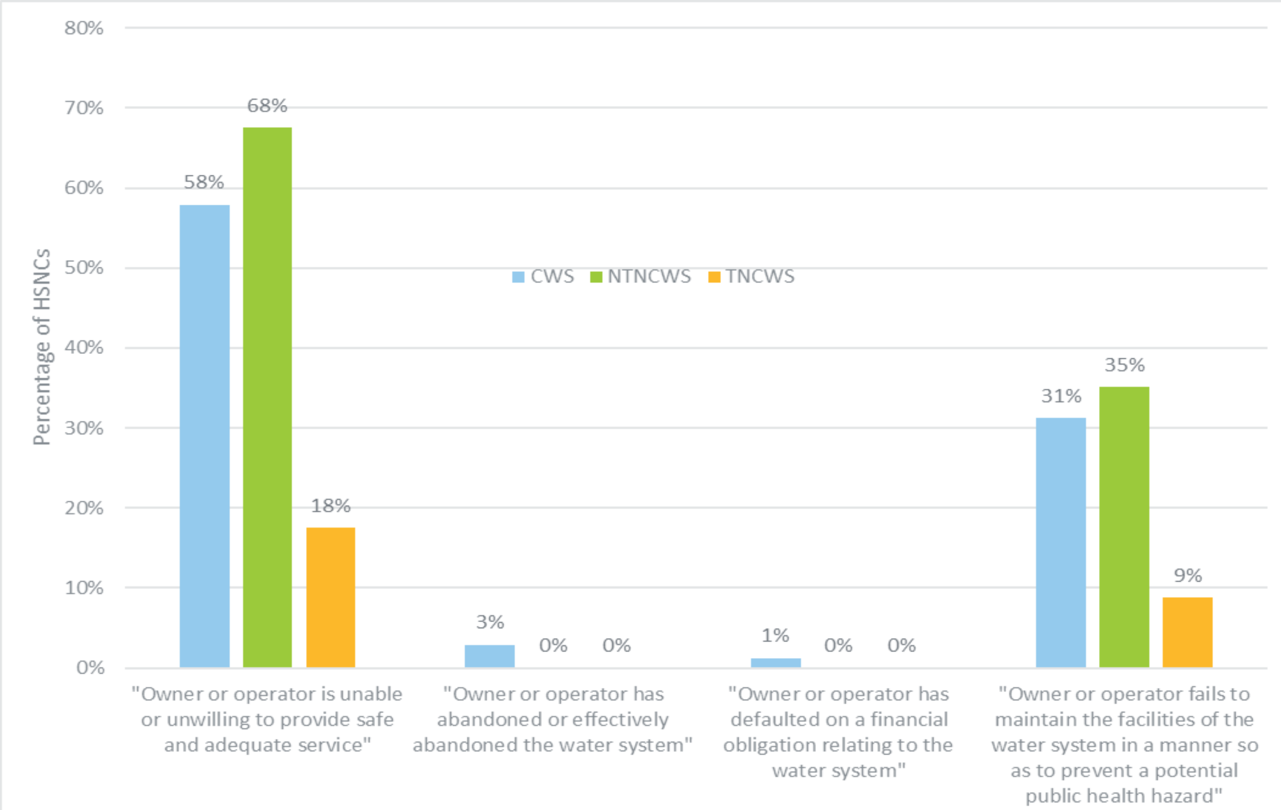
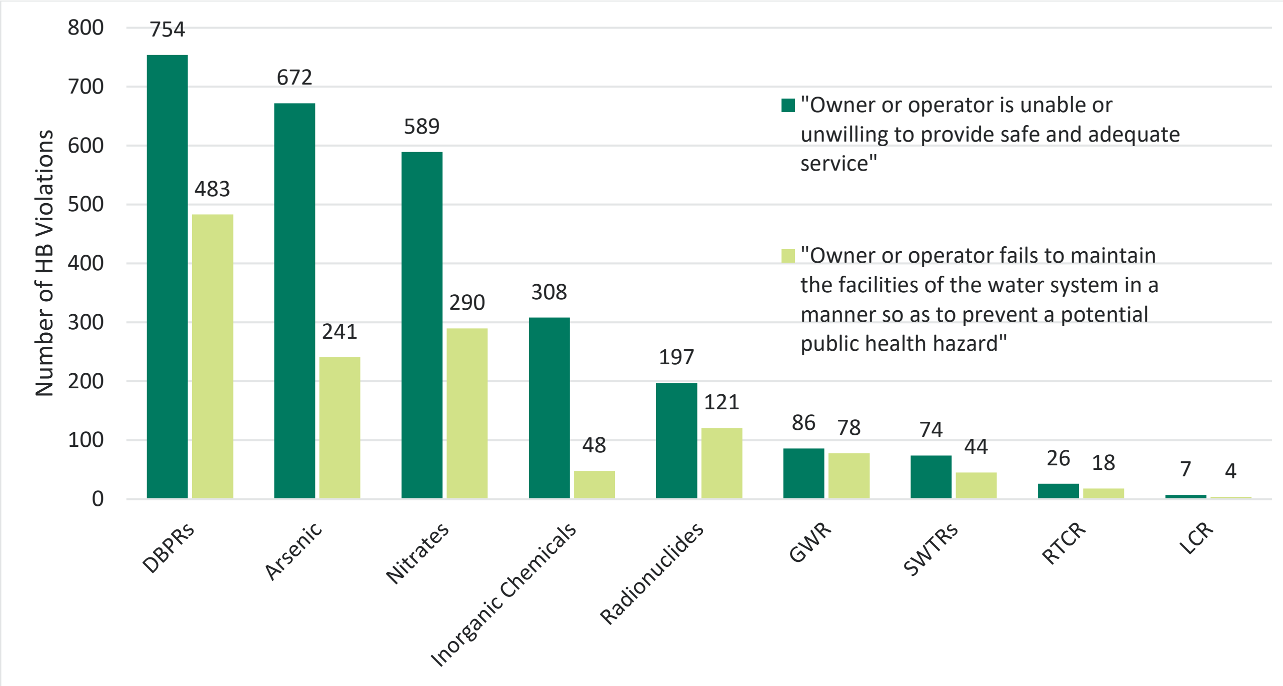


Figure 7 displays the number of HB violations for HSNCs reported by rule and AWIA characteristic. Only two of the four AWIA characteristics were identified a sufficient number of times (i.e., more than 10 HSNCs) for a meaningful analysis of violation trends by rule group. HSNCs characterized by *"Owner or operator is unable or unwilling to provide safe and adequate service"* represented the greatest number of rules in non-compliance. For this characteristic the number of violations per rule followed the same pattern as the overall number of violations. The most violations occurred under the DBPRs (754 total), followed by the Arsenic (672 total), Nitrates (589 total), and Inorganic Chemicals (308 total) Rules. For the HSNCs which were described by the AWIA characteristic *"Owner or operator fails to maintain the facilities of the water system in a manner so as to prevent a potential public health hazard,"* DBPRs had the most violations (483 total), followed by the Nitrates (290 total), Arsenic (241 total), and Radionuclides Rules (121 total).

Figure 7: Number of HB Violations by Rule by the Two Most Identified Owner/Operator Characteristics



4.4 Trends in Technical, Managerial, and Financial Barriers

In addition to collecting responses related to the characteristics specified in AWIA, EPA asked EPA Regions and primacy agencies to identify applicable TMF barriers for each HSNC with HB violations. This information provides additional contextual information on the challenges faced by small systems to supplement the information provided by the four AWIA characteristics. See Chapter 2.2 for more information on TMF capacity.

Twelve common barriers were selected for soliciting responses, four in each of the TMF categories (as shown in Table 2).

Table 2: Technical, Managerial, and Financial Barriers Assessed for the 334 HSNCs with HB Violations

Technical	Managerial	Financial
• Unable to address treatment challenges. • Source water contamination/impairment. • Lacks certified operator with the knowledge or skills to operate the system. • System infrastructure is in poor condition and/or sanitary survey deficiencies remain unaddressed.	• System is generally understaffed. • Does not implement an asset management plan. • Governing body (e.g., water board) lacks training on water system management. • System does not have an up-to-date operations and maintenance (O&M) plan.	• System has not adopted and/or implemented a budget. • Rate revenues do not cover the current and future costs (e.g., routine O&M costs, staffing) of providing service. • Difficulties obtaining financial assistance (e.g., loans, grants). • System lacks a Capital Improvement Plan.

Of the 334 HSNCs with HB violations evaluated for this report, at least one TMF barrier was identified for a total of 272 systems (81%). None of the 12 TMF barriers were selected for 62 systems (19%). Figure 8 shows the percentage of systems (in each PWS type) assessed with barriers in each TMF category. Of the three categories, technical barriers were the most commonly selected for all three PWS types, with 84 percent of CWSs, 78 percent of NTNCWSs, and 35 percent of TNCWSs identified with at least one technical barrier. Managerial barriers were the second most commonly selected for all three PWS types, with 60 percent of CWSs, 65 percent of NTNCWSs, and 23 percent of TNCWSs identified with at least one managerial barrier. Financial barriers were the least commonly selected category for all three PWS types, with 46 percent of CWSs, 57 percent of NTNCWSs, and 11 percent of TNCWSs identified with at least one barrier in this category. A larger proportion of CWSs were identified with at least one barrier in any category (91%) as compared to NTNCWSs (86%) and TNCWSs (39%). Sixty-six HSNCs were identified as having barriers in two out of three TMF categories, and 115 HSNCs identified at least one barrier in each of the three categories.

Figure 8: Number of HSNCs with HB Violations Reported as Having TMF Barriers by PWS Type

