Rural Water Manager Challenges in New Mexico

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RURAL WATER MANAGER CHALLENGES IN NEW MEXICO
MASTER’S PROFESSIONAL PROJECT

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This document is submitted in partial fulfillment of the requirements for the degree of Master of Water Resources, Water Resources Program, University of New Mexico
Acknowledgements Page

First, I would like to acknowledge and thank my esteemed committee. Dr. Ben Warner, Professor John Fleck, and Dr. Caroline Scruggs were instrumental in making sure my edits improved this professional project, focused the topic, and that additional insights were explored.

I would also like to thank Dr. Becky Bixby, the Director of Water Resources, for her encouragement and advice in getting to the finish line.

Another big thanks to my research colleague and friend Tucker Colvin for inviting me to beers one night to discuss this grand idea with him and Ben, and for being so great to work with.

My road trips all over the state wouldn’t have been as fun or feel as safe without my three road trip companions, each of our pups, taking turns loading up and hitting the road. So, thanks to Haruko, Kumiko, and Hudson.

And last, never least, my spouse Renee Ortiz, for everything along the way. The pep talks, the food set in front of me when I didn’t leave my desk for six hours straight, and for supporting my dream of being the first college graduate in my family - even though it took a few extra years. I will be forever in gratitude to these folks and many more.
### Table of Contents

Abstract .................................................................................................................. 4 
Introduction ........................................................................................................... 5 
Background & Literature Review ........................................................................... 9 
  - New Mexico .................................................................................................... 9 
  - Public Water Sourcing ................................................................................... 14 
  - Water Source Contamination & Regulation .................................................. 16 
  - Regulation & the SWDA .............................................................................. 18 
  - Public Drinking Water Systems .................................................................. 21 
  - Rural Community Drinking Water Systems ............................................... 22 
  - CWS Management Challenges .................................................................. 25 
Research Questions ............................................................................................... 29 
Methods .................................................................................................................. 31 
Results .................................................................................................................... 34 
  - Manager Challenges .................................................................................... 35 
  - Manager Motivations .................................................................................... 69 
Discussion .............................................................................................................. 79 
  - Delivering Safe Water .................................................................................. 79 
  - Overburdened and Underfunded .................................................................. 82 
  - Rural Retainment .......................................................................................... 84 
  - Local Sovereignty ......................................................................................... 86 
  - Connecting Challenges and Motivations ....................................................... 87 
Conclusion .............................................................................................................. 90
Abstract

New Mexico poses a valuable set of circumstances to study the challenges faced by drinking water systems. A general lack of resources for small systems, be it personnel and funding issues, lack of community engagement, lack or loss of institutional knowledge, ability to meet regulations, and aging managers were found to be very common and widespread. Rural water manager positions that are unsupported financially do not assist in alleviating rural poverty or draw the workforce. Therefore, the negative state demographic statistics are reinforced, further complicating rural water management rather than helping the issues. To look at drinking water management comprehensively, I interviewed managers to grasp what their motivations and challenges were from their perspective. Manager motivations seemed oftentimes tied to challenges. Overall, helping rural water managers face the current challenges outlined in this study behooves asking what motivates them to meet those challenges. It also requires understanding their motivations to meet future challenges. Understanding that these two themes are intersecting is key to increasing resiliency in small and rural community water systems.
Introduction

New Mexico poses a valuable set of circumstances to study the challenges faced by drinking water systems. Though water systems nationwide are experiencing threats, New Mexico is uniquely situated to lend additional insights into overlapping issues. Low population density complicates providing for the basic health needs and services of communities like drinking water. Nearly 80% of the counties in the state are considered rural. For rural areas in the state, poverty is higher, income and educational opportunities are lower, and populations are decreasing for the workforce and younger generations. The decreasing population density of most of the state will continue to put strain on providing services to rural areas.

There are over a thousand public drinking water systems in New Mexico according to the state database, with more than 60% of community drinking water systems being in rural counties. Public drinking water systems can serve as few as “15 service connections or that regularly serve at least 25 people” and serve those “individuals daily for at least 60 days out of the year” (Tiemann 2014, NMED 2022). Connections in rural areas of New Mexico average half as many connections per system compared to metro areas.

All drinking water systems must meet state and federal drinking water standards and be run by a certified operator (NMED 2022). Within these systems, there are multiple organizational structures; private and public systems, non-profit and for profit, and several different institutional arrangements for governing and management staff. Being a geographically rural state, New
Mexico has a higher-than-average number of rural water users (Drinking Water Watch). These systems confront a variety of challenges, as do the managers overseeing the operations.

Rural water system managers face a lack of resources and personnel, environmental and infrastructure challenges, population fluctuations, public relational issues, arduous regulation, and more, while managing these small systems. Managers are often volunteer or work from small stipends yet are motivated to assist their rural communities despite the vulnerability of their systems. Rural water manager positions that are unsupported financially do not assist in alleviating rural poverty or draw the workforce. Therefore, the negative state demographic statistics are reinforced, further complicating rural water management rather than helping the issues.

Additionally, New Mexico has been noted as an area in the nation with an increase in regulatory violations and contaminants. These are both naturally occurring, and human caused contaminants. Regulatory violations include a high number of reporting violations in New Mexico, especially in rural areas. Water sourcing in New Mexico is also more uncommon compared to other states. These issues are important to examine simultaneously with all the other challenges small, rural drinking water systems face to obtain a more wholistic understanding. It is important to investigate the motivations behind how drinking water is being managed in the face of all these challenges as well.
This research project investigates the challenges and experiences of rural drinking water managers across New Mexico, as they run small systems, managing water with severe threats. The research explores what motivates these managers for their unique and demanding roles, what their embedded constraints are in their position, and how they view their organization's and their own function of water management. The effort focuses on the managers themselves, hearing directly from rural water managers. To look at drinking water management comprehensively, I interviewed managers to grasp what their motivations and challenges were from their perspective.

For my methodology, the research approach was a modified grounded theory method and mixed methods of both qualitative and quantitative data. Qualitative data consisted of 33 interviews, transcribed, and then coded using qualitative research software. Quantitative data consisted of information from public databases such as demographics, and size, capacity, arrangement, and structure data about the water systems themselves.

My primary research questions are:

What motivates rural water managers to run their community systems?

What challenges do community drinking water system managers while running these small systems?

The results section of this study outlines the themes that emerged in the interviews and qualitative examination of the interviews. The key takeaway from this research is that manager motivations most often originate from the
challenges that rural water managers face. The discussion section elaborates on the results and concludes the key findings of this project.
Background & Literature Review

New Mexico

New Mexico is an inland arid land state with a lower population relative to its geographical size of 121,412 square miles. The highest elevation is at 13,161 feet on Wheeler Peak, the lowest lies at 2,842 feet at Red Bluff Reservoir, and the mean is 5,700 feet giving a ranking as the fourth highest state in the US (ESRI n.d.). New Mexico sits roughly between latitudes 32° and 37° N and longitudes 103° and 109° W and the minor precipitation received yearly comes from 500 miles west and southwest where the nearest oceans lie (WRCC 2022).

The tail end of the Rocky Mountain range ends in New Mexico and the Rio Grande River (third longest river in the US) runs the full length, cutting down the middle. West of the Rio Grande, the continental divide slices through the length of the state north to south too. There are dozens of additional rivers and streams that flow through the state, perennial, intermittent, and ephemeral. The climate also falls in line with other areas of the Rocky Mountains, especially in the north.

New Mexico is characterized by its blue skies with generous sunshine around 300 days per year. The state is also characterized by low humidity and precipitation, monsoons, high evaporation, and a wide range in temperatures. Pan evaporation ranges from 41 inches to 73 in the warmest six months of the year and potential evaporation is even greater if the maximum water was available for evapotranspiration (WRCC 2022). The Western Regional Climate Center notes rainfall in the late summer accounts for more of the overall yearly precipitation in much of the state, with 60-80% of the total average yearly
precipitation of 13 inches occurring during the warmest half of each year. Annual average precipitation in the state is under 10 inches in the south and over 20 inches in the north, with fluctuations as low as three inches and highs of 30 inches, historically (WRCC 2022).

According to the Western Regional Climate Center, the continental divide retains most winter precipitation from the Pacific Ocean to the west one third portion of the state, making central and eastern New Mexico driest in the wintertime. Mountainous areas also greatly influence the temperature extremes. Average temperatures in the high northern mountains are 40 degrees Fahrenheit or lower annually, while they average 64 degrees Fahrenheit in the southern plain of the state (WRCC 2022). Summers can frequently rise above 100 degrees in lowland areas but tend to hover around 70 degrees in the mountains and cool in the evenings and during summer storms (WRCC 2022). The elevation range, source of storm origin, and geography of New Mexico greatly influence the climate.

Although the state is the fifth largest state in the U.S. by land area, 26 out of 33 New Mexico counties are considered rural according to the 2020 US Census. While 65% of the state lives in metro areas within a few cities in seven counties, geographically, the majority of New Mexico has very low population density (HRSA 2020). Most of the land has less than fifteen people per square mile, with a state average of 17.5 persons per square mile (HRSA 2020, Bureau 2020). Low population density increases the difficulty of providing for the health
of communities. Rural areas tend to have lower access to services and water is one of those.

According to 2020 US Census Bureau, the state’s population is at over two million and increasing, with rural populations decreasing slowly. The decreasing population density of most of the state will continue to put strain on providing services to rural areas. From 2010 to 2020, 60% of the counties in New Mexico showed a declining population (Bureau 2020).

Any population growth in other rural counties was by people above the working age group and populations age 65 and older are already higher in New Mexico than other states (HRSA 2020). This also complicates and adds stress to providing services to rural communities, as the workforce leaves the communities and retired populations increase. The very workers who run the service systems or potential workers are leaving rural areas as service dependency is increasing in some areas. This applies to water management as well.