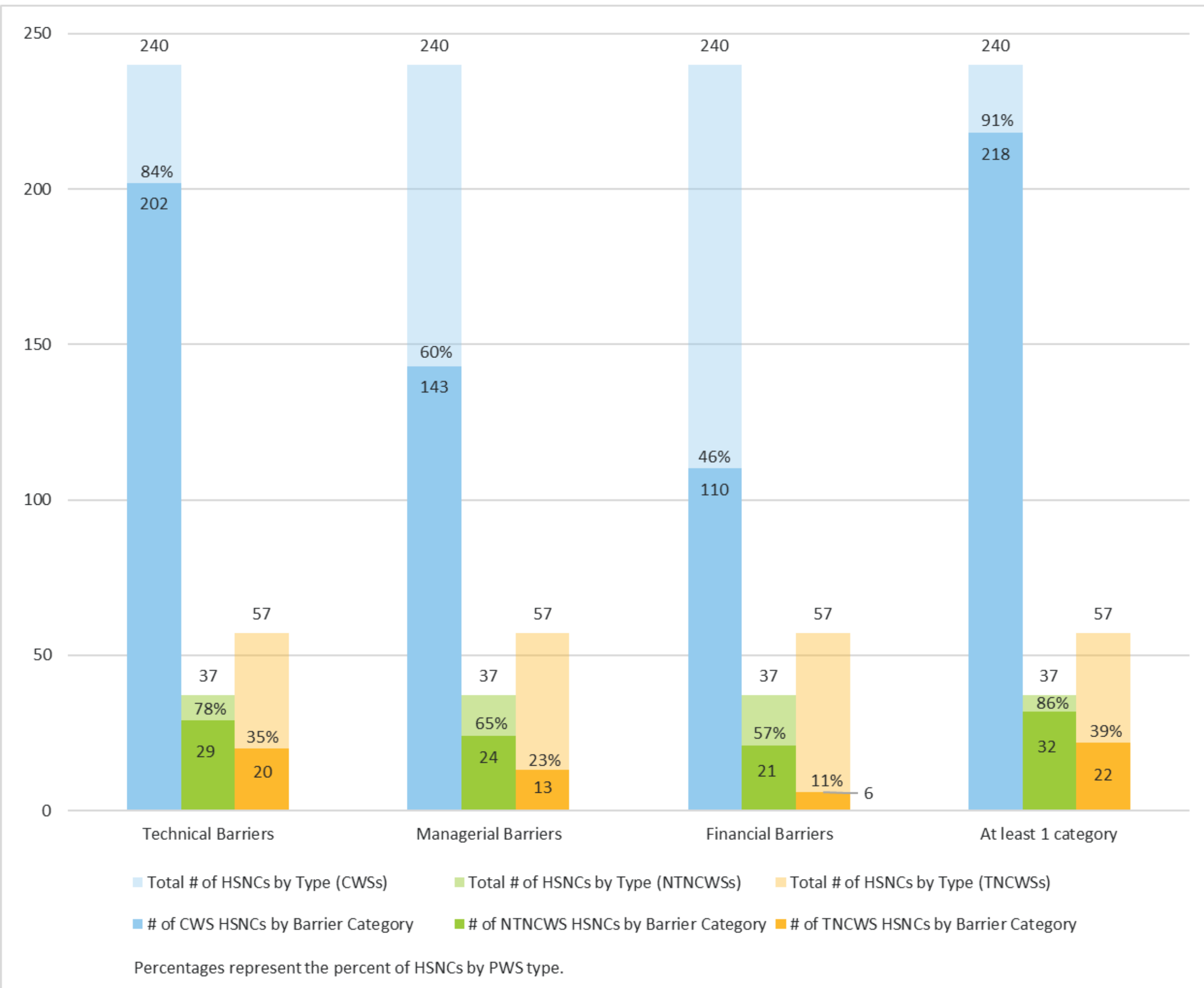


Figure 9 shows the number of HSNCs with HB violations by PWS type for each individual technical barrier. Note that multiple barriers could be selected for each HSNC hence the total number in Figure 9 will add to more than the total number of HSNCs assessed to have technical barriers (251). A larger number and proportion of CWSs were identified as having technical barriers to compliance as compared to the other two system types (as shown in Figure 8). Among the individual technical barriers, “Source water contamination/impairment” was the most commonly indicated barrier for all three PWS types (52% of CWSs, 70% of NTNCWSs, 18% of TNCWSs). For all three PWS types “System infrastructure is in poor condition and/or sanitary survey deficiencies remain unaddressed” was the second most commonly identified barrier (40% of CWSs, 22% of NTNCWSs, 14% of TNCWSs). A total of 83 HSNCs had no technical barriers identified. Addressing each of the two most commonly identified barriers may require significant investment in infrastructure or treatment technology. Given the financial challenges faced by small systems, these barriers may go unaddressed for a significant amount of time. These barriers may lead to repeated drinking water rule violations over a long period of time, leading to the system’s inclusion as a HSNC.

Figure 9: HSNCs with HB Violations by Technical Capacity Barriers by PWS Type

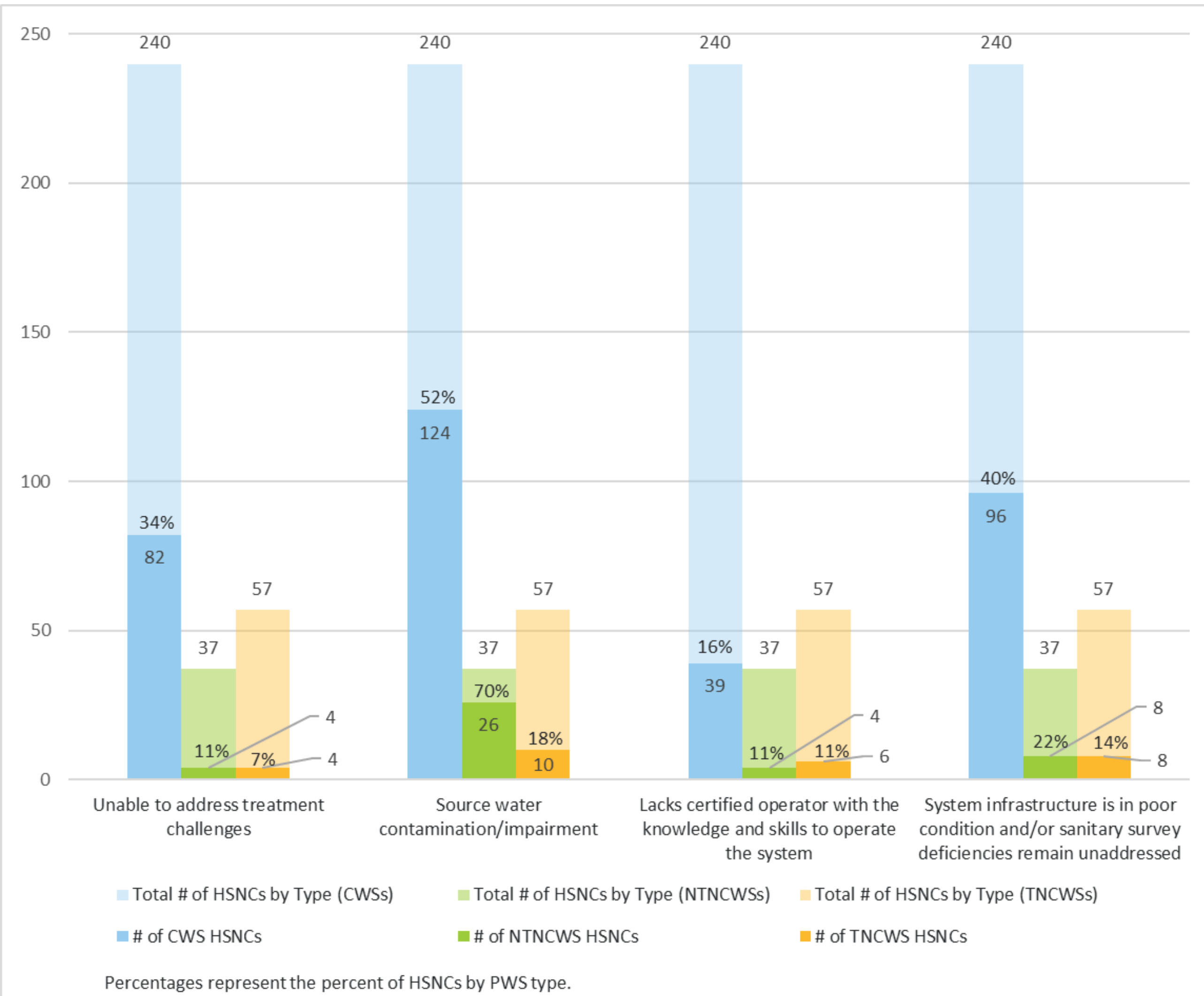


Figure 10 shows the number of HSNCs with HB violations by PWS type for each individual managerial barrier. Note that multiple barriers could be selected for each HSNC hence the total number in the figure will add to more than the total number of HSNCs identified with managerial barriers (180). Based on PWS type, CWSs were identified with the largest number of managerial barriers to compliance as compared to NTNCWSs and TNCWSs. Among the individual managerial barriers, “Does not implement an asset management plan” was the most commonly identified barrier for CWSs (42%) and NTNCWSs (57%), while for TNCWSs the most commonly identified barrier was “System is generally understaffed” (14%). The second most commonly identified managerial barrier was “System does not have an up-to-date O&M plan,” for all three PWS types (40% of CWSs, 41% of NTNCWSs, 7% of TNCWSs). Note that for TNCWSs “Does not implement an asset management plan” was also cited for 7 percent of the systems. No managerial barriers were identified for 154 HSNCs (46%). The top two most commonly identified managerial barriers are closely related to the most commonly identified technical and financial barriers. For example, implementing an asset management plan could help systems better maintain their infrastructure (technical barrier) and help inform a capital improvement plan (financial barrier). Similarly, an up-to-date O&M plan could help systems better address treatment challenges and maintain infrastructure (technical barriers) as well as help inform an operating budget (financial barrier).

Figure 10: HSNCs with HB Violations by Managerial Capacity Barriers by PWS Type

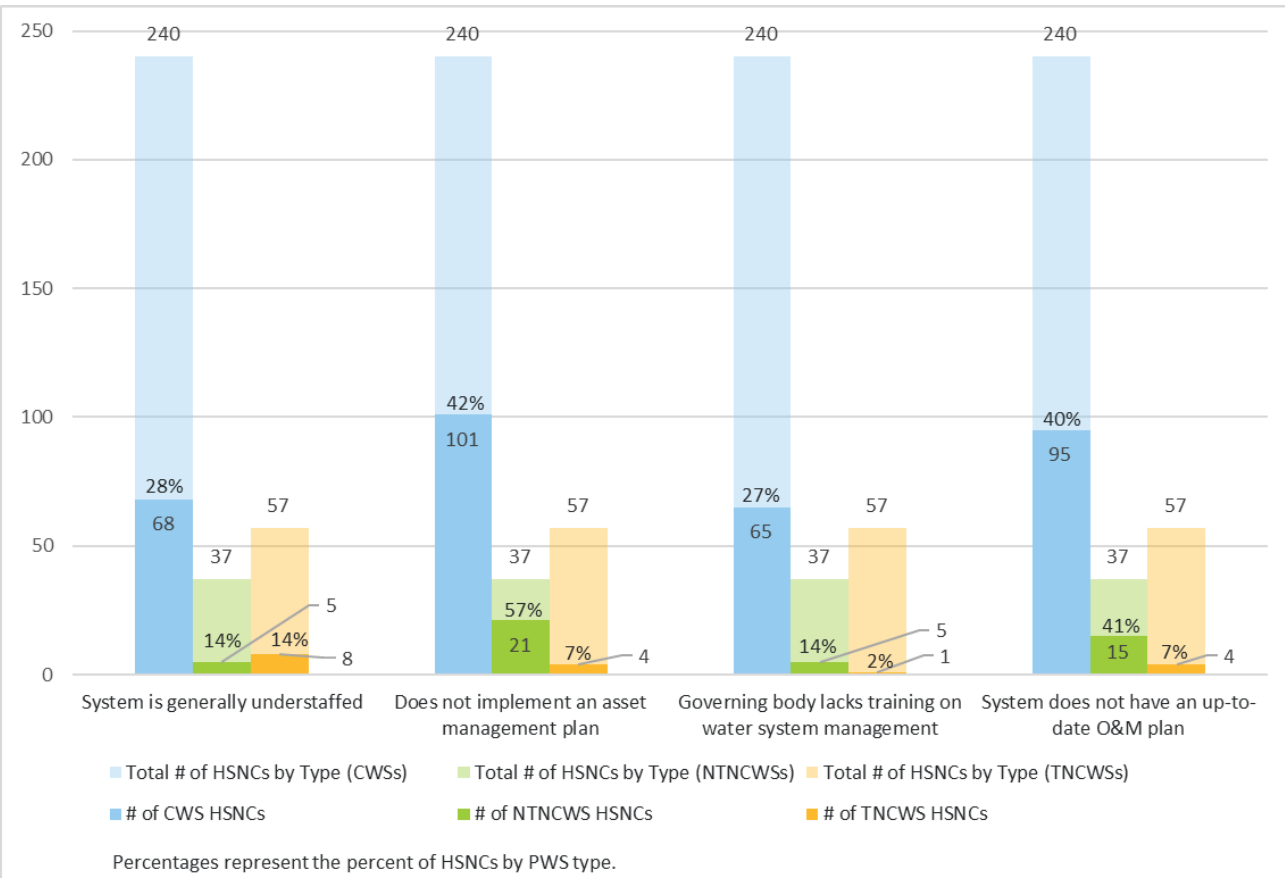
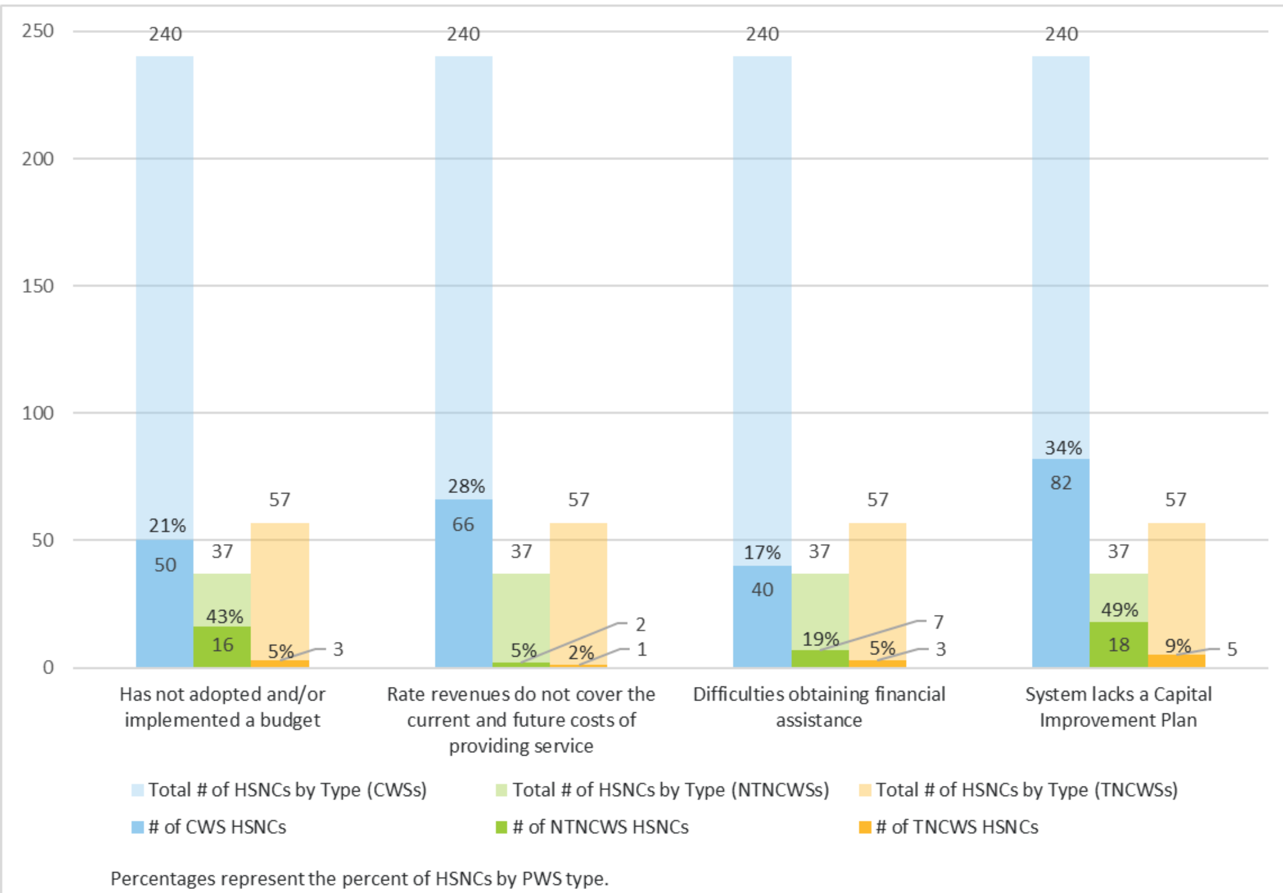


Figure 11 shows the number of HSNCs with HB violations by PWS type for each individual financial barrier. Note that multiple barriers could be selected for each HSNC hence the total number of barriers identified in Figure 11 may be in excess of 137, the total number of HSNCs identified with any financial barriers. A larger number and percentage of CWSs faced financial barriers to compliance as compared to the other two system types (as shown in Figure 8). Among the individual financial barriers, “System lacks a Capital Improvement Plan” was the most selected for all three PWS types (34% of CWSs, 49% of NTNCWSs, 9% of TNCWSs), followed by “Rate revenues do not cover the current and future costs of providing service” for

CWSs (28%) and “Has not adopted and/or implemented a budget” for NTNCWSs (43%) and TNCWSs (5%). The least commonly selected barrier for CWSs was “Difficulties obtaining financial assistance” (17%) while “Rate revenues do not cover the current and future costs of providing service” was the least selected financial barrier for NTNCWSs (5%) and TNCWSs (2%). In total, 197 HSNCs had no financial barriers identified. Particularly for this category, addressing an individual barrier may help a system address other barriers in this category. For example, if a system implements a budget, they may be better able to adjust rates appropriately to cover the current costs of providing service. Similarly, if the system develops a capital improvement plan, they may be more likely to receive financial assistance which in turn could help alleviate revenue shortfalls. Sometimes, enforcement actions taken to address a struggling system can, in turn, make new avenues of financial assistance available to that system. For example, under EPA’s Drinking Water State Revolving Fund, a primacy agency may prioritize funds for projects at a CWS that is in non-compliance and under a SDWA administrative enforcement order or judicial order to correct its violations.

Figure 11: HSNCs with HB Violations by Financial Capacity Barriers by PWS Type



For each rule or rule group, the number of HB violations reported was counted for each HSNC that listed any TMF barrier, as shown in Figure 12. The HSNCs with technical barriers had a greater number of HB violations regardless of rule, and technical barriers were the most commonly identified barrier type overall among HSNCs. Consistent with the AWIA characteristics, the DBPRs, Arsenic, Nitrates, and Inorganic Chemicals Rules had the largest number of violations with any type of TMF barrier for HSNCs.

Figure 12: Number of HB Violations Reported by Rule and TMF Barrier

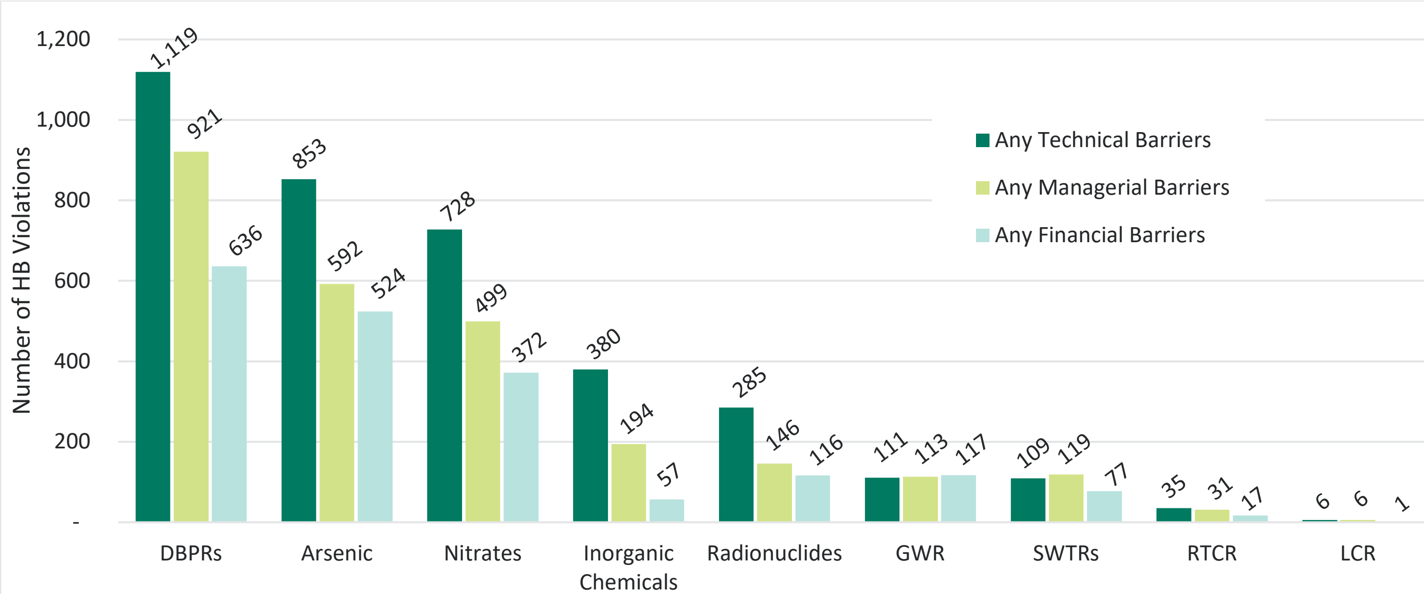


Figure 12 shows the total number of violations reported for HSNCs with designated TMF barriers. The four rules with the highest number of violations by HSNCs with TMF barriers are the DBPRs, Arsenic Rule, Nitrates Rule, and Revised Total Coliform Rule (RTCR). Note that there were fewer total violations under the RTCR compared to other rules but more HSNCs in violation.

- The most common TMF barriers reported for HSNCs with DBPRs violations (99 HSNCs)
  - Unable to address treatment challenges. (Technical)
  - System does not have an up-to-date O&M plan. (Managerial)
  - System infrastructure is in poor condition and/or sanitary survey deficiencies remain unaddressed. (Technical)
- The most common TMF barriers reported for HSNCs with Arsenic Rule violations (85 HSNCs)
  - Source water contamination/impairment. (Technical)
  - Does not implement an asset management plan. (Managerial)
  - System lacks a Capital Improvement Plan. (Financial)
- The most common TMF barriers reported for HSNCs with Nitrates Rule violations (71 HSNCs)
  - Source water contamination/impairment. (Technical)
  - Does not implement an asset management plan. (Managerial)
  - System infrastructure is in poor condition and/or sanitary survey deficiencies remain unaddressed. (Technical)
- The most common TMF barriers reported for HSNCs with RTCR violations (61 HSNCs)
  - System infrastructure is in poor condition and/or sanitary survey deficiencies remain unaddressed. (Technical)

- System does not have an up-to-date O&M plan. (Managerial)
- System lacks a Capital Improvement Plan. (Financial)

For these four most commonly violated rules, the most prevalent TMF barrier for each rule reflects challenges associated with that particular rule. For example, disinfection byproducts are formed in the treatment process and can be addressed through improvements to precursor removal or changes in disinfection practices. This is reflected in the most common barrier for HSNCs with violations of the DBPRs: “Unable to address treatment challenges.” Arsenic and Nitrates Rules are both contaminants typically found in source waters; the most common barrier for each of these rules was “Source water contamination/impairment.” The RTCR regulates water quality in the distribution system where infrastructure deficiencies can often lead to microbial violations. The most common barrier for HSNCs with RTCR violations was “System infrastructure in poor condition and/or sanitary survey deficiencies remain unaddressed.”

5. Data Analysis of Historically Significant Non-Compliers with Non-Health-Based Violations

Consistent with the data analysis described in Chapter 3, the analysis of non-HB violations was derived from SDWIS-Fed, the federal database-of-record.

Typically, non-HB violations do not pose the potential of immediate risk to the public. Nevertheless, these violations can lead to HB events being undetected or overlooked, since they indicate that monitoring may not have been performed. The primacy agency issues and reports a non-HB violation when it determines a PWS has failed to provide information by an applicable deadline demonstrating that the PWS performed a required monitoring or reporting action or failed to provide required information to the public and/or the primacy agency. In accordance with the NPDWRs, non-HB violations include the following.

1,547 PWSs were identified as HSNCs with non-HB violations for ¾ of the year in all three calendar years of 2016-2018. Fifty-eight of these incurred both non-HB and HB violations.