New Mexico is ranked high in affordability making it appealing for retirement. New Mexico is also a minority majority state. US Census estimates for 2021 show 50.1% of the state identifies as Hispanic or Latino, 11.2% as Native American, 2.7% as Black, 1.9% as Asian and 35.9% as white non-Hispanic. Over half of the population identified female (50.2%) and 18.5% of the population was 65 or older in 2021 according to the same estimates, which is over 1% higher than the national average. The state is also consistently high in poverty.
The poverty rate in New Mexico is 18.7% compared with a 12.3% rate nationally and household income averages $51,945 yearly compared to $65,712 nationwide according to the 2020 US Census estimates. Per-capita income for 2020 in urban areas was 5.6% higher than rural areas and the poverty rate was 15% higher in rural areas than urban for the state (USDA 2022). The US Department of Health and Human Services notes that “poverty is a root cause of many other health issues and inequities” and New Mexico continues to rank among the bottom five in the US for this measurement (HRSA 2020). Rural areas fair worse in several statistical measurements, such as educational attainment, poverty, and employment.

Only 11.9% of the state’s urban population reported not obtaining a high school diploma while in rural areas the percentage was much higher at 16.8% of people without a high school diploma in 2020 (Rural 2021). This education gap becomes even larger when comparing rural to urban areas of the populations who have completed college. The gap between urban and rural college graduation rates is 11.7%, with rural areas having a much lower college degree rate (USDA 2022).

These unfavorable statistics for rural New Mexico continue in the workforce as well. Unemployment in rural areas was 7.5% in 2021 as opposed to 6.5% in urban areas (Rural 2021). From 2017 to 2021 in New Mexico, 56.6% of the population was classified as potential labor force by the US Census as opposed to 66.6% nationally. Job opportunities differ generally between metro areas and
rural areas. New Mexico has seen populations continue to decrease in rural areas as populations move to cities for better employment opportunities.

Economic industries that support the workforce vary depending on location. Commonly oil and gas, agriculture, tourism, government, outdoor recreation, mining and logging, energy, and trade are cited as principal sectors of industry in New Mexico (WRCC 2022, Bureau 2020, BLS 2022). Sectors can be grouped roughly into rural or urban sectors, with natural resource-based industries primarily in rural areas, while government, tourism, and technology-based sectors tend towards metro centers.

This draws younger generations away from rural areas towards higher paying job opportunities and education. Labor that is more physically demanding also trends towards rural areas like logging, mining, and agriculture. Outdoor recreation could draw younger generations towards rural amenities, but it can take years to establish a stronghold in this industry to begin to employ a larger workforce within it. The amenities of the outdoors in New Mexico and the agreeable mild and dry climate does encourage retirement and second home purchases in rural areas, but these populations do not seek employment where they settle (WRCC 2022). Retirees and second home part-time residents do rely on public services and add to the needs of rural areas, while not expanding the work force.

Since many rural drinking water systems are run by volunteers or the compensation is low, there is less draw for younger generations to take on these positions instead of moving to metro areas for opportunities of employment and
education. Additional roles in water management such as being a certified operator for a system require technical education. Rural water manager positions that do not pay or pay well do not help to alleviate rural poverty either and do not attract the workforce. Therefore, the demographics of the state reinforce the complications of supporting rural water management.

Public Water Sourcing

Primarily, public drinking water systems service water for consumption in New Mexico. These drinking water systems obtain their freshwater supplies from a variety of water sources, in several fashions. The objective of this section is to discuss the drinking water sources of New Mexico water systems as a public service.

For US freshwater sourcing, around three quarters of drinking water systems source from surface water and a quarter from groundwater, fluctuating by 5-10% depending upon the year and ways calculated (USGS). In this state, drinking water is drawn from both surface and subsurface water sources. New Mexico is the leading state in the Southwestern US in groundwater sourcing for domestic water use with “about 87 percent of New Mexico’s public water supply” from subsurface sources (EPA 2017). The most common types of surface water utilized for drinking water in this inland state are rivers, streams, lakes, and reservoirs.

Other states depend more on surface water sources where readily available, or where groundwater isn’t easily accessible (USGS). As a more arid state, groundwater seems more dependable and reliable than surface water. In
sourcing, small and rural systems trend toward groundwater, while larger urban systems lean towards utilizing surface water with water return systems (EPA 2008). New Mexico’s higher-than-average rural population adds to the additional dependency upon groundwater over surface water (Misra 2016). Especially as most rural community drinking water systems are aging systems, put in when groundwater wells were the standard.

Utilizing the state’s Drinking Water Watch online search program in October 2022, a query conducted of “primary water source types” revealed 1,006 active systems with groundwater listed as their primary water source (Drinking Water Watch). Seven of these being spring-sourced groundwater in origin. A search for surface water as the primary water source resulted in 61 combined active drinking water systems (Drinking Water Watch). This combined surface water sourcing breaks down to 34 drinking water systems sourcing directly from surface water and 27 systems purchasing surface water as their primary source (Drinking Water Watch).

Sometimes water sourcing is a mix of multiple sources, with systems utilizing groundwater as their primary source but also utilizing surface water at a lesser rate. Often systems sourcing surface water have a groundwater well as backup. So, looking at primary sourcing on Drinking Water Watch website does not give an exact picture of each systems’ water sourcing but it gives a good estimate.

**Water Source Contamination & Regulation**

In understanding how small drinking water systems are regulated, it is important to better understand their water sourcing and how contamination
can occur. As stated above, groundwater is more often a primary source in New Mexico. Groundwater makes up 97% of all freshwaters on the planet that is in a liquid state (Brooks et al. 2013). This is water that flows underground and through the pore spaces in the subsurface. Over half of the world’s human population and 94% of New Mexican drinking water systems depend on groundwater (Brooks et al. 2013, Drinking Water Watch).

Groundwater tends to be hidden from our view but can be occasionally seen with springs or geysers or caverns (Fitts, 2002). The origin of wells is likely due to use of springs or caves, which became qanats, similar to acequia systems still found today in New Mexico (Fitts 2002). Just like with precipitation flows, led by gravity into catchments which feeds surface water, subsurface water is also fed by precipitation and gravity at work. Groundwater can gain or lose volume with connections to surface water.

Most groundwater for small drinking water systems is pumped from the subsurface by wells and transferred to a reservoir such as a storage tank, or multiple tanks. Water quality often depends upon the bedrock type that the subsurface water is drawn from and varies widely (Li et al. 2005). Groundwater tends to be higher quality than surface water, but is not as easily accessed, though sources near polluted surface water can be as contaminated as the source it is connected to (Brooks et al. 2013, Fitts 2020). Biological contamination in groundwater can also occur by the leaching of landfills, septic systems which is more common in New Mexico, water and sewage disposal on land such as sludge ponds, and through livestock waste (Dodds and Whiles 2020). Thus, small
drinking water systems can become contaminated by both natural and human derived chemicals.

Geology has an even greater influence on groundwater chemistry due to the length of time in contact with the bedrock type. Contamination from point-source, nonpoint-source, and natural sources in New Mexico results in areas where drinking water is “too salty or has high levels of natural uranium, fluoride, or arsenic” (Li et al. 2005). Pockets of permeable limestone, highly prevalent in New Mexico, can significantly contribute to potassium in well water systems (Fitts 2020). Nitrogen is found in shallow aquifers through groundwater contamination but is low risk for most of New Mexico except near agriculture areas (USGS). Treating for nitrogen once groundwater has been contaminated is an arduous and costly management task and the treatment methods can sometimes cause even more water quality issues (Dodds and Whiles 2020).

Surface waters are in a constant state of flux, with flows, with sediment movement, and with life. Water volumes experience loss through seepage into groundwater sources and evaporation, and then replenishing gains through forms of precipitation. Precipitation can carry pollution and contribute to sediment loads. Within the 4,000 miles of rivers and streams in New Mexico, 92% contain nonpoint sources of pollution (Li et al. 2005). Over three million tons of nitrogen (N) are precipitated yearly from the atmosphere in the US, “derived either naturally from chemical reactions or from the combustion of fossil fuels, such as coal and gasoline” (USGS).
Sediment transport also plays a key role in heavy metal and nutrient contamination found in surface water sources. Common rock types in New Mexico can contribute different elements to surface waters: limestone contributes to higher levels of calcium and potassium, basalt adds sodium concentrates, and both basalt and limestone contribute heavy metals (Brooks et al. 2013). Sediment transport increases eutrophication which is “the process of nutrient enrichment leading to dense algae growth” (Brooks et al. 2013). High phosphorus can also be due to groundwater discharge, as 30% of streamflow in the US is attributed to groundwater and up to 50% for some lakes (Brooks et al. 2013). Regulation of contaminants must be adhered to for small drinking water systems no matter the contaminant source.

**Regulation & the SWDA**

The Safe Drinking Water Act (SWDA) “is the key federal law for protecting public water supplies from harmful contaminants” such as the natural and human caused ones mentioned above (Tiemann 2014). The SWDA has authority by “programs that establish standards and treatment requirements for public water supplies, promote compliance capacity of public water systems, provide technical assistance to small water systems,” among other governing actions, “and protect sources of drinking water” (Tiemann 2014). The way that water for consumption is regulated can have a large impact on bodies of water and how the public is allowed to interact with them.

The SWDA is also responsible for the current state-enforced, federally mandated structure that shapes our interaction with the water bodies drinking
waters are sourced from and their contamination specifications. “Congress passed this law after nationwide studies of community water systems revealed widespread water quality problems,” to give the Environmental Protection Agency (EPA) the power “to regulate drinking water contaminants” and gave some states the authority to enforce those regulations (Tiemann 2014). The focus of this law, though it covers other aspects of public interaction with surface water bodies and groundwater sources, is contamination and it is reduced or eliminated.