- **Monitoring (M):** Violations occur when a PWS fails to conduct specific contaminant monitoring to determine drinking water quality.
- **Reporting (R):** Violations occur when a PWS fails to report required information (e.g., sample results) to the primacy agency within the applicable timeframe.
- **Other (O):** Violations occur when a PWS fails to comply with the CCR Rule, the PN Rule, and recordkeeping and monitoring plan requirements.

The SDWIS-Fed analysis identified 1,547 HSNCs with 47,732 non-HB violations between January 1, 2016, and December 31, 2018. The focus of the data analysis throughout this chapter is on the non-HB violations that occurred among these 1,547 HSNCs. Fifty-eight of these HSNCs also had open HB violations for at least 274 days in all three calendar years (i.e., 2016-2018). The HSNCs with non-HB violations represent 1.2 percent of all PWSs that serve fewer than 1,000 people in the United States. The HSNCs with non-HB violations are located in all 10 EPA Regions, specifically in 43 states, three territories, and one tribal area (Navajo Nation). Approximately 1.5 percent of the HSNCs with non-HB violations are located in the U.S. territories of American Samoa, Northern Mariana Islands, and Puerto Rico although less than 0.6 percent of all systems serving fewer than 1000 people are located in these areas. Eight non-HB HSNCs are located within the jurisdiction of a tribal primacy agency. Another 40 HSNCs with non-HB violations are in Tribal areas overseen by an EPA region or a primacy agency.

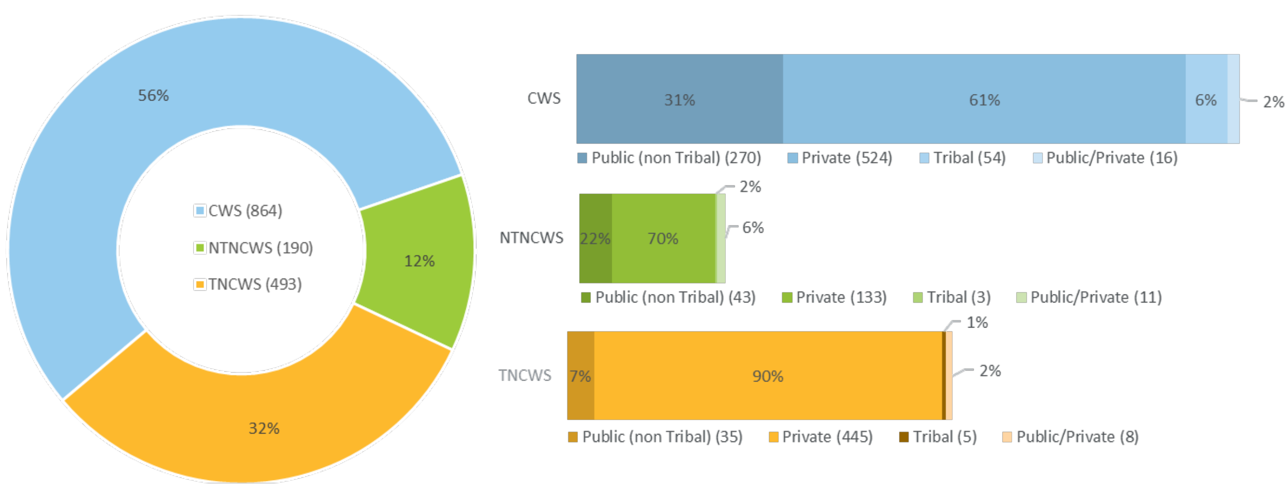
As discussed previously, a PWS is classified as a CWS, NTNCWS, or TNCWS. Water system ownership varies within a system type and includes four categories.

- Public (e.g., municipality, township, county, non-tribal).
- Private (e.g., homeowner association, investor owned).
- Public/private (e.g., publicly owned but privately operated).
- Tribal (e.g., tribal governments or tribal utilities of federally recognized tribes). Note, tribal systems are a subset of publicly owned and operated systems but are shown separately here due to their unique challenges compared to other public systems.

Of the 1,547 HSNCs with non-HB violations, 56 percent are CWSs, 32 percent are TNCWSs and 12 percent are NTNCWSs. Recall that CWSs accounted for 72 percent of HSNCs with HB violations.

As shown in Figure 13, regardless of system type, more than half of the HSNCs are privately operated/owned. Approximately 71 percent (1,102 HSNCs) of HSNCs with non-HB violations are privately operated/owned. This trend also applies by system type: 90 percent of TNCWSs, 70 percent of NTNCWSs, and 61 percent of CWSs are privately operated/owned. In comparison, among HSNCs with HB violations, 57 percent (192 HSNCs) are privately operated/owned. As detailed in Chapter 4, the “private” designation ranges from homeowner associations to investor owned.

Figure 13: HSNCs by PWS Type and Operator/Ownership Type



Note: Percentages were adjusted manually to account for rounding.

5.1 Trends in Non-HB Violations

Monitoring and reporting (M&R) violations are the most common violations across all NPDWRs for HSNCs with non-HB violations. This trend is consistent with national PWS trends of small systems, especially among those serving fewer than 1,000 people. When compared to larger PWSs, small systems are more likely to lack the TMF capacity to comply with NPDWRs, including monitoring and reporting requirements (USEPA, 2011b).

As discussed in Chapter 2.3, small systems are often overseen by part-time managers and operators. This can greatly affect a system's ability to comply with regulations. Due to the lack of managerial capacity, staff may lack the proper training and standard procedures necessary to comply with basic requirements like collecting samples and reporting the results according to regulations.

PWSs are required to routinely monitor for contaminants and report the results to their primacy agency. When a PWS fails to meet these requirements, the primacy agency issues a violation that is reported to EPA, and the PWS is required to notify customers in accordance with the PN Rule and CCR requirements (for CWSs only). A PWS also incurs a violation when it fails to meet PN and CCR reporting requirements.

Note that M&R violations are reported jointly (as one code) in SDWIS-Fed for all rules except the Revised Total Coliform Rule (RTCR). As such, the combined M&R violation does not specify if the PWS's failure to provide information resulted from incomplete monitoring, incomplete reporting, or both. Throughout this chapter, the distinctions are noted as M&R, M, or R, as applicable to the rule.

As reflected in Table 3, of the 47,732 reported non-HB violations, 63 percent (30,190 non-HB violations) are M&R, 24 percent (11,480 non-HB violations) are Other, 12 percent[1] (5,530 non-HB violations) are M-only and one percent (532 non-HB violations) are R-only. Within system types, M&R accounted for most of the non-HB violations that occurred among CWSs (68%) and NTNCWSs (73%). Among the TNCWSs, 41 percent (2,407 non-HB violations) of the violations incurred are M-only, 31 percent (1,840 non-HB violations) are Other, and 24 percent (1,447 non-HB violations) are M&R. Nationally, among small PWSs, M&R and M non-compliance are the most frequently incurred non-HB violations. Hence, the HSNCs' M&R and M non-compliance is consistent with national trends.

Table 3: HSNCs by Type of Non-HB Violation

PWS Type	M&R Violations	O Violations	M Violations (RTCR Only)	R Violations (RTCR Only)	Total Violations (with system total)*
CWS	24,438 (822 HSNCs)	8,507 (787 HSNCs)	2,740 (398 HSNCs)	239 (72 HSNCs)	35,924 (864 HSNCs)
NTNCWS	4,305 (171 HSNCs)	1,133 (128 HSNCs)	383 (68 HSNCs)	48 (18 HSNCs)	5,869 (190 HSNCs)
TNCWS	1,447 (346 HSNCs)	1,840 (410 HSNCs)	2,407 (349 HSNCs)	245 (81 HSNCs)	5,939 (493 HSNCs)
Total	30,190 (1,339 HSNCs)	11,480 (1,325 HSNCs)	5,530 (815 HSNCs)	532 (171 HSNCs)	47,732 (1,547 HSNCs)

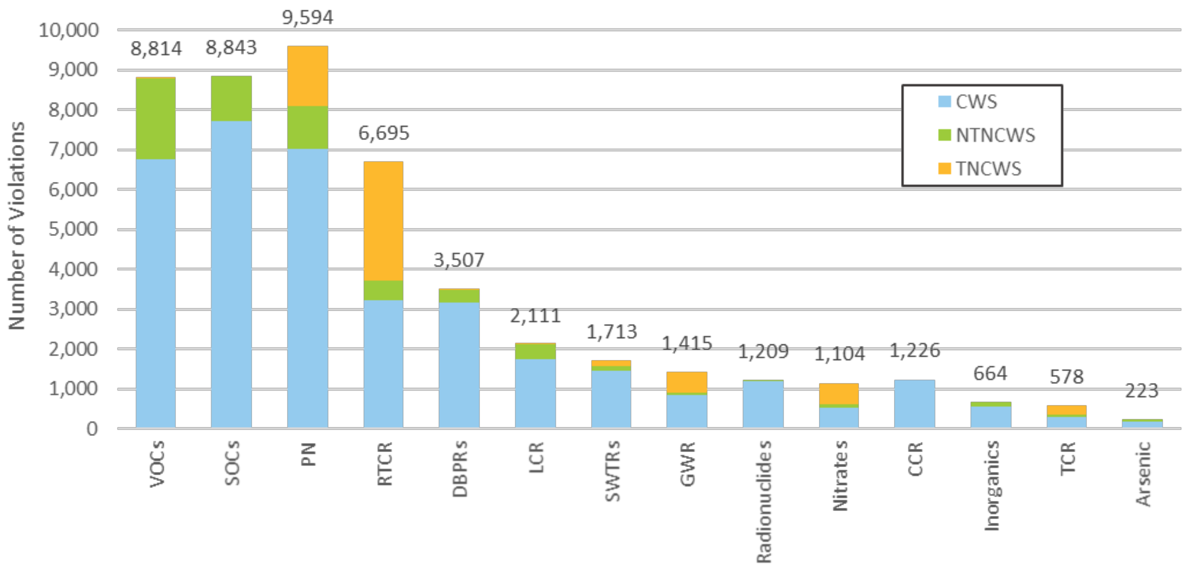
*The sum of HSNCs in rows or columns may add to more than the total number of HSNCs since systems may have violations of more than one type.

Figure 14 shows the number of non-HB violations by rule and PWS type. Consistent with the analysis completed for the HSNCs with HB-violations in Chapter 4, the data in Figure 13 are grouped into rule groups for some of the NPDWRs. The rules with the most non-HB violations are PN (20%), SOCs (19%), VOCs (18%),

[1] Note, monitoring (M) and reporting (R) violations as a separate code only applies to the Revised Total Coliform Rule that was promulgated in February 2013 and became effective in April 2016.

RTCR (14%), and DBPRs (7%). It is important to note that primacy agencies enter separate violation records for every individual contaminant not monitored or reported under an individual rule. This means that rules with multiple contaminants (i.e., VOCs, SOCs, Inorganic Chemicals Rules and disinfection byproducts) may have multiple violations listed for a single missed rule monitoring event. Based on sampling results, primacy agencies can waive/change monitoring schedules for Chemical Contaminant Rules (VOCs, SOCs, Inorganic Chemicals) and the Radionuclides Rule. This may result in longer monitoring periods than every three years for individual systems. Hence, the data used in this report (from calendar years 2016-2018) may not be a representative sample of overall monitoring and reporting compliance.

Figure 14: Number of Non-HB Violations by Rule and PWS Type



Further analyses show that 197 (13%) of the HSNCs with reported non-HB violations had non-HB violations under only one rule group, while 364 HSNCs (24%) had Non-HB violations in two individual rule groups. The remaining 986 HSNCs (64%) had non-HB violations under three or more rule groups.

Out of the 47,732 non-HB violations incurred by HSNCs, 17 percent remained open (i.e., 8,107 non-HB violations incurred by 1,304 HSNCs) at the end of 2018. Further, of the 8,107 non-HB violations that remained open, the majority (6,403 non-HB violations or 79%) were being addressed through the following enforcement actions:

- 2,158 (27%) had state or federal administrative orders or consent decrees issued, or court cases filed.
- 4,433 (55%) had resulted in PN requests, PN being issued, site visits, formal violation notices, reminders from the state or federal government, or case being dropped.
- Of the remaining open non-HB violations 1,516 (19%) had no enforcement action listed.

6. Enforcement

6.1 Enforcement Targeting Tool and Priority Systems

A primacy agency's initial responses to HB and non-HB violations are often actions such as reminder letters, warning letters, notices of violation, field visits, and telephone calls. If a violation continues or recurs, the primacy agency may initiate a formal enforcement response that requires the violating PWS to return to compliance on an enforceable schedule.

In December 2009, EPA introduced the Drinking Water Enforcement Response Policy (ERP), developed in conjunction with the primacy agencies to help regulators prioritize allocation of enforcement resources to address non-complying PWSs. The ERP includes an Enforcement Targeting Tool (ETT) that assigns points each quarter to a system's current reported NPDWR violations that have not been addressed by a formal enforcement response or returned to compliance. The ETT is scored according to HB and non-HB violations.

- 10 points is assessed for every HB violation with potential to cause immediate health effects (i.e., microbial contaminants, nitrates).
- 5 points is assessed for every HB violation with potential to cause health-effects if the water is consumed over an extended period (other contaminants).
- 1 point is assessed for all non-HB violations.

The quarterly score for each non-complying PWS aggregates the points assessed for each of its unaddressed violations and adds one more point for each year that the system's oldest violation has remained uncorrected and unaddressed. If a PWS's quarterly score is 11 points or higher, the PWS is designated a priority system. The ERP provides that a priority system should be returned to compliance or addressed with formal enforcement within two quarters of reaching priority status. The ETT assigns no points to violations that have been either returned to compliance or addressed by formal enforcement. Since January 2010, when EPA first began calculating and tracking ETT scores for non-complying PWSs, increased enforcement focus, and improved reporting of activities have resulted in a reduction in the annual number of PWSs that have been in priority status at any point during the federal fiscal year. For graphics, see ECHO Drinking Water Dashboard at https://echo.epa.gov/tools/data-downloads#downloads.

There are currently many compliance and enforcement tools and approaches, including formal enforcement, to help systems attain and maintain TMF capacity. The extent of the use of programs, tools, and concepts varies by primacy agency. As noted in the *Public Water System Historical Significant Non-Compliers: National Trends Report* (USEPA, 2010), EPA recognized the need for a comprehensive, targeted approach that enables the prioritization of enforcement against PWSs. The ETT addresses this need by identifying serious violators that should either be returned to compliance or addressed by a formal enforcement action. Formal enforcement responses include the following actions.

- Administrative orders with or without penalties.
- Civil referrals to attorneys general or to the U.S. Department of Justice (DOJ).
- Filing criminal charges.

If there is a present or likely event that may cause imminent and substantial endangerment to public health, EPA or the primacy agency can invoke emergency powers to require the PWS to take immediate action to protect the health of the public.

EPA also recognizes that traditional enforcement may not be the most effective way to address non-compliance for certain PWSs that must overcome significant TMF barriers. The primacy agency's challenge is to find and implement an effective strategy that resolves these barriers. In certain cases, enforcement options can help build momentum and complement capacity building efforts. For example, an enforcement order can include a compliance schedule to address a HSNC system's specific violations. In turn, the HSNC system may be able to leverage that enforcement action to access funds for infrastructure upgrades.

When an owner or operator has been unable or unwilling to engage in the process of returning its PWS to compliance, one alternative to address this issue would be to place the system in receivership. A receiver is a person with authority to collect the assets of, manage, and carry on the business of a utility owned/operated by someone else. For primacy agencies that have a receivership law, this approach has been successful in bringing systems into compliance. Receiverships do not always solve all the issues at the water system, but it is a good tool for EPA and primacy agencies to consider using to address non-compliance issues. Another alternative would be the creation of a water association, in a scenario where the community is engaged and chooses to accept ownership/operation of the local utility.

6.2 HSNC Trends in Enforcement Targeting Tool

As shown Table 4 and Table 5, there are notable data trends in ETT priority systems for HSNCs.

- Of the 334 HSNCs with HB violations, 47 (14%) had ETT scores of 11 or more as of April 2019.
- Of the 1,547 HSNCs with non-HB violations, 309 (20%) had ETT scores of 11 or more as of April 2019.
- Of the 58 HSNCs with HB and non-HB violations, 32 (55%) had ETT scores of 11 or more as of April 2019.

> The purpose of the ETT is to identify where EPA and primacy agencies should focus enforcement resources.

As explained above, the quarterly ETT does not assess points to violations that have been reported returned to compliance or have been addressed by a formal enforcement action, even if the formal enforcement action has not yet resulted in the PWS's return to compliance. This outcome reflects the ETT's purpose as a tool for identifying where EPA and primacy agencies should focus enforcement resources. The difference between the total number of HSNCs and the number of HSNCs that are priority systems reflects the fact that many HSNCs have been returned to compliance and/or addressed by a formal enforcement action since the end of 2018, meaning they have been taken off the priority list.

Note: Due to one primacy agency's revision to their inventory coding in June 2019 (specifically, changes to the public water system identification number (PWSID)) the ETT dataset used in this report may potentially reflect a slightly smaller number of HSNCs that should be priority systems. These PWSID coding changes were made to the primacy agency's non-community water systems (NCWSs). As such, the ETT dataset may not reflect accurate historical enforcement performance for the following number of NCWSs: one out of 334 HSNCs with HB violations and 28 out of 1,547 HSNCs with non-HB violations.

Table 4: HSNCs with Non-HB Violations and an ETT Score 11 or More[2]

System Type	HSNCs with non-HB violations with ETT scores ≥11	M&R Violations	O Violations	M Violations (RTCR Only)	R Violations (RTCR Only)	Number of non-HB violations 2016-2018
CWS	239	17,194	4,530	1,710	49	23,483
NTNCWS	21	1,911	740	195	4	2,850
TNCWS	81	502	513	718	42	1,775
All	341	19,607	5,783	2,623	95	28,108

Table 5: HSNCs with HB Violations and an ETT Score 11 or More[2]

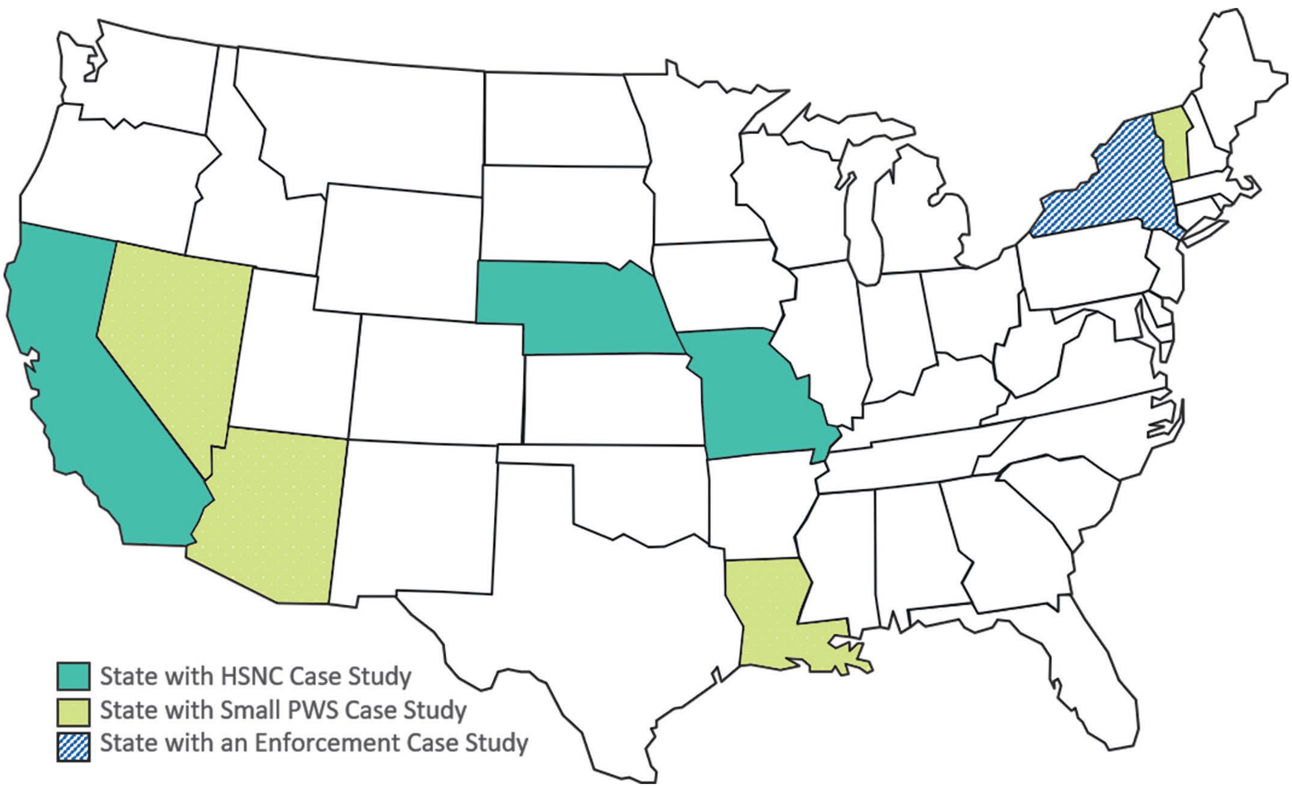
System Type	HSNCs with HB violations with ETT scores ≥ 11	MCL Violations	TT Violations	Number of HB violations 2016-2018
CWS	65	1,012	145	1,157
NTNCWS	7	84	1	85
TNCWS	7	25	12	37
All	79	1,121	158	1,279

2. Includes 32 HSNCs with non-HB violations and HB-violations.

7. Case Studies

This chapter incorporates case studies of both HSNCs and other small PWSs (i.e., those serving 3,300 or fewer people per year). The case studies highlight the processes or tools used to assist these small PWSs in complying with drinking water regulations. The main purpose is to demonstrate the variability in the challenges that affect these small PWSs and the need for tailored solutions for each local community. The return to compliance status was not tracked with the NPDWRs' data identified in Chapters 4, 5, 6.

Figure 15: States with a Case Study



Case Study 1 – Robeline Marthaville Water System

Where:	Robeline and Marthaville, Louisiana
PWS type:	Small CWS
Population served:	1,341
Water Source:	Ground Water
Owner type:	Private (Nonprofit Co-op)
NPDWR Issue:	DBPRs
Source:	Louisiana Rural Water Association, KSLA News, Natchitoches Parish Journal

Background

Robeline Marthaville (R-MV) Water System had been in operation since 1978 to provide drinking water to consumers in the towns of Robeline and Marthaville, Natchitoches Parish, Louisiana. Its treatment plant is fed by two wells and uses chlorine gas to disinfect the water. Through the years, R-MV Water System experienced few upgrades and faced challenges with failing infrastructure, increased operational costs, a lack of proper management, and increasing consumer distrust in the public water system (PWS). A Louisiana Rural Water Association (LRWA) EPA Technical Assistance and Training Specialist had provided technical assistance to R-MV Water System through the years. The ongoing technical assistance included: onsite visits, telephone calls, emails, text messages, and conference calls with the Louisiana Department of Health (LDH), U.S. Department of Agriculture (USDA) Rural Development, Louisiana Delta Resource, R-MV Water System, Sabine Water District #1 (SWD#1), and other agencies.