The Act covers over 90 contaminants, including the specifications for mitigation and “treatment techniques for drinking water disinfectants and their byproducts, microorganisms, radionuclides, organic chemicals, and inorganic chemicals” (Tiemann 2014). The EPA deems contaminants in very broad terms, basically anything other than water molecules in the water itself.

Public drinking water systems in New Mexico are mandated to control and check for fifteen different inorganic compounds (NMED 2019). This category includes “fluoride, heavy metals and nitrate,” which have both natural and anthropogenic sources (NMED 2019). Most violations are linked to natural causes, except nitrate which tends to be a human caused occurrence, such as septic waste system leaks prevalent in rural New Mexico (NMED 2019).

In 2018, a study focused on public drinking water systems of the US found the southwestern US to be a “hotspot” of contamination violations (Allaire et al. 2018). The study found violations to be increasing temporally and rural area violations higher than urban areas (Allaire et al. 2018). Two of those hotspots are
in the southern corners of the state. Arsenic is also found in high concentrations in these areas, due to natural occurrence within the area’s geology and from the mining industry (Camacho et al. 2011). The highest concentrations are found in groundwater, the primary drinking water source for the areas (Camacho et al. 2011). Arsenic was used more widely in fertilizer historically and was a major concern for surface water in the past (Dodds and Whiles 2020).

New Mexico is a state that has limited water sources and contains many types of contaminants, both naturally occurring and anthropogenic. It is a state that leans on groundwater, which has high levels of contaminants in areas of water source scarcity. Public drinking water systems have high occurrences of contamination violations and general violations of the SWDA. These studies also demonstrate small systems struggle to meet the regulations that they are required to meet. Sometimes management of freshwater where drinking water is concerned can “lead to conflicting values and trade-offs,” with ecology and economy clashing in oversight (Dodds and Whiles 2020). For the purposes of this paper, the focus will not be on the details of contamination, the water sources, or mitigation, but on the small public water systems and the managers that are adhering to the policies that govern them.

**Public Drinking Water Systems**

Public drinking water systems are those that can serve as few as “15 service connections or that regularly serve at least 25 people” and serve those “individuals daily for at least 60 days out of the year” (Tiemann 2014, NMED 2022). Public drinking water systems must meet state and federal drinking water
standards. Fundamental to the management of healthy drinking water is the Safe Drinking Water Act (SDWA) of 1974, which is the principle regulatory law (NMED 2022). Public drinking water systems must also be run by a certified operator (NMED 2022).

Drinking water is often overseen by state government entities but how those states govern water for consumption is permitted and guided by federal legislation. The U.S. Environmental Protection Agency (EPA) must carry out the implementation of the SDWA standards but can delegate oversight to states and Tribes through what is called primacy (EPA 2022). States that meet a stringent list of exigencies to be granted primacy can then enforce treatment, monitoring, reporting, and other federal requirements (EPA 2022). Among the state requirements by the EPA for primacy is a duty to maintain an inventory of public drinking water systems (EPA 2022).

New Mexico has been granted primacy and drinking water system oversight is done through the New Mexico Environment Department (NMED), which means it has the authority to implement and enforce the primary SDWA regulations. The state maintains a list of public drinking water systems through an online database called the Drinking Water Watch.

There are 1,068 active public drinking water systems in New Mexico, according to an inquiry on the Drinking Water Watch site as of 2022. Public drinking water systems are categorized in three ways by the EPA. Non-Transient Non-Community Water System (NTNCWS), Transient Non-Community Water
System (TNCWS), and Community Water Systems (CWS) are the three types (EPA 2022).

A NTNCWS is a “public water system that regularly supplies water to at least 25 of the same people at least six months per year" that tend to have self-contained water system such as a school or hospital (EPA 2022). “A public water system that provides water in a place such as a gas station or campground where people do not remain for long periods of time" is designated a TNCWS (EPA 2022). Finally, a CWS is a “public water system that supplies water to the same population year-round" (EPA 2022).

**Rural Community Drinking Water Systems**

There are over 570 active CWS in New Mexico according to the Drinking Water Watch website as of 2022. That is over half of the public drinking water systems in the state. These often-smaller community systems act as the infrastructure for drinking water sourcing in much of the state (Hilton et al. 2013).

The number of connections to the community systems in New Mexico fall between one and 175,386, with the high end of that range of connections being an outlier in a metro area with the highest population in the state (DWW n.d.). The next lowest number of connections below the outlier in the range is under forty thousand. There are only eleven systems with over 7,600 connections, 1.90% of the total CWS. This is less than the number of systems with only one connection.

Statewide, the average number of connections for a CWS in New Mexico is 1,135. That average is skewed by the few outliers and nearly 500 (86.90%)
systems have 1,000 or fewer connections. The bulk of the systems are on the even smaller range of that spectrum yet. The median number of connections is 84 for CWS. There are 400 (69.7%) CWS with 200 or less connections, 317 (55.2%) with 100 or less, 194 (33.8%) CWS with 50 or less, and 99 (17.2%) CWS with 25 or less.

These smaller systems obtain their water supplies from various sources, dealing with the same compliance requirements as large urban systems. No matter the size of the system, regulations set by federal and state laws must be adhered to, especially where reporting and contamination is concerned (NMED 2019). These systems can be voluntarily managed, compounding difficulties with water sources and water quality requirements (Tiemann 2014).

Community drinking water systems in rural areas are most often run by volunteers who are also users on the system. Managers of small systems tend to have no funding to pay staff and often do the work solo or with other volunteers. They must also be or have a certified operator, same as larger systems. The volunteer managers of these systems must mitigate of wide range of contamination within their water sources and systems (Groenfeldt and Schmidt 2013). The managerial structure of who runs these rural systems varies system by system from a single volunteer to the rare small municipality with a few paid staff members (Drinking Water Watch).

Rural New Mexico community drinking water systems make up much of our state water supply for consumption. When breaking down CWS further to account for rural areas, the number of systems in rural counties accounts for
61.7% (354) of CWS in New Mexico. That is 221,241 connections. When comparing rural CWS to overall CWS, the average number of connections (624) was 55% lower for rural counties statewide. Rural public drinking water systems lean heavily towards the small side of the spectrum. Over 200 of rural CWS have 100 connections of fewer.

Within rural community drinking water systems, there are multiple organizational structures; private and public systems, non-profit and for profit, and several different institutional arrangements for governing and management staff. In New Mexico, Mutual Domestic Water Consumer Associations (MDWCAs) and Water Cooperatives are the two most common institutional designations for the organizational structure of these systems. These smaller systems face a wide variety of challenges, as do the managers overseeing the operations.

**CWS Management Challenges**

Water is a basic human need and right. Humans require this basic need met in order to live, in order to be healthy, and in order to thrive. This basic need is found to be more arduous for rural residents to meet. As noted previously, Allaire et al. (2018) found higher violations in New Mexico and specifically more SDWA violations in rural areas than metro areas. Through an in-depth literature review spanning 30 years of studies, it was also found that small drinking water systems face widespread challenges in industrialized countries like the US because of their unique situation of fewer connections, remote locations, and the limiting capacity of capital and management in small communities (McFarland & Harris 2018).
It has been found that rural and small drinking water systems are challenged by issues surrounding water quality, sustainability of systems, equity, and system functionality in developed countries where clean and safe water is considered a right (Nelson-Nuñez 2019). This same study notes that the shift to community-based management practices in water systems prevalent worldwide in the 1990s was built on an assumption of capacity to manage these systems adequately but this has led to failure of smaller systems (Nelson-Nuñez 2019).

Smaller communities have a higher burden in delivering public services and a lower capacity to do so. As noted previously, rural communities face greater financial hardships too. Balazs & Ray (2014) found that small rural communities often rely on contaminated drinking water sources due to socioeconomic barriers and that inequity of safe water access and violations of the SDWA correlated with race, ethnicity, and class.

The American Society of Civil Engineers’ latest report card for US infrastructure rated the nation’s drinking water systems a C- grade, up from a D in prior years, and notes there was “a 27% increase in water main break rates between 2012 and 2018” due to most pipes being laid in the 19th century and past their average life span for usage (Drinking Water 2022). The American Water Works Association has over 2000 publications on “aging infrastructure” continuously citing issues of infrastructure replacement and repair needs and the extremely high costs of doing so (AWWA 2023).
Understanding the challenges water managers face is important so that they can be addressed, and basic needs can be met more equitably. Knowing that smaller and rural water systems face more challenges than metropolitan and larger systems, it is imperative to examine these issues in greater depth. Through interviews with managers of small CWS, this study examines why and how smaller systems struggle to meet demands and how managers running those systems address challenges.

This paper seeks to contribute to literature on this topic and to further illuminate the issues. The hope for this project is to prompt assistance to:

- reorganize and restructure systems to meet capacity where it is,
- address aging infrastructure,
- navigate arduous and expensive regulations,
- focus on management capacity,
- investigate inequities,
- motivate new generations to take on management roles.

Despite the large volume of research on small drinking water systems, there is little research that involves actively working with the managers of these systems to seek answers (Warner, et al. 2023). Most bodies of knowledge about rural water systems also approach the topics from a technocratic lens or come from an academic background of scholarly work or from a top-down approach of what is thought to be best for these systems from the overarching perspective of state or federal regulatory institutions (Warner, et al. 2023). There is a lack of
research from the bottom-up approach of manager’s knowledge, viewpoint, and experience itself.

New Mexico rural water managers provide a unique opportunity to lend a viewpoint and insight not seen before on water management issues studied globally. The state gives a geographic location on a larger scale to study rural water on a larger scale, diversifying insight obtained. Studying these systems and the challenges the managers face, their expertise and insight also has the potential to address issues locally and regionally.
Research Questions

My primary research questions are: What motivates rural water managers to run their community systems? What challenges do community drinking water system managers face while running these small systems?