Problem

R-MV Water System operated with marginal long-term maintenance and struggled to conduct adequate repairs. Subsequently, R-MV incurred MCL violations under the Disinfectants and Disinfection Byproducts Rules (DBPRs) resulting from failures in treatment processes. In December 2016, the main water tank at the R-MV Water System treatment plant sprung holes, leaving consumers without an adequate supply of water. This situation continued throughout the winter. The Red Cross stepped in and provided bottled water to Robeline and Marthaville residents.

“You can’t wash your dishes. You can’t do your laundry. You can’t flush your toilet. You can’t wash your face,” one Robeline native lamented.

Working with a LRWA EPA Technical Assistance and Training Specialist, R-MV Water System sought a solution for its failing system. Repairing the entire PWS would cost $3,000,000, shifting an additional cost of $20/connection/month to the consumer. As a result of this high cost, R-MV Water System settled on a different solution: constructing three connections to a neighboring water system at a cost of $370,000.

Response

On April 24, 2017, proxies designated by the R-MV Water System board to represent the community voted 127-5 to merge with SWD#1. Four months later, SWD#1 also approved this merger, and the paperwork to transfer the ownership of R-MV Water System to SWD#1 was signed on September 28, 2017. SWD#1 put the construction project to interconnect the PWSs up for bid, and construction began shortly after the merger was finalized. In April 2018, SWD#1 began flowing water through the R-MV Water System water mains. The residents of Robeline and Marthaville saw water quality improvements in a matter of days. LRWA has continued to provide follow-up technical assistance with SWD#1, and they are working together to improve treatment processes, increase water production, and expand the distribution system, which includes a proposal to acquire the Ajax Beulah Water System.

Cost

Three points of connection were added between the R-MV Water System and SWD#1. The project cost a total of $370,000, the majority of which can be attributed to the planning and construction of the interconnections. The

State of Louisiana Community Water Enrichment Fund (CWEF) contributed $250,000, and SWD#1 contributed $120,000. SWD#1 also acquired approximately $75,000-$100,000 of existing debt from the R-MV Water System, which it was able to pay off after the two systems were connected. The merger was assisted by staff from LRWA, LDH, Delta Regional Authority, USDA, and local planning commissions. The rates for R-MV Water System consumers have not increased, and SWD#1 has since lowered the installation fee of a residential water meter from $1,000 to $600.

Case Study 2 – Hillview Water Co.

Where:	California
PWS type:	CWS HSNC
Population served:	307
Water Source:	Ground Water
Owner type:	Private
NPDWR Issue:	Arsenic, Radionuclides
Source:	California State Water Resources Control Board - Division of Drinking Water

Background

In 2017, the State Water Resources Control Board (SWRCB) launched the website, the Human Right to Water Portal, to help the public understand what is at stake and find resources related to a powerful mandate: that every Californian deserves safe and affordable drinking water.

The SWRCB Portal provides stories of water systems overcoming obstacles to deliver healthy water to their customers. The Hillview Water Co. (HWC) based in Oakhurst, California is such an example.

HWC had the perseverance to bring a long-ailing system out of the doldrums and into compliance. It was a 25-year odyssey replete with delays, failed tests, and frustration, but also with teamwork, public outreach, transparency, and commitment.

Problem

For years, the water provided by the HWC from the Oakhurst/Sierra Lakes wells exceeded the maximum contaminant levels (MCLs) for uranium and arsenic. Working with the SWRCB, HWC dealt with a freeze on Proposition 50 funding, and used grants and loans via the SWRCB's Division of Financial Assistance and Division of Drinking Water (DDW) to work slowly but surely to turn things around.

Supplying water to Oakhurst and Raymond in Madera County in the central part of the state, HWC had long been out of compliance for uranium. When the MCL changed for arsenic in 2006, its water exceeded legal levels for that as well.

Response

The HWC success story, says Kassy D. Chauhan, a senior sanitary engineer with the SWRCB, "highlights some of the challenges you encounter when you can't just go out and pay for a project on your own. When things take that long, the rules change, and the players change – and that in itself is a challenge."

"When things go on that long [24 years], you get a lot of skepticism from rate payers. But they overcame a lack of trust from the community," added Chauhan.

HWC made a commitment to its customers – if you agree to a rate increase, the water company will make good on its pledge to bring itself into compliance once and for all.

In early March of 2019, Hillview finally had a chance to tout some good news – 25,000 feet of new water lines; a state-of-the-art treatment plant that removes arsenic, iron, and manganese from the water at a 1,200 gallons- per-minute clip; a uranium removal system operating at 1,000 gallons a minute; eight new wells, six new water tanks holding over 1 million gallons of finished water, and much more.

HWC President Roger Forrester said, "When we began the process of looking for solutions to our water contamination problems and sources of funding, it never entered my mind that it would take 24 years before the problems would be 100 percent resolved. We never gave up and continued to pursue every avenue to make sure the problems would be solved."

"I'm overjoyed that our long journey is now at an end with the completed projects better and larger than when we first began. We are proud of our hardworking HWC staff; thankful for the outstanding contractors we've had; and grateful to the Water Boards for supporting us through thick and thin, and to our customers for their patience."

Cost

The ambitious project took 12 years and $19 million, but it now "sends a message of hope," said Chauhan. "I could give you the names of 10 other water systems where they are wondering – 'Are we ever going to get to the end of the road?'."

Case Study 3 – College View Park

Where:	Nebraska
PWS type:	CWS HSNC
Population served:	150
Water Source:	Ground Water
Owner type:	Private
NPDWR Issue:	Nitrates
Source:	Rural Community Assistance Partnership

Background

Disadvantaged communities face many of the same challenges as small PWSs, but they often lack the labor and financial resources needed to maintain TMF capacity (USEPA, 2011b).

College View Park is a low-income (median household income $25,210), mobile home park northeast of Columbus, Nebraska. It is comprised of 66 connections.

Problem

College View Park had been found in violation of requirements to submit samples and complete paperwork for several years under a previous owner for several rules including the Arsenic and Inorganic Chemicals Rules, Ground Water Rule, Revised Total Coliform Rule, and Disinfectants and Disinfection Byproducts Rules. They were served with an Administrative Order to correct violations of the Nitrates standard. The Nebraska Department of Health and Human Services (NE DHHS) asked Midwest Assistance Program (MAP, a Rural Community Assistance Partnership (RCAP) member) to assist the new owner to return to compliance and work through the Administrative Order.

Response

MAP staff assisted the new owner and newly hired operator with completing all outstanding tests and public notices of violation. Outstanding paperwork was completed and submitted to the NE DHHS. Testing was administered to clear College View Park from an Administrative Order for Nitrates. With MAP’s assistance this low-income mobile home park returned to compliance for sampling and paperwork challenges. MAP helped them to accomplish the removal of the Administrative Order for Nitrates. The residents of this community are now being provided safe drinking water.

Cost

RCAP technical assistance projects, for approximately 80 hours of support, cost $8,000 on average to complete. These costs are typically paid for through federal grant programs from U.S. Department of Agriculture, EPA, and U.S. Department of Health and Human Services. If technical assistance projects are not completed in the first year and rolled over for additional assistance, the cost would subsequently increase. Many of these services would otherwise have to be paid for by the system to a contractor/consultant at a much higher rate.

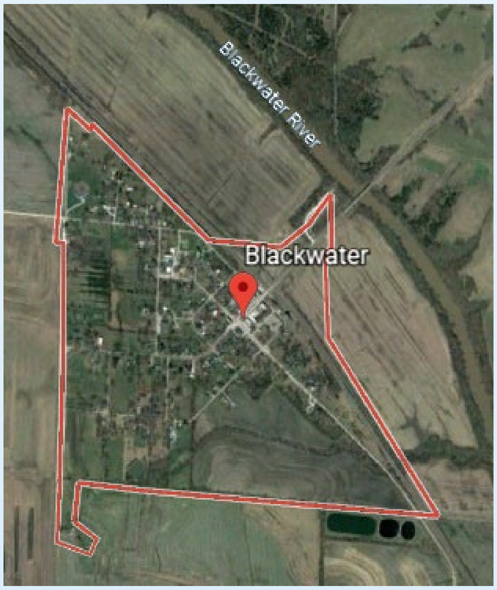
Case Study 4 – Blackwater

Where:	Missouri
PWS type:	CWS HSNC
Population served:	162
Water Source:	Ground Water
Owner type:	Local Government
NPDWR Issue:	DBPRs
Source:	Rural Community Assistance Partnership

Background

The city of Blackwater is a small rural community located in northwest Cooper County near the boundary with Saline County in the historic Arrow Rock area of Missouri. The city received funding from U.S. Department of Agriculture (USDA) Rural Development in 2004 to make significant improvements to their drinking water distribution system, while continuing to purchase their source water from a nearby city through a rural water supply district.

Problem



Several years ago, turnover within city government resulted in a failure to submit the required annual financial reports to USDA Rural Development, while the system also incurred maximum contaminant level (MCL) violations of the Disinfectants and Disinfection Byproducts Rules (DBPRs). The city is a consecutive system that purchases treated ground water for distribution to its customers. Blackwater was eventually referred to the Rural Community Assistance Partnership (RCAP) member Midwest Assistance Program (MAP), by a USDA Rural Development Area Specialist for assistance with catching up on the financial reports. Following initial contact with the city clerk, the technical assistance (TA) provider decided that Blackwater would also need more extensive assistance with budgeting and accounting.

Response

MAP staff initially established a working relationship with the city in February 2017. Through USDA's Rural Development Technitrain Program funding, RCAP builds local capacity through water and wastewater training and technical assistance in technical, managerial, and financial (TMF) topics for existing and potential USDA borrowers. Through the availability of RCAP's USDA Technitrain Program funding, an initial TMF assessment of the system was conducted in 2017 and the technical assistance project was finalized in August 2018. When comparing the initial and completed TMF assessment, it was clear that there were improvements in a number of key performance areas, in particular in the financial capacity category. This was in large part due to efforts from both the City and MAP. The required financial documentation was submitted to the federal funding agency, which put the City back in good standing with USDA. This action also allowed for the development of processes and policies that encouraged proactive planning for future system upgrades. Simultaneously, the TA provider focused on ensuring the city's water was compliant with Safe Drinking Water Act (SDWA) standards following the treatment plant improvements by the supplier and also addressed some minor wastewater operations issues to maintain compliance with the Clean Water Act (CWA). Through MAP's help, the city of Blackwater is now compliant with USDA Rural Development reporting requirements, has addressed some minor wastewater operations issues to maintain compliance with the CWA, and is better-positioned to address improvements by their water supplier.

Cost

RCAP technical assistance projects, for approximately 80 hours of support, cost $8,000 on average to complete. These costs are typically paid for through federal grant programs from USDA, EPA, and U.S. Department of Health and Human Services. If technical assistance projects are not completed in the first year and rolled over for additional assistance, the cost would subsequently increase. Many of these services would otherwise have to be paid for by the system to a contractor/consultant at a much higher rate.

Case Study 5 – Jones Co-op Water Association

Where:	Arizona
PWS type:	Small CWS
Population served:	35
Water Source:	Ground Water
Owner type:	Private
NPDWR Issue:	Arsenic
Source:	Arizona Department of Environmental Quality

Background

The Jones Co-op Water Association (JCWA) is a small community of residential homes located in the unincorporated area of Yuma County, just outside of Yuma, Arizona. There are currently 21 homes in the development with 17 homes served by the JCWA and four homes served by the City of Yuma Utilities Administration. Residents are primarily low-income families and retirees on fixed incomes. The public water system (PWS) consists of one active well, a storage tank, a booster pump, a pressure tank, and the distribution pipes. JCWA had their first arsenic maximum contaminant level (MCL) exceedance in January 2016, when arsenic was measured at 0.013 mg/L. (The federal arsenic MCL is 0.010 mg/L.)

Problem

The Drinking Water Technical Assistance Program tasked KUV Consultants, LLC to evaluate cost-effective treatment options. Several options were considered, including drilling a new well, centralized arsenic treatment, point-of-use devices, and connecting to the City of Yuma water system. Installing point-of-use devices at the kitchen sink in each home was the least cost solution to comply with the arsenic drinking water standards. KUV was tasked to prepare the "Approval to Install" application. Jones Co-op Water Association was the first PWS that Arizona Department of Environmental Quality (ADEQ) recommended to receive a $9,500 grant from the Small Drinking Water Systems Fund to purchase and install the arsenic treatment units. ADEQ worked with the PWS owner to approve the installations and modify the start-up monitoring to save sampling costs.

Response

As of March 5, 2019, all customers are receiving water that meets the arsenic MCL through a relatively low-cost treatment option – point-of-use devices.

Cost

The point-of-use devices cost $9,500. The water system received a grant from the Small Drinking Water Systems Fund to purchase and install the treatment units for arsenic.

Case Study 6 – Barnet Fire District #2

Where:	Vermont
PWS type:	Small CWS
Population served:	205
Water Source:	Ground Water
Owner type:	Local Government
NPDWR Issue:	TCR, GWR
Source:	Rural Community Assistance Partnership

Background

Despite recent source water and treatment plant improvements made by Barnet Fire District #2 (BFD2), maintaining regulatory compliance is a real challenge – as it is for many rural communities. The water system, which serves about 205 customers, had been under a boil-water advisory since 2004 due to long-term source water deficiencies.

Problem

BFD2 lacks adequate technical, managerial, and financial capacity to address the many challenges facing small water systems. Despite recent source water improvements, the system struggled to maintain compliance with both the health-based and monitoring and reporting requirements of the Total Coliform Rule (TCR) and Ground Water Rule (GWR), address distribution system deficiencies, and lacked financial capacity to build up reserves for future system improvements.

Response

In 2014, members of the community expressed a desire to acquire the system from its private owner, and Rural Community Assistance Partnership (RCAP) facilitated several steps in this process. The goal of the purchase was to give the community more control over the fate of its water system. As a publicly owned water system, BFD2 would be able to access federal funding sources for long overdue improvements.

In February of 2017, BFD2 completed a major source water improvement project. This should have marked an important milestone for the community, as they were able to lift the decade-old boil water advisory following the improvements and installation of a new disinfection system. Unfortunately, it was not the end of their infrastructure concerns. Frequent distribution system failures were crippling the system's operating budget. To address issues in the distribution system, RCAP provided an action plan to the board which included the recommendation to apply for a planning grant to prioritize water main replacement – including the replacement of a critical, aging water main crossing a river in the village. In addition to securing a planning grant, the board would need to gain the support and trust of the community for any new projects. For a system the size of BFD2, taking on more debt was a likely scenario considering a lack of reserves and continuing infrastructure concerns. For the system's board, it was more important than ever to build on the achievements of the source water improvement project in order to generate community support for future needs. Unfortunately, operational issues with the new chlorination system coupled with the lack of local capacity for diagnosing and resolving those issues contributed to a violation in late 2017 for failing to maintain adequate microbial treatment. After becoming aware of the treatment violation and continued problems with the chlorination system, RCAP responded after-hours to the treatment plant and spent the next day successfully reestablishing chlorine residual in the system. This action helped the system to avoid a second violation, which was critical. Every violation or misstep for the board reduced the likelihood that they would be able to gain the community trust necessary for future improvements. In the weeks that followed, RCAP provided practical guidance to the system's operator and treatment plant engineer on how to improve the treatment system. RCAP has also helped community members to identify common issues with their plant equipment and to provide the system's board members with the knowledge they need to maintain compliance with primacy agency and federal regulations. Upon resolution of the system's chlorine residual issues, RCAP closed out their technical work with the system, but continues to support them in building local managerial and financial capacity.

Cost

Significant funding was secured from EPA Training and Technical Assistance Grant and the U.S. Department of Agriculture (USDA) Rural Development Technitrain Programs to provide technical assistance and training resources to this system. RCAP technical assistance projects, for approximately 80 hours of support, cost $8,000 on average. These costs are typically paid for through federal grant programs from USDA, EPA, and U.S. Department of Health and Human Services. Many of these services would otherwise have to be paid for by the system to a contractor/consultant at a much higher rate. Since BFD2 was provided with technical assistance that was funded under multiple grant programs simultaneously, the value of the services provided would be at least double, or $16,000 instead of $8,000. If technical assistance projects are not completed in the first year and rolled over for additional assistance, the cost would subsequently increase.

The system incurred significant debt to contractors to fix a serious main break emergency. A local church provided a $50,000 low-interest loan so that the water system could easily pay off those debts and maintain financial solvency. The system was also recently awarded a $27,000 forgivable loan from Vermont Department of Environmental Conservation (VT DEC) to develop an asset management plan and additional capacity building services including hydraulic modeling; a process which should help the system to better plan for asset replacement and prevent future infrastructure failures. The loan will be forgiven if it meets certain stipulations including the approval by the primacy agency of the final asset management plan submitted by the project consulting engineer.

Case Study 7 – Thunderbird Water Treatment Plant

Where:	Nevada
PWS type:	Small TNCWS
Population served:	90
Water Source:	Surface Water
Owner type:	Private
NPDWR Issue:	SWTR
Source:	Nevada Rural Water Association

Background

Thunderbird Lodge in Nevada had a membrane filtration system to treat water from Lake Tahoe. The Thunderbird Water Treatment Plant (WTP) was built by the previous site owner/manager, the University of Nevada Reno (UNR). The WTP was subsequently transferred to a historical preservation organization. The Nevada Division of Environmental Protection (NDEP) Bureau of Safe Drinking Water determined it is a public water system (PWS) based on the number of annual visitors to the lodge.

Drinking water programs must conduct periodic sanitary survey of all PWSs. In June of 2017, the Washoe County Health District and NDEP Bureau of Safe Drinking Water conducted a sanitary survey. Nevada Rural Water Association (NvRWA) also participated in the sanitary survey. During the sanitary survey, several significant deficiencies were identified at the Thunderbird WTP.

Problem

The 2017 sanitary survey of the Thunderbird WTP identified the need to comply with several Surface Water Treatment Rule (SWTR) requirements. These requirements included continuous monitoring and recording for turbidity, disinfectant residual, pH, and temperature. The survey also found that the PWS needed to determine the CT (residual disinfectant concentration x disinfectant contact time) achieved through disinfection.

Response

The NvRWA worked with the Thunderbird WTP to help them achieve compliance and correct the deficiencies identified during the sanitary survey. First, the NvRWA worked with the site manager to find suitable monitoring equipment. The staff then installed a turbidimeter, pH monitor, and temperature gauge, and arranged for a manufacturer to calibrate the equipment. Next, the NvRWA helped the system determine CT for virus inactivation. To do so, NvRWA visited the site again to evaluate and measure the system's contact tank and piping. Using that information and the temperature and pH data from other Lake Tahoe PWSs, NvRWA determined that CT for virus removal could not be met without using excessive amounts of disinfectant. NvRWA provided guidance, and the Thunderbird WTP was able to obtain validation from the manufacturer that membrane filtration would provide sufficient log removals to meet the SWTR requirements for turbidity. NvRWA also found an engineer to work pro-bono to design additional concentric-flow contact tanks. The Thunderbird WTP staff then installed the tanks.

After the additional contact tanks were installed and upon request by the NDEP Bureau of Safe Drinking Water, the NvRWA conducted a CT study. This request was made to NvRWA in part because they were an external third party, had the expertise, and were able to conduct the study at no cost to the PWS. The tracer study was required to be completed before the lodge opened for the season, in order for the PWS to be fully permitted for operations and avoid a boil water order during the busy season.

The NvRWA designed the tracer study, brought testing equipment, and assisted Thunderbird WTP staff in conducting the study. Using EPA guidance manuals, a tracer study protocol and data sheet were developed. NvRWA, system staff, and the engineer conducted two analysis runs and submitted a report for approval. As a result of the study, the PWS was able to establish the detention time through the revised disinfectant contact system. NvRWA worked with the system operator to ensure that the chlorine dose was calculated to meet the CT for 4-log virus inactivation and provide a disinfectant residual throughout the distribution system. The system was approved to distribute water in time for the Thunderbird Lodge seasonal opening in May 2019.

Cost

Because NvRWA assistance came at no cost to the Thunderbird WTP, and because the engineer worked pro-bono, this project came at no cost to the Thunderbird WTP. The technical assistance that NvRWA provided had a value of approximately $4,000 which covered technical assistance, labor, and travel. Had this work been completed by a consultant, the cost of the project is estimated at $10,000. In addition to completing this work at a cost savings, Thunderbird WTP staff gained a deeper understanding of their water system, tracer studies, log removal, and concentration and detention times. The staff can use this knowledge in the future to continue supporting their water system.

Case Study 8 – Painted Apron, Orchard Hill Estates, and Scott Acres Water Company – Enforcement Approach

Where:	New York
PWS type:	CWS
Population served:	463
Water Source:	Ground Water
Owner type:	Private
NPDWR Issue:	TCR
Source:	EPA Region 2 Enforcement and Compliance Assurance Division

Background

Three very small, privately owned community water systems (CWSs) in Orange County, New York, were identified as priority systems through EPA's routine quarterly Enforcement Targeting Tool (ETT).

Problem

Three small public water systems (PWSs) in Orange County, New York had been cited for multiple violations ranging from the failure to monitor and/or report information for multiple rules, to the failure to maintain an adequate level of treatment, and the occurrence of *E. coli* in the distribution system, a health-based violation of the then Total Coliform Rule (TCR). The pattern of non-compliance lasted for over five years prior to EPA's involvement. Boil water orders were issued as early as 2007 and county/local government agencies were unable to resolve the problems. The CWS owners were not responsive to the regulatory agencies, expressing the desire to "walk away" from the water systems. However, the owners were not pursuing the appropriate steps to complete valid transfers of ownership or taking actions to ensure continued operation of the systems. Ultimately, the owners walked away, the water systems were abandoned, and the communities were left without a safe, reliable source of drinking water and forced to boil their water for an indefinite period of time.

Response

In July 2011, the New York State Department of Health referred the cases to Region 2 for appropriate action. Region 2 subsequently issued SDWA administrative orders. The owners of the CWSs did not respond to the administrative orders, and the cases were referred to the U.S. Department of Justice (DOJ). EPA initially thought that a court-ordered receivership at each of the water systems would be the path to compliance. EPA then identified another approach - opening the lines of communication among various governmental agencies and members of the community in order to use existing authority at the lowest level of government to solve the problem. The state's Public Service Commission (PSC) had authority to appoint a temporary operator; a temporary operator is a responsible party that can manage and oversee operations of the PWS.

Between 2012 and 2013, EPA and DOJ met with state and local officials, community leaders, larger water utilities, and technical assistance providers to identify potential solutions and investigate alternative options for short-term operation of these smaller water supplies. With the help of this group, receivers (temporary operators) were found for all three systems.

Initially, EPA met with the municipalities where the systems were located to ascertain whether the municipality would be willing to take over the system. It became clear that in one case, local politics were a barrier to a resolution. The involvement of DOJ elicited the attention of state and local officials, community members, and the absentee owners. The Town began to take steps to submit a petition for PSC appointment to become the temporary operator. The team was successful in reaching an agreement with one of the absentee owners through a judicial consent decree that stipulated he could never hence own or operate a water system.