Additional areas of interest in this study are: How can current experiences of the managers guide adaptations in how rural water systems are run to increase resiliency in the face of future water challenges? In other words, how do managers increase flexibility and bake in the ability to bounce back when faced with challenges? How do we use this knowledge in findings to inform changes? What are the managers insights that can guide planners in how to retain and secure future generations to run rural systems, despite population outflows from rural to urban centers by successive generations? How can community and regional planners and water managers adapt institutional arrangements and organizational structures to better serve the needs and challenges that rural water managers face? How do regulations of these systems hinder or help managers and their systems?

Water scarcity is an often-noted issue for the present and the future, especially in Southwestern states like New Mexico. As rural water systems face challenges like climate change, wildfires, groundwater reduction, rural communities experiencing population decreases and aging members, who will continue to run these small systems and how are new managers motivated to take on the position?
The overarching project focuses on will be on the rural water managers and how they relate to these research questions and topics of interest. This research can have a great impact on community planning for rural water systems, where these systems tend to be the sole source of water in many areas of the state.

With these issues addressed by current rural water managers through interviews, the hope is to be able to better plan for the future of rural water in New Mexico. The current experiences of these managers can advise how rural water systems can address future water vulnerability with finesse. Knowledge of manager motivations will inform governing institutions and planners in building flexibility into rural water systems. Institutional arrangements and regulatory oversight can be adapted to better serve the needs and challenges that rural water managers face by planners and systems organizers.
Methods

Interviews were conducted in-person from March 2019 through February 2020. Thirty active drinking water systems managers, along with three professional water experts, were the subjects of the interviews. The interviews consisted of semi-structured and open-ended questions. Questions broadly covered systems, management, history, and challenges.

To gather interviewees, an audit of the Drinking Water Watch database was utilized to pull the 570 community drinking water systems (in 2019) into a list that was then randomized. Systems that were not deemed small, those that serve over 5,000 residents as defined by the New Mexico Rural Water Association, were removed from the list. Systems were grouped regionally to ensure interviews throughout the state. The research team then conducted outreach by phone and email to reach the administrative contacts and request an interview. The team exhausted about one third of the list to obtain the 30 willing subjects for interviews.

The administrative contact for each system varied, often it was the operator or manager themselves, other times it was a board member or accountant or clerk. The contact would usually get the research team transferred to the manager for further correspondence and scheduling. Occasionally interviews involved more than one person, and beyond the main system manager, staff member(s), the operator, or board member(s) would also be present for the interviews.
The main data used in this study consisted of audio recordings of the interviews, as transcribed, then coded using QSR International NVivo 12 qualitative research software. The coding included the focus topics of the research, along with emergent themes. The focused topics of the research questions were also coded from the interview data as they emerged. Some emergent themes were manager motivations, institutional constraints and compliance, systems, and regionalization.

The research approach used was grounded theory, detailed by Strauss and Corbin (1994), “as a general methodology for developing theory that is grounded in data systematically gathered and analyzed.” This “allows issues to arise organically rather than focus interviews on entirely predetermined topics within SDWS management” (Warner, et al. 2023). The grounded theory approach as originally designed became a modified grounded theory approach as management research progressed (Partington 2000). As the original interviews began to demonstrate a particular manager experience, the interviews were modified to explore the emerging learned topic as well. Findings were developed and researched as they emerged from the data analysis. Themes, topics of focus, and emergent theories were also researched through peer reviewed papers, other applicable literature, and previous drinking water studies. Qualitative data from interviews and literature was supplemented by quantitative data from public databases to contribute to a more rounded and detailed representation of study findings such as demographics of New Mexico
rural communities, and size, capacity, arrangement, and structure data about the water systems themselves.

Through interviewing managers, I rely directly on water managers’ understanding of their systems and their quotes to answer my research questions. In each of the following sections after, these insights are presented as my data and my interpretation of the resulting findings. I conclude with a discussion of the key outcomes and impression from my results.
Results

The script for the interview questions was broken up into sections with intros to let interviewees know what topic we would be moving to. The five sections of interview questions consisted of:

- general information about the drinking water system,
- the management and organizational structure,
- concerns about the system and needs to address those concerns,
- management challenges and potential solutions,
- and manager motivations and roles.

The interviews were structured by the script but flexible in exploring or expanding upon interviewee insight. There were scripted questions asked and some secondary questions that were not asked if they had already been brought up, or time was limited. The semi-structured interview was carried out in such a way as to let the interviewee answer and discuss matters without influence.

The managers and additional personnel interviewed oversaw a variety of small drinking water systems. Of the systems interviewed, the organizational structure, personnel and staffing size, age and size of drinking water system, and water sourcing were diverse to gather a holistic viewpoint throughout the state. While the size or organizational structure of the water systems overseen differed some, the results presented here represent unanimity in the findings. The results of these interviews are broken into two sections with main themes within each.
The sections include manager challenges and manager motivations. Themes of manager challenges included:

- lack of resources and personnel,
- burdensome regulations and compliance,
- managers feeling overextended,
- aging population
- community relations,
- and infrastructure and environmental concerns.

Themes of manager motivations included:

- trust and loyalty,
- knowledge,
- community obligation and civic service,
- and maintaining local control.

**Manager Challenges**

A general lack of resources for small systems, be it personnel and funding issues, lack of community engagement, lack or loss of institutional knowledge, ability to meet regulations, and aging managers were found to be very common and widespread. There were more internal challenges referenced than external constraints, though compliance and regulations were often noted as the source of these challenges, so they are linked and cyclical.

**Lacking Resources & Personnel**
One of the common themes in manager challenges was a lack of personnel and public participation. As one interviewee put it, “Nobody wants to put an order in the water. Nobody wants to have a little skin in the game, but they’ll complain pretty loud when the water doesn’t run.” It was difficult for managers to get volunteers and to keep them, especially for boards, hard to financially support any staff or pay for the training and certification requirements for both bookkeepers and operators. Another manager said,

“We’ve had people that, ‘Okay, I’ll be on the board.’ Well, they don’t show up for any of the meetings and you know that they can. We try to be very careful with the board. I shouldn’t say, we can’t really control it because when a board member comes up for election, it’s done at the annual meetings. People are aware. I send out notices telling them when and what’s going to happen. Agendas and that it’s an election time. If they’re elected, they either don’t say anything or they say, ‘I don’t want it.’"

Personnel positions were often a revolving door of seeking people, training them, and then losing them. That work seems more arduous for small drinking water systems that are already strained. With the loss of each person goes the resources spent to train new personnel and the knowledge that was obtained. One manager explained how it affected decision making for their systems, “and those, sometimes we had those that were, had committed to do certain things to investigate or research certain [things], that never came to fruition. And if they did, the information was never passed on to the decision makers.”
Knowledge is also a repeated topic in manager challenges, both in a lack of knowledge on the specifics of their systems or in loss of knowledge. Repeatedly training personnel and then losing them as illustrated previously as well as institutional or generational knowledge being lost or not passed on; managers keeping operations, histories, and system knowledge in their minds and not formally keeping records or training successors.

Some managers also found themselves in their position from another volunteer role and did not feel knowledgeable about what they were doing. As one manager stated, "I don't know as much as people think I do. I mean, I said, 'I'll be the secretary. I'll keep track of notes and meetings and stuff like that.' I said, 'I don't want anything to do with the money and I will not do any physical work at the well.'" Some managers needed to consult operators or bookkeepers regarding system knowledge, while others knew their systems thoroughly due to holding their positions for so long. Managers also rely on expertise of specialized fields needed in their roles that can be costly due to lack of knowledge. As this manager demonstrated, "We went to the lawyers. That was another expense. We had to go through lawyers and make sure we were doing things properly and send things out. It's a challenge."

It was noted often that various personnel would hold on to the positions for years and then become irreplaceable by holding onto knowledge about the systems and not keeping paper records; a concept known as institutional knowledge. Another manager said, "there's a lot of systems that rely on operator knowledge and have very little written down. You know, post-It notes of where
the valves are kind of thing, and if that person, something happens to them, there's... a lot of institutional knowledge is gone."

Loss of knowledgeable people to run the system and aging rural populations were intertwined, as are most themes of the challenges managers were facing. The strongest connections with personnel challenges were aging managers and compliance with regulations with the link being loss or lack of knowledge. Challenges managers face must be looked at holistically to see how issues are intertwined that complicate the ability to run their systems. As one interviewee tried to make the connection,

"I think the old bylaws, being that it's a volunteer board and people stay in here forever and they get old and they... I think that's what happens is nobody takes the lead. Just kind of, the old bylaws and policies kind of didn't fit modern time. And then, if the state passed regulation and we want to ask for grant money, we weren't in compliance to even be able to ask for money."

One of the ways that managers attempt to solve personnel, compliance, and resource issues is to hold multiple roles in their own systems. Managers who take over systems will act as operators, often are self-taught to pass certification to keep their systems in compliance with regulations. Same with bookkeeping since this also requires regulatory compliance and ongoing training certifications. Explained by this manager,

"I was blessed to have somebody that trained me on how to do everything. I didn't really have a choice. It was like, okay, whatever, you'll
be your clerk [and] treasure, and then anything else that comes your way. You just either grab it and go or you falter. That's what these small communities [do]. You go to the bigger communities, and they have a person for each job. They have like five or six people doing what I do and it's like, okay."

Managers often had to self-train to be operators or pay operators outside of their area to maintain compliance. Another solution some managers were doing was sharing the operators with other systems, which can cause issues in emergency situations when they need help quickly. A few managers were trying to develop an education system to encourage younger people to stay in their geographic areas. Some managers had tried all these tactics like this manager, "Myself, or we have hired water operators before. And we don't have one now. I think we'll be looking for one. That's one of our solutions, to hire a water operator, certified, local we hope. We're talking about educating a young person. "We'll pay for all of your courses and education if you will stick with us for five years or three or whatever." It's one of our ideas to develop a water operator that might stick with us... Can't keep them... They're just, they're not here... And we're rural, it's hard to get goods and services at the rural interface where we live. It's just harder and usually costs a little bit more when we do."

The overlap in personnel issues and funding issues was a very strong theme also. Personnel is required for compliance, and it is an additional financial burden on small, rural drinking water systems. This then pushes small systems to seek
volunteers, which does not incentivize staff to stay in their positions. As this manager stated,

"Number one, it wouldn't justify the expense of somebody outside of the town. You couldn't generate an income for third party management at all. And so, it really has to be local. It has to be volunteer. The only thing that we can afford to do is a third-party operator."

Another manager stated,

"Honestly, one of the neighboring [systems], they kind of volunteer and then, we're about to hire one because, like I said, people are aging, the... water operator, he probably been doing it most of his life and now, he probably... even that's getting harder. He probably can't pass, one, because of age and because of the new rules. So now, I found a young guy and he right away goes, "Was there a signing bonus?" And then, I tell him, "We have this much in the..." "Well, that's kind of low," because, usually, there's a signing bonus and usually, it's this much a month. And then, if there's repairs, that's additional on top of what you pay him monthly. So, I'm like, "Well, we don't have that." And he goes, "I get it." I mean we're in negotiations now but..."

This is another example of how external constraints exacerbate the internal challenges of lacking personnel and resources in these small systems. Financial challenges for small systems run high and overlap with all the other challenges mentioned in a variety of ways that complicate even their public relations in low-income rural areas. In one interview a manager said,
“It’s a challenge. That’s a real big challenge. The budget, we spelled that out. We sat here for hours trying to figure out how we’re going to do this. We have to have it increase next year? Yes.”

Many small systems find themselves having to raise their rates, knowing the hardship it places on their communities because they feel they have no other options. As this interviewee notes,

“So, what would happen is we’d hire people, and then they’d do okay for a while, like say managers or so forth. You can’t afford a professional, somebody that knows how to do this because your rates aren’t correct or if you did raise your rates to where you paid for an individual, you have all these low to moderate-income individuals that can’t afford it. So, you’re between a rock and a hard place.”

Another challenge under lack of personnel and resources that ties together these issues is funding. Funding challenges can complicate obtaining grants, replacing infrastructure, handling emergencies, legal issues, personnel, and staffing, and much more beyond community relations. As this manager states, often it is simply time as a resource with volunteer staff, “a lot of small systems, we don’t have time.”

The overlapping complications with funding challenges manifest in many ways. As one manager illustrated, “It would be difficult for us to come up with matching funds if we had to come up with a 10% match on replacing tanks, or doing that kind of, it’d be difficult for us to do that because of, we just don’t have the rate base.” Small systems seek financial help through grants often must
match funds but do not have the funding to event do that, especially the smallest systems. The requirement to match funds for a grant sizeable enough to replace infrastructure, with only one to twenty connections generating revenue makes funding out of reach for the systems that need the most help.

This manager discussed the overlap with their budget, rates, and legal needs,

“So just imagine this whole vicious circle and then getting back to we need to set a budget. We need to set rates. We need to do this. We need to do that. We need to research this. Is this legal? Is this not legal?” Then you don’t have answers to those questions. You need to seek legal. You need to get a lawyer or something like that involved. That's not in all situations, but then it comes to money. You don't have the money. It's just this craziness. It's so difficult. Then you run into problems and then you have situations where receivership happens. It seems to happen quite a lot in smaller systems from what I see."

Burdensome Regulations and Compliance Concerns

The overwhelming sentiment with regulatory compliance for water managers is that the regulations are arduous to meet. For several reasons, managers feel that compliance is too burdensome for the number of people working the systems, the size of their systems, the funding available, and the aging system infrastructure. A difficult part of this seemed to be reporting requirements and the ways that managers are required to submit their reporting. Certification was another issue cited as arduous. The requirements for
certification of an operator and a bookkeeper, the cost and travel associated, and the regular re-certification were a huge financial strain on small systems.

Another issue discussed that made regulatory compliance difficult was testing, though managers agreed with the importance, the frequency and amount of testing seemed difficult, and some managers thought testing for parameters they had never been out of compliance for in the history of their system need not be as frequent. Often managers interviewed talked of general burdensome regulation, as all of it is difficult for their small systems. Compliance in general seemed to cause managers a lot of stress. When asked if concerned with compliance one manager replied, “Yes. That’s probably the one that wakes me up at night.”

Managers also generally felt there was a lack of help from various agencies that are meant to assist them or regulate water. The lack of assistance makes low resources even more difficult for small and rural drinking water systems. As one interviewee stated,

“Yeah, and imagine if you're a board member and you have a full-time job and you're trying to get these questions answered, it's just not going to happen. So, navigating through all of that that’s the key. Navigating, if you can navigate and you’re persistent you can, you can find your way. But the average volunteer, it's asking a lot.”

There were a few positive comments, but most were negative where regulations were concerned.
Managers understood the need for regulations for public health and safety but disagreed about how those regulations are carried out for small and rural systems. The general difficulty to comply without the same resources as larger systems was common in interviews. One manager explained,

"We need the State people to consider this smaller rural community as far as we still need to follow the regulations in order to provide safe water to our customers. But some of the things that they are requiring small systems to fulfill, they have us at the same level as the big municipalities. And it creates a hardship for us because we don't have the income. And most importantly, we don't have the people. We just don't have the people."

It was also noted often that regulations are getting more complicated and challenging, instead of less.

"The other thing that I think is difficult, since you brought up an operator, that's a big liability. When you got a small system, the budget is, or the revenue is based on number of members you have. So, as having a small number of members, but just not very big. So, you know, a waterline leak could eat up a lot of the budget, but the state keeps passing regulations that the same water system in Albuquerque, they expect a little system like us to keep up with... Well, we had no means or capabilities. And you're looking at hundreds of thousands of people in Albuquerque area, where here... It doesn't make sense. And as the state keeps passing more regulation, it's really hard on all the systems."
A few positive comments about compliance had to do with the trainings available for certification programs. Yet, it still takes someone with expertise to gain from the trainings offered. One manager said,

“We went for financial training, which was really informative, wow. With the state, yeah. They headed over in Las Cruces, it was really informative, what we need to do. You got to remember this is an old system. It’s like a mom-and-pop type system. Fortunately, we have one of our board members, he’s a certified accountant, so he’s helping us bring our accounting standards up. We did a lot of spreadsheet type things, which was great to keep track of budgets and money and things like that. However, we have to bring it up to the next level.”

Most of the interviewees had negative feelings towards compliance, regulations, and state controls already in place.

Managers discussed how some compliance issues were unnecessarily burdensome. That beyond outlining exact protocols, being helpful to small systems with a lack of personnel, time, and knowledge, regulatory requirement assistance is often non-existent with agencies. In one interview, a manager stated,

“Then the only other compliance issue we have is if I could get the CCRN on time. I don’t think it’s fair. This is where I have to take exactly what the state already has, and I have to put it into another form. Then if their form doesn’t work and it’s not calculated correctly how they want it, then they throw it back. Even though I’ve submitted it and without the corrections
because it wasn't submitted correctly in a timely manner, then we get violation for it, and I don't think that's right.”

Another manager said,

“Yes, because we're volunteers. That's hard, that's hard. Every year, we have, the state comes out and does their ... What do they call it? Annual survey or something like that. Yes. And so, when I took over, I was writing, ‘Please forgive me,’ letters to the state for nearly a year to get caught up on some of the hits on that and getting those taken care of.”

Another layer to the challenge of burdensome regulations and compliance concerns was the general lack of trust that has developed with managers. The difficulty in getting help, over-regulation, and inadequate assistance when questions and issues arise has led manager to distrust agencies to properly oversee safety in their communities and systems. One manager said,

“We're in negotiations down to try to sell the system and turn it over to somebody else. Because the concerns that I have with that is we haven't been involved with the PRC [Public Regulatory Commission]. I don't like government regulations. I spent 30 years involved in government regulations. The worst thing that I thought could ever happen is the government getting involved in our water system. I really do.”

Another manager stated, “It's truly our system. That's really why I took over in 06. Because I didn't want some outside source coming in and messing with my water system.”
There is also a lack of trust in government entities to oversee with the same level of detail and care. Managers feel like agencies do not understand small, rural communities and do not have the same level of care as local managers.

When one interview was asked about state oversite of their system, they said, “State does not need to come in here and control every aspect because they don't understand. I really don’t think that they understand the rural communities. That's great that they have the people to the bigger communities and stuff. I think they understand that because that's a mass thing. To come in here and try to rule a rural community with the same logic as a larger community, I don’t think that that's very beneficial.”

Another manager stated, “I don't think we need Somebody else coming out here screwing with our system. Over the years, I would say, I’m quite sure if we hadn't... If I hadn't been here, it may have been weeks before we knew about the water leaks that we've had.”

Many managers voiced how long it took to get responses and assistance from regulatory agencies, often not receiving the help they needed if they did get through to someone. This carried over into their lack of trust in government oversight directly in their communities.

Many small systems felt that they should not have to meet the same regulations as the larger urban systems with more resources. Most managers understand the need for regulations to ensure safe drinking water but disagree with the way in which they must comply. Managers noted that regulations
should be set up in a way that is appropriate to the size and resources of each system. One interviewee expanded on this by saying,

“But what they got to understand is when you put requirements like that, you got to be able to facilitate the need of those systems to be able to meet those requirements. It's because that sophistication may not be there to do so or if it is there, the last thing you want to do is work 12 hours at a bank, and then go home, and then have to do all the financials for your system, and the reporting, and making sure it's on time and so forth because your system only charges so much and it can't afford even an infrastructure maintenance program or anything like that.”