In the other two cases, the team worked to encourage members of each community to form an entity to create a sense of responsibility and "ownership" of their water supply. These two systems were owned by the same person who passed away during the period of involvement by EPA, DOJ, state and local officials, and community leaders. Therefore, no enforcement action could be pursued to the owner. All three systems are now in compliance.

8. Recommendations

As noted in the EPA publications referenced throughout this report, PWSs that acquire and maintain TMF capacity are more likely to achieve long-term sustainability and regulatory compliance. Evident in the data and case studies presented in this report, each system has a unique combination of TMF capacity barriers that contribute to persistent non-compliance with drinking water regulations. As such, achieving compliance requires a unique combination of strategies and diverse implementation tools.

Consistent with past analyses on PWS compliance with drinking water regulations, small systems serving 3,300 or fewer people historically have the highest reported violation rates in drinking water regulations. As reflected in this report, small systems like the HSNCs continue to disproportionately incur violations and struggle with maintaining compliance nationally.

The goal among the many studies conducted on small system compliance with drinking water regulations has been to identify primary reasons for non-compliance and develop tailored solutions. EPA recommends a non-prescriptive approach that facilitates collaboration across state drinking water programs and agencies that focuses attention on the PWS's attainment and maintenance of its TMF capacity. Recognizing the individual characteristics and unique challenges small PWSs face, the approach for addressing non-compliance will vary. The 1996 SDWA Amendments emphasize a holistic approach to the protection of public health and prevention of drinking water contamination. State programs and PWSs have different needs and resources. Therefore, EPA's recommendations involve the incorporation of various strategies (listed below), many of which EPA and primacy agencies are already implementing.

As noted in the EPA publication – *Public Water System Historical Significant Non-Compliers: National Trends Report* (USEPA, 2010), there are currently many tools and approaches, including formal enforcement, to help systems attain and maintain TMF capacity and engage or identify alternatives for systems where the owner or operator are unable or unwilling to provide safe and adequate service. Best practice approaches are also detailed in the EPA publication: *Re-Energizing the Capacity Development Program Findings and Best Practices from the Capacity Development Re-Energizing Workgroup* (USEPA, 2011a) as well as in the findings of the Non-Community Water System Workgroup.

EPA encourages the use of the following programs, tools and concepts. The extent of use will vary by primacy agency. The discussions below include links to EPA and USDA websites that provide additional information about pertinent programs and resources.

State Capacity Development Programs – The focus of these programs is to assist systems to develop and maintain the TMF capacity to ensure public health protection. State Capacity Development programs have been critical in addressing the small system challenges across the nation. Primacy agencies evaluate the capacity of new water systems to ensure non-viable systems are not added to the inventory and continuously assess existing systems to ensure they maintain their capacity or provide the assistance needed to attain capacity. For more information about EPA programs and resources, visit https://www.epa.gov/dwcapacity/capacity-building-program-management-drinking-water-systems. USDA Rural Development's Circuit Rider Program can also assist with TMF capacity development. For more information, visit https://www.rd.usda.gov/programs-services/water-environmental-programs/circuit-rider-program-technical-assistance-rural-water-systems.

Asset Management – Managing assets (e.g., buildings, equipment, pipes, and operators) ensures that a system gets the most value from each of its assets, has the financial resources to rehabilitate and replace them when necessary, and can reduce costs while increasing the efficiency and the reliability of a system. EPA has developed a number of resources to support small systems. For more information, visit https://www.epa.gov/dwcapacity/asset-management-resources-states-and-small-drinking-water-systems.

Section 2012 of AWIA requires that state capacity development strategies include a description of how the state will, as appropriate, "encourage development by PWSs of asset management plans that include best practices for asset management" and "assist, including through the provision of technical assistance, PWSs in training operators or other relevant and appropriate persons in implementing such asset management plans." For more information, visit https://www.epa.gov/dwcapacity/implementation-capacity-development-program-related-safe-drinking-water-act-amendments.

Drinking Water State Revolving Fund – Under this program, state agencies use funds to provide loan assistance, as well as additional subsidy in the form of principal forgiveness, negative interest loans, and grants, to PWSs for infrastructure improvements to ensure safe drinking water. States have the option of taking a variety of set-asides. These set-asides help fund state programs and activities to ensure safe drinking water, including targeted assistance to small water systems. For more information on the Drinking Water State Revolving Fund, visit https://www.epa.gov/dwsrf, and for more information regarding set-asides, visit https://www.epa.gov/dwcapacity/use-drinking-water-state-revolving-fund-dwsrf-set-asides. USDA Rural Development's Direct Water & Waste Disposal Loan and Grant Program can be utilized in conjunction with the Drinking Water State Revolving Fund. For more information, visit https://www.rd.usda.gov/programs-services/water-environmental-programs/water-waste-disposal-loan-grant-program.

Funding Collaboration – Funding collaboration involves the deliberate coordination and careful targeting of available funding sources to achieve maximum efficiency and derive the most benefit from each dollar spent. Many primacy agencies have found that coordinating drinking water infrastructure funding with other departments and agencies allows them to stretch limited funding dollars and support a greater number of projects. Some primacy agencies have also found that this improves their ability to communicate with and provide assistance to PWSs, and offer better overall support to their PWSs (USEPA, 2012).

Primacy agencies have come up with many simple and innovative ways to coordinate funding, from holding quarterly meetings to utilizing statewide pre-application forms. While primacy agencies have had to invest time to establish these coordinated activities, many have found the payback is highly rewarding and feel that they are better able to maximize their funds and support more high priority projects. For more information, visit https://www.epa.gov/dwcapacity/drinking-water-program-collaboration-resources-states.

Water Efficiency, Water Availability for Water Suppliers, and Water Reuse – There is limited freshwater is available for consumption. As a result of population growth, greater competition for resources, and climate considerations, drinking water suppliers will increasingly need to adopt best industry practices for water efficiency as well as new strategies that adjust for variable water quantity and quality, and in some cases, this may include potable water reuse. For more information, visit https://www.epa.gov/sustainable-water-infrastructure and https://www.epa.gov/waterreuse. The Drinking Water State Revolving Fund and USDA Rural Development's Direct Water & Waste Disposal Loan and Grant Program can provide funding for a system to make improvements that help support these objectives. For more information, visit https://www.epa.gov/dwsrf and https://www.rd.usda.gov/programs-services/water-environmental-programs/water-waste-disposal-loan-grant-program.

Operator Certification Program and Workforce Development – Recruiting, training and certifying water system operators is vital to the capacity and long-term sustainability of a water system. EPA has developed various materials on improving water system operation and developing experienced operators, including information on apprenticeship and training programs. There are also resources for managers such as an updated "Water Operator Hiring and Contracting Guide" and tools to help small drinking water systems improve knowledge retention as employees retire or leave the system. For more information about EPA programs and resources, visit https://www.epa.gov/dwcapacity/learn-about-workforce-issues. For information about opportunities for operator certification training, workforce development training, and apprenticeship programs available through USDA Rural Development's Technical Assistance and Training Grant Program, visit https://www.rd.usda.gov/programs-services/water-environmental-programs/water-waste-disposal-technical-assistance-training-grants.

Water System Partnerships and Restructuring – Partnerships provide opportunities for collaboration on compliance solutions, operations, and maintenance activities, and to share costs with other nearby systems. This collaboration can increase capacity, enable water systems to provide safe and affordable water, and enhance compliance by leveraging existing resources. Partnership options range from sharing equipment or bulk purchasing to transferring ownership of water systems. Water systems facing continuous compliance problems should consider a water system partnership, which involves changes to the operational, managerial, or institutional structure of a water system, sometimes referred to as water system restructuring. EPA has developed an interactive website that highlights different types of partnerships and associated case studies. For more information, visit https://www.epa.gov/dwcapacity/water-system-partnerships. The Drinking Water State Revolving Fund and USDA Rural Development's Direct Water & Waste Disposal Loan and Grant Program can provide funding for ownership transfers and system acquisitions. For more information about these programs, visit https://www.epa.gov/dwsrf and https://www.rd.usda.gov/programs-services/water-environmental-programs/water-waste-disposal-loan-grant-program.

Formal Enforcement – As noted in the *Public Water System Historical Significant Non-Compliers: National Trends Report* (USEPA, 2010), EPA recognized the need for a comprehensive, targeted approach that enables for the prioritization of enforcement against PWSs. In 2009, EPA introduced an ERP and ETT that would assign each violation a number of points based on the threat to public health. Any PWS with a threshold number of points is recognized as a priority system. If a priority system is not returned to compliance within a designated timeframe, it may be subject to a formal enforcement action. The ERP can be found at https://www.epa.gov/sites/production/files/2015-09/documents/drinking-water-erp-2009.pdf. For example, an HSNC system may be able to leverage an enforcement action to access funds for infrastructure upgrades or go into receivership when the owner or operator is unable or unwilling to provide adequate service.

Technical Assistance – In addition to primacy agencies, many organizations across the country provide technical assistance to small systems. Primacy agencies can help identify a technical assistance provider. For help in this selection, visit https://www.epa.gov/dwcapacity/capacity-development-resources-states-and-small-systems.

Not all best practices or ideas, programs or tools, will be applicable to all primacy agencies in meeting the challenges of small system compliance. EPA continues to work in partnership with primacy agencies and third-party technical assistance providers to understand existing compliance challenges, evaluate roadblocks to building water system capacity, and identify and facilitate the sharing of best practices. This approach can lead to targeting the assistance needed to help small systems attain and maintain compliance with drinking water regulations to put them on a path toward long-term TMF capacity.

9. Acronyms

AWIA	America's Water Infrastructure Act of 2018
CDC	Centers for Disease Control and Prevention
CWA	Clean Water Act
CWS	Community Water System
DBPRs	Disinfectants and Disinfection Byproducts Rules
DOJ	U.S. Department of Justice
EPA	U.S. Environmental Protection Agency
FBRR	Filter Backwash Recycling Rule
GWR	Ground Water Rule
HHS	U.S. Department of Health and Human Services
HSNC	Historically Significant Non-Compliers
IESWTR	Interim Enhanced Surface Water Treatment Rule
ILA	Interlocal Agreements
LCR	Lead and Copper Rule
LT1ESWTR	Long Term 1 Enhanced Surface Water Treatment Rule
LT2ESWTR	Long Term 2 Enhanced Surface Water Treatment Rule
M&R	Monitoring and Reporting
MAP	Midwest Assistance Program
MCL	Maximum Contaminant Level
MRDL	Maximum Disinfectant Residual Level
NCWS	Non-Community Water System
NPDWR	National Primary Drinking Water Regulations
NTNCWS	Non-Transient Non-Community Water System
O&M	Operations and Maintenance
PWS	Public Water System
RCAP	Rural Community Assistance Partnership
RTCR	Revised Total Coliform Rule
SDWA	Safe Drinking Water Act
SDWIS-Fed	Safe Drinking Water Information System Federal Reporting Services
SOC	Synthetic Organic Contaminant
Stage 1 DBPR	Stage 1 Disinfectants and Disinfection Byproducts Rule
Stage 2 DBPR	Stage 2 Disinfectants and Disinfection Byproducts Rule
SWTR	Surface Water Treatment Rule
SWTRs	Surface Water Treatment Rules (SWTR, IESWTR, LT1ESWTR, LT2ESWTR)
TA	Technical Assistance
TCR	Total Coliform Rule
TMF	Technical, Managerial, and Financial
TNCWS	Transient Non-Community Water System
TT	Treatment Technique
USDA	U.S. Department of Agriculture
USDA RD	USDA Rural Development
VOC	Volatile Organic Contaminant

10. References

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