Managers Feeling Overextended

Another theme that emerged was managers felt overextended with lack of resources, time, or energy. As mentioned previously managers are most often volunteers and carry multiple roles for their small drinking water systems. Some of those roles require added compliance with training time and certification requirements. These personnel positions such as bookkeeping also add an additional financial burden through those regulations. Managers who take over systems and act as operators often are self-taught to pass certification to keep their systems in compliance with regulations. Getting help from other systems to manage emergencies and burdensome compliance requirements is one way managers cope with these difficulties, but they are usually asking for help from another overburdened manager. When asked, one manger said about a
neighboring system, “by himself, there’s no way he had the bandwidth to add into what he’s already doing or the money to add into what he was doing.”

Managers noted that beyond being volunteers, often managers have other full-time jobs or responsibilities in addition to the roles they held in their systems. As such, one manager said, “You’re guaranteed every other weekend to be working a few hours even on your days off.” When managers try to bring on other personnel to relieve the feelings of burnout, it doesn’t often work out well and can make additional problems, financial and otherwise. As one interviewee said,

“But life gets in the middle of everything because you have your priorities. Then you need to be able to afford somebody in the office or something to be researching this. Then when you do have somebody in the office, that oversight isn't there.”

Then the issues fall back on the manager anyways.

Having qualified and reliable personnel is another challenge for managers that overlaps with other themes in this section. Small, rural systems lack funding, time, and other resources to provide for the level of personnel needed. Having to resort to volunteers continuously due to funding constraints creates additional burdens. Managers often end up doing most of the work even with additional personnel. This interviewee expanded on the conundrum with passion, stating,

“This responsibility to these systems doesn’t ever go away. Then most of the time, in the boards, you maybe have three to five members in these small systems, but you only have one person that does everything. You have
the other two that just show up. That's what I see in a lot of boards and other individuals that I meet with that are in boards and that I talk to. Basically, there's one person doing it, and people show up to the board meeting so that one person takes the responsibility on because if not, then the whole board dissolves, and then you're really up shit creek."

Another manager, also responding with strong sentiment, said, “I could cry because I was like, been there, we can't get qualified people to be on the board, we can't get people who know what they're doing.”

Continuous overextension for managers leads to burnout and feelings of resentment for their roles. As one manager put it,

“And no good deed goes unpunished, my friend. Let me tell you. In this type of business, it does not. It's difficult to deal with that because sometimes, you just want to say, ‘Well, everybody go to hell. I'm doing this for free,’ because you gain nothing, but making sure your water turns on, your toilet flushes, and that your trash is thrown beyond that. It's quality of life. And so, other than that, you get nothing, but you get all the responsibility."

Managers overextend themselves until they can no longer handle the role because they feel a responsibility to their small drinking water systems and communities.

As mentioned previously, managers often hold multiple roles in the organization, work other jobs, or perform several duties for their small, rural communities.
“Like our water guy, he’s our water supervisor. He does all the repairs. He does all the meter readings, which [are] done manually. He also takes care of all the streets and parks and everything. He’s also on the fire department and the ambulance. He drives the ambulance… That’s just to name a few of the things. The mayor, he’s a farmer, rancher, but he’s also on the fire department. He does all of our legislation stuff and everything like that. We all wear lots and lots of hats.”

This need in small rural communities for people to take on multiple roles also leads to burnout. Despite any assistance provided by regulation and government agencies, there is a lot to be done in small communities with a lack of population to fill those roles. As another manager put it,

“Because the State does provide resources, information, and so forth, but imagine you living, having to provide for your family, just living, and then going and having to do research about water, and how you get water, and what is this, and what is that, and how to do this, and how to do that. I mean, imagine that. That’s total burnout. You’re totally done by the time… after a year. Or people actually because they think, ‘Oh, cool. I’m going to be a board member. I’m going to tell people. I’m going to make sure things are done right, and we’re going to do this, and we’re going to do that.’ Then reality hits and you’re like, ‘Screw this. I don’t even make a dollar for all this stress, all this pressure.’ It’s weighing on individuals.”

Burnout forces manager turnover, especially without compensation. In small communities, where volunteering is the expectation due to financial
constraints, people will stay in roles longer than they are suited for without relief or breaks that would help with keeping managers. As another manager said,

“And I somehow just ended up doing that. Keeping up with it. I mean, it was just somebody had to do it. Nobody else would admit to being able to, and so, 'Okay, well I guess I can do this.' And it was like, really, it got to be a big commitment in time and so I got tired enough of it to say, ‘All right. I'm not ... I'm off.’ And so, I left the board for eight years, I guess probably.”

Even though this manager returned, the manager had to fully abandon the role for a period to get a necessary break.

**Aging Rural Population**

As briefly mentioned previously, small, rural drinking water systems are strained by their aging populations and shortage of younger generations, combined with inadequate resources. Aging rural populations and brain drain were a major theme in interviews. This theme creates overlapping worries and fears for managers. A few repeating topics were lack of community engagement, elderly populous and managers, lack of funding for staff. Managers explained that younger people do not want to take on volunteer roles and need to be able to support themselves and their families with well-paying jobs. Communities lack volunteers, though most systems are volunteer run, and community members do not show up to meetings.

A further complication that overlaps in many rural water systems with insufficient successive generations and funding is institutional knowledge loss.
Managers are obligated to stay in their position longer than they want or is healthy. Institutional generational knowledge being lost or not passed on; managers end up keeping operations, histories, and system knowledge in their minds and not formally keeping records or training successors. There is a need for generational overlap in small, rural drinking water systems.

The lack of community engagement is difficult on managers who feel obligated to their position with no one to replace them; feeling like they cannot quit and can only retire from their volunteer position if they pass away. Managers are most often volunteer, older, and feel obligated to remain in their positions because of a lack of replacements. Managers repeatedly talked about how younger generations did not stay in the area anymore, they leave for employment or education elsewhere. This phenomenon is often referred to as brain drain, successive generations leaving rural areas for opportunities in metro areas. As one interviewee said,

“...I think a lot of it is work. This little town, most of our kids leave anymore. Unless they can get out with the forestry service, the village, the county, or the state. There’s no work here for them. Unless you want to work at one of the local grocery stores, which isn’t going to pay much.”

Another manager explained,

“...Not interested. Well, people can’t live here and work. Unless you work out of your home or something. I mean, they could, but that would be a long commute. 50 miles to... 20 miles to... and there’s no work there.”
Even if the area does have younger generations around, managers said they are busy with the paid work they have and family commitments and do not volunteer or get involved. Systems have a shortfall in replacing aging managers with the next generation. "We used to have more full-time, but I figure 50 years. These people got old, and we've lost lots of people that were involved and now the younger people, they don't have time."

Aging populations in small, rural areas also puts a financial strain on drinking water systems. Managers struggle to raise revenue for needs beyond their shortage of personnel. Decreasing populations means reduced income due to less people on the system. Those funds make basic upkeep possible. As this manager stated,

"I think that is due to we need infrastructure improvements, decreasing members. I mean my neighbor down the road just passed away, so that's one less revenue we get, right? And, you know, families are getting smaller, people aren't coming back here, and their families aren't moving back or aren't building. So, it makes it hard."

Running these systems in rural areas with an aging population puts a strain on revenue and system management. Another manager said,

"And you know, they serve because it's that generation, that's their obligation to serve the community, the view, putting in their obligation. But the selection is fewer. Right? Because a lot of community members move away, or they passed away. So, some of the houses here are abandoned..."
or they're used as summer homes, so you don't get the revenue costs to maintain the system. So, it's difficult."

The aging rural populations and brain drain exacerbate community involvement also. Often managers felt there was no one else to do the job, no one willing to step up, and that there is no one willing to take their place. As one manager said,

"We just have concern about somebody stepping up, and around here, it's not going to be younger. There's just a couple of little kids, lady on the street has two little ones, but everybody else is retired or older. There's no younger ones, so everybody is older."

Two interviewees exchanged,

Interviewee 1: "And age is a problem. We have three girls that go to school that live here and we just don’t have that many young people here. So."

Interviewee 2: "I'd say, "The average age is over 70." Don't you think? Or pretty close."

Interviewee 1: "Yeah. That's at least 55, between 55 and 65, is probably the average age. Lots of retired. Lots of people that are here are retired."

Often in small rural areas, it is the elder, retired population that is putting in the volunteer time to hold personnel positions for these drinking water systems. Managers and other personnel get into these positions and then see no end in sight. They struggle with the physical labor required and have to deal with no one to take over their role. As one interview said,
“It’s all changed, but if something comes up about the maintenance on the well, it’s like, "Okay you can show me, but I will not do it." I am too old. I’m not getting down on my hands and knees and reading the meter. Isn’t going to happen. Just isn’t going to happen."

Managers stay in their roles longer than they wish to. As another manager said,

“Part of the reason is, I’m 71 years old and he’s 69. I ain’t going to do this the rest of my life. I have no intention.”

Some managers find themselves doing the labor anyways, despite age. With no one to help, they must just do it themselves. As this manager said,

“So, no, I’ve read meters. I still do, even though I’m 79. But, if need be, I will be out there on my hands and knees reading meters if it requires it, I have done it.”

Managers find themselves staying in positions out of obligation or because there is no one to take over the role. Some managers are in their roles for decades and still doing physical labor themselves as there is no one in the community ready or willing to take their place. Elderly managers are often replaced by other older generations, of retirement age and beyond. As this interviewee stated,

“The man I replaced, he’s 92 years old and he was still out there, and you know...his prime has already passed where it was difficult for him to do certain things, and the only reason I got on the board, why I had sat on it as a board member. And then, there was change and like I said, nobody wants to serve.”
One manager said, “I’ve got people in my board, my treasurer is in his 80s and he grew up in…” Managers discussed the difficulty of elders not being able to leave their roles in these small, rural systems. Another manager said,

“That's how bad it is. A lot of the individuals that have been running these local systems, the people are retired and they’re wanting to let it go…I mean, he's my mentor in a lot of ways... and that poor guy, he's 74 years old.”

Community Relations

Another theme among the challenges faced by small drinking water system managers was community relations. Managers seem to communicate conflicting feelings about their communities, relaying a strong sense of obligation and loyalty while they often feel negatively about their communities' values and involvement. Managers would convey that their communities are wonderful, support each other, are close-knit, and care about each other. Then in other sections of interviews communicate that their communities do not value water enough, treat managers poorly in their positions, do not step up when asked to come to meetings or volunteer, and only care about their bills.

These conflicting outlooks about community were widespread. Managers mentioned several challenges within this theme. The more common community relations challenges were low community participation, negative experience with community members, negative feedback about rate increases, and having to shut off water. There was also a resentment to negative feedback about
managers since managers felt no one would take over their position but were happy to complain about them.

By far, one of the most resounding internal constraints for system managers is a lack of community engagement and interest. Though managers felt their communities were concerned with water, engagement is very low except when there is a complaint. When asked about how well their system works, one manager said,

"It works very well for us, except for the fact that we can’t get anybody else on the board. People don’t have time and they don’t care. As long as when they come to the lake, they can turn the faucet on and they have water, that’s all they’re concerned about."

As an explanation for low community engagement managers often mentioned low and aging rural populations and retirement or seasonal homes being a large sector of their users. When asked about participation, one manager said, “I wish there could be more. Of course, more interaction with more people, but that's never going to happen as long as it's a weekend place.” Another manager said,

“Also, we have a lot of second homes. In other words, people that live in Texas that owns home here. And so there you go. You don’t have those people coming out just for a meeting.”

Beyond low population, managers also complained about people simply not showing up and not putting in the work the system requires. When asked how their system runs, one interviewee stated,
“Oh, it works wonderfully, as long as you get people to participate. Again, participation is the biggest struggle. But again, we’re not unique in that fashion. Anything you do, it’s the 80/20 rule, but now it’s becoming the 90/10 rule... Really. 80% of the people do all the work or 20% of the people do 80% of the work.”

Another explained that you often cannot run meetings or even try to elect new volunteers. This manager expanded with, “They had elections, and nobody showed up. Nobody registered and then nobody showed up to run or to vote because there’s nobody to vote for.” Without people at the meetings, business cannot always be conducted, as this manager said,

“I’m sure we could if we could get somebody to the meetings. Every meeting we’ve had since in the last 13 years we haven’t had a quorum ever. The first one we did after that nobody showed up.”

Managers and boards have had to reshape how systems are run, including changing bylaws to stay in compliance due to the challenges of community engagement.

Another way of dealing with the challenge is by incentivizing community participation. Managers have tried both negative and positive incentives to get community members involved in their water systems. Tactics have included offering discounts on bills, making meetings into community gatherings, and providing food to participants. In one interview it was said,

“Yeah, they came to our yearly meeting, which we had to cancel the first time, and then we had to offer bribes to get people to it, basically told
them, ‘Come to it. Or we’re just going to dissolve the board and you’ll be on your own for water. Because we’re not going to do this.’ We actually threatened it because nobody showed up to our meeting. And then we implemented what a 10% discount for every time you come to a board meeting, we’re going to take five bucks off your bill. And that’s what we had do. And we’re still not getting ... People still aren’t taking advantage of that.”

Managers have also tried to elect people who do not show up to meetings or raise water rates to get people to show up, even if to complain. As one manager put it,

“We have to sit down and visit like we are because nobody shows up and we’ve tried enticing them, giving them ...prices, whatever. I think my next meeting which will be next April will be send out notices of telling them I’m raising their water rates so that everybody shows up.”

That was a common occurrence, that manager found the most participation they could get was negative in nature. Community participation only if there were complaints.

Raising water rates for any reason was a repeated community relations challenge. Whether it was to raise funds, incentivize participation, or simply time since it had not been done in decades; it was a struggle for managers in small communities. Often, the only way to afford personnel or do maintenance was through revenue generation. As one manager said, “They’re going to have to start paying someone to do what I do and what the board does and then
people are going to get real upset because their water bill is going to go up." Manager felt they had no other choice than to upset their neighbors to take care of their systems. As this manager put it,

"We had accrued a whole bunch of money, but now we've depleted a lot of that. So now we have to re-accrue. This is the challenging part because once you tell people we're going to have to assess you or we're going to have to raise your rates and that's when the battle starts. But so be it."

This stress of negative community relations increases further when managers must deal with water shut offs. In small, rural communities this means you are likely shutting off water for someone you know or shutting of water for an elder on a fixed income, or a low-income family. Many interviewees discussed how this sometimes made for unfair situations where they let people have water for free, while others continued to pay, out of fear or because they felt too terrible to follow through on it. One manager explained the situation with,

"People are getting free water because water boards are afraid to go and shut off water. There's no system to shut off and warn people that hey if you don't pay. Can you imagine living in a small community with three or four hundred people and you shut off your uncle's water or here you know your grandmother's water. And so, you're dealing with that and that's a problem."

Another manager said,
“I've got one of those right now that has run up a tab of several hundred dollars and what do we do? That's a discussion because it's like, 'Okay, it's unfair to all the other users if we just let this person slide and keep using water without paying for it. On the other hand, shutting off somebody's water is a pretty serious event.'"

Other managers described the danger in shutting off water also. When community members know you, know where you live, and can hold a grudge or be very angry. Another manager mentioned how often the danger is in the physical act of shutting the water off. Water shut offs can be located at people houses “and where I think that gets difficult is imagine if somebody is delinquent or they stopped paying and you got to shut them off, coming onto their property creates a lot of issue.”

Several managers and other personnel interviewed mentioned legal battles within systems and their users as well. Users who try to take over systems or sue when they don't agree with something a manager has done. In small communities, a lawsuit can affect the entire community through the system and the interrelations of a low population where everyone knows each other. As one manager illustrated,

“And had a lawsuit over that that went for several years, and we ended up being able to do what we needed to do for the system and the community but that was a pretty acrimonious period. ... has enough people to where it's a real human community. So, there's gossiping and
there's frictions that go on and that just turned into one off, an acute situation where you couldn't just sit down and talk it out."

The ripple effect of legal issues can add to the challenge of community relations far beyond the parties involved, in small rural areas.

**Infrastructure and Environmental Concerns**

Infrastructure challenges and environmental concerns were wide ranging. A few repeating topics were aging infrastructure, drought, and fires. Of these, infrastructure issues and how to fund them was a frequent worry. The lack of funding managers have available, the aging infrastructure of their systems, and the lack of help from various agencies with repairs and disasters were also repeating challenges mentioned. Managers feared not being able to deliver water properly without fixing the multitude of issues wrong with their old systems. Most systems were decades old, some even a century.

Some of the disrepair and infrastructure is so old or piecemeal that it can be quite shocking what is delivering people’s drinking water to their taps in small, rural communities. Even managers themselves are shocked at times with what they find within their own water systems. As one manager illustrated,

"When you're seeing things had been fixed 30 years ago with bailing wire and an inner tube, it's just like, whoa, what happened here? Now we're getting a lot of that old stuff replaced and finding where lines shouldn't be, they're not really there. It's like, well it's says on the map that it goes this way, and it goes this way. That's old water systems."

Another manager said,
“We had a water leak this week and found out that they’ve used, and this line that we know of, the gentleman who lives in the house is here before me. And he did not put the line in. And so, it’s like thin black poly, three quarter inch line. And it’s still in the ground.”

This interviewee stated,

“Because we’re already having a lot of leaks with the old system. The whole piping...Yeah. It’s 73 years it’s already brittle.”

The aging infrastructure is often system-wide and felt like an overwhelming challenge to tackle for many managers.

Infrastructure challenges was one major issue nearly every manager was facing in small, rural areas. “That was my biggest complaint because I don’t think the accuracy and the true reading is coming across and it’s not like it’s human error or anything. I think it’s equipment is not adequate, it’s aged, just like all of our waterlines.” To fix one component of the system takes a lot of their budget, and there are more issues than revenue can cover in a timely manner, so most systems were running like ticking time bombs with managers just working in emergency repair mode, unable to get ahead. Other managers demonstrated the overlap with other challenges mentioned thus far. “The water system was about 20 years old, maybe more and we had frequent breaks and leaks and we are a relatively poor community, poor association. So, when we had those leaks, we had 70- and 80-year-old men out there digging ditches in the middle of winter, middle of summer, whatever.”
Some managers were also dealing with emergencies of water supply and dreading ongoing drought conditions. “Because last year it was so dry that spring it produces about 35 gallons a minute. It used to provide 50 but then it’s because of drought it’s down to 35 now.” Another manager said,

“To that I will add that the spring across the highway, which has pumped water for over 60 years, suddenly went dry in August. We lost half of our water supply. We are in kind of emergency mode right now.”

One interviewee explained how drought causes increased water use, when there is less to go around, saying,

“I don’t know right now, everybody’s watering their livestock because there’s no water in the ditches and the creek has dried up. So, people are watering their livestock and we’re using our normal usage like 15,000 gallons a day, now it’s up to 21,000, 22,000. Because of the drought.”

Another manager explained that their system is dependent on precipitation, so drought is a major factor for them. They said,

“Yeah, we would love to have an alternate water supply. Springs are totally dependent on weather for your climate. Typically, we’ve done pretty well up here. Like I said, the spring that went dry ran fully for 60 years, but the mountains had been in a drought. We’re about to break the drought, we think. We’ve had quite a bit more moisture the last two years. But you’re at mother nature’s whim…Yeah, it’s a spring-fed system. We’re at the mercy of the precipitation.”

Wildfire was another recurring environmental concern and challenge small systems had faced. Many managers put that towards the top of their list of
concerns. “Yes, we are concerned about wildfire. We do have that threat on a daily basis.” Several managers recounted fires that had already been an issue in the past. When asked if wildfires were a concern one such manager replied,

“Yes. Yes, it is. Because the fire didn’t burn everything. It didn’t leave a blank page as far as the environment is concerned. So, there’s still plenty of trees that could burn. There’s shrubbery, vegetation, a prairie fire type scenario in addition to a forest wildfire scenario. Okay. Both of those are possible for us... The Drinking Water Bureau is looking for an emergency response plan from us. And so that's a fault that I feel like we face. I need to get my rear in gear and get the thing down on paper. We're not... I mean, there's not very much there but wildfire would probably be at the top of the list.”

Another manager said,

“Wildfires? Oh yeah. You see that mountain right there? Well... we're real concerned about that. In one of the things, we did several years ago, the state had a program where if you used and they came in and they mark the trees... Then we had someone come in for forest remediation and they cut the trees down, ground them all up, and it looks like a park down there now. But are we concerned? You bet every year. We had to leave the house because the fire was so close. We have friends that lost their houses down here... 242 homes were lost here.
Managers had many ways that they worked to mitigate the threat, like taking advantage of programs like the one mentioned or working within their community to be prepared. One manager illustrated by saying,

“My wife is a County Commissioner and she's been working with the residents in regard to wildfire and the cleaning of the sites, of everybody's property. And trying to get rid of the debris and those kinds of things that can create the fires, a fire hazard. So, yes, we are concerned.”

Other managers mentioned concerns of house fires also.

Most managers were not concerned about flooding except for where their pump houses and other infrastructure were located. As for contamination, it was lower on the list of concerns, yet one of the repeat mentions common in rural areas was contamination due to septic systems. The main concerns were aging infrastructure, drought, and wildfire.

Challenges presented in the previous section are interwoven with how managers describe what motivates them to do the job they do. Often, the challenges faced in these roles create the motivations for water managers. To understand the insights of rural water managers who often carry out their duties under difficult circumstances, with seemingly little to gain, it is important to understand what motivates them.

Manager Motivations
Themes of manager motivations to hold the role in their small rural drinking water systems included trust and loyalty, knowledge, community obligation or civic service, and an interest in maintaining local control.

**Community Trust and Loyalty**

Managers seemed highly motivated by a sense of loyalty to their community. Community trust was another common tread. There was also a strong sense of trust within their communities with their board members, local staff, and community in general and a lack of trust for agencies, for non-local hired personnel, for experts in water. Managers who were nominated to their position felt trusted by their peers and community to do right by locals and their water systems. As one manager put it,

“And at the meeting, at the annual meeting, where that occurred, it was not the immediate past president but a guy who had been a president of the organization for many years. He was the one who nominated me, and I felt like that was a great sign of trust and it was like, okay, this is something that I took care off for 20 years and I am saying that I trust you to carry it forward.”

Another manager stated,

“I talk a lot and I was nominated, and everybody knew me. I think that’s another thing. People that are on the board, they need to be known in the neighborhood. It helps because if you’re not known, people are not going to trust you with finances, with money. And I’ve had people tell me that they don’t put anybody else being the treasurer because they would
worry about the money. Fraud and thievery is very common in small water associations."

Having a strong sense of loyalty to their community and feeling that their community trusted and believed in them was a major reason for people to volunteer for these unpaid roles. Another interviewee said,

"Most of the systems here are run by local people. It's a volunteer type thing, not paid. It takes somebody that's interested in their good of their community and their own good. If we don't have water, if I don't do it and nobody else does, then what happens? Well, just shot myself in the foot. Is a special person? They don't have to come from a special background. You don't have to be an engineer; you don't have organizational skills. Who becomes president of the woman's club or whatever, somebody that steps up."

Managers seem to communicate conflicting feelings about their communities, relaying a strong sense of obligation and loyalty while they feel negatively about their communities' values. These conflicting outlooks about community were especially interesting when examining manager motivations.

Managers will convey that their communities are wonderful, support each other, are close-knit, and care about each other. "But it is people from the community kind of rising to the occasion, to the need." Then in other sections of interviews communicate that their communities do not value water enough, treat them poorly in their positions, and do not step up when asked to come to
meetings or volunteer. “That old concept of the citizen, that’s much abused these days. But yeah.”

   Somehow it seems that sense of loyalty and community trust runs deep enough to keep people in their water management roles longer in rural areas, as unpaid positions. One manager explained, “We give everything we have and it’s not for our benefit. It's because we want to see our community thrive.” Another manager expanded the sentiment with,

   “I've always had an interest in bettering my community. I was a fire chief for 29 years, founded the fire department and I was on the school board for 26 years. I just been, I just love my community. I would like to see it get better. Make it a better place for my grandchildren.”

   Though managers often said conflicting things about their community outlook and relations, ultimately, loyalty and trust won out in motivating them in their roles.

   **Institutional Knowledge**

   Another motivational theme that emerged was knowledge. Being knowledgeable, having institutional knowledge, sharing knowledge through the generations or among community, and feeling like their community believed in their knowledge. Others felt motivated by an agency ask, like the manager that said, “So then, the state called me if I’d serve back again and probably because of my youth, and some knowledge.”

   Some managers were also motivated by a fear no one would know how to run systems as well as them. Some have been running systems for decades
and keeping institutional knowledge in their minds, so passing along the position feels too difficult. When asked who runs a system, one manager said it had to be someone that “kind of has the institutional knowledge to be able to do it.”

Feelings of community loyalty also overlapped with being a knowledgeable manager. As one manager said, “You know what, being on the board now that’s why I came over here because I want to be more knowledgeable as far as how the water system operates. Because I’m part of the community, I would like to see the improvements being made and better living conditions here.” Wanting to ensure the manager of the system is knowledgeable and doing right by their community sometimes meant they had to step up and become that knowledgeable person themselves.

Institutional knowledge often went beyond immediate communities to include other local water systems. Sometimes managers lean on the institutional knowledge among their region and call on other water managers to fill gaps in knowledge. In an interview with multiple personnel, one staff member spoke of their manager’s relationship with neighboring systems, saying, “I think they rely more on him because he’s got all that experience for so many years.” This institutional knowledge keeps managers in their roles longer.

Once in their position, managers also found that no one wanted to volunteer to take their position, due to their institutional knowledge gained over years of service. A few managers said they found themselves volunteering because no one else was, then found themselves stuck for years or decades in
the role. “We were at a meeting and nobody else was willing to take the job and I finally said, "Okay, I'll do it." ...Nobody wants to take the job away.”

Other managers were motivated by keeping a long-standing succession of institutional knowledge going. They felt a part of something bigger by knowing how to run the same systems that had been going, managed by locals for decades. As one manager said,

“And somehow decade by decade we’ve managed to do it. It's funny, I mean, I kind of see myself as like in a line of people, going back further than I know and hopefully going on into the future. We've got issues we've got to solve but there's been enough community spirit to sustain it so far.”

Sense of Community Obligation or Civic Service

Managers are most often from the community they serve, without a water management background, and simply were in the right place at the right time to be put into the position to serve their community. Feelings of obligation, civic service, and commitment to community were common threads in motivations. Often managers felt there was no one else to do the job, no one willing to step up, and that there is no one willing to take their place. The lack of community engagement is difficult on managers who feel obligated to their position, but they continue to hold their role, motivated by a sense of civic duty or community service. When asked what type of person becomes a water manager, one manager said,

“Those dumb enough to stick up their hand and volunteer. All the rural systems are all volunteer jobs, so it’s people that just caring enough that
are willing to spend some time doing it. I would say being retired helps. When I was still working when I started this thing, I retired four years ago, and it was hard to find the time then. It's still hard to find the time.”

Another manager expanded upon their conflicting feelings with,

“I really don’t want to, but I see that nobody else is. I don’t want to do it forever. I do it because it’s like giving back to the community, but at the same time, it’s a thankless job and I get told off and this, and you’re a... Money’s not going into my pocket.”

As noted previously, manager motivations and community outlook often caused conflicting narratives about community. Managers are motivated by a sense of generosity towards their small, rural communities even though they are not treated as kindly in return or compensated.

One of the strongest motivators for managers to volunteer for their roles was out of a sense of community need, combined with a lack of people to fill that need. Managers accounted repeatedly of getting into the position in this way and having to stay in it for the same reason. Some managers are elderly acting as managers with the sense that there is no one in the community ready or willing to take their place. “You see a need and it seems that you can perhaps fill that need. The way I came to it was that, well, there’s a kind of a perennial need for new board members.” Another manager said, “I don’t think it’s being civic minded. It’s just saying, "Okay, I’ll do it," because nobody else will.” Yet another manager stated, “We were at a meeting and nobody else was willing to take the job and I finally said, ‘Okay, I'll do it.’”
A strong sense of values was a reoccurring motivational theme in interviews. Obligation to communities, obligation to systems, and obligations to do right were frequently accounted. Managers are strongly motivated by their value systems. One manager, when asked if they were more civic minded than their neighbors, said,

“Yes, because I think the people that work here at the town hall and stuff with exception of a couple but won’t get into that. We give everything we have and it’s not for our benefit. It’s because we want to see our community thrive. I think in the last five, six years we’ve seen our community just, we have a new senior center, we have a new fire station, we have infrastructure going in. I think we have a really good group of us that work very well together.”

Another manager responded by saying,

“Well, at this point maybe civic minded would be the box to check… So, I mean, it was not an intentional choice by any means but it’s just that a little bit of what I lived through in my background was that. It’s funny because you asked about spiritual connections with water and it’s like, well, okay, as far as I have any spiritual connections or feelings of any kind, water is certainly in part of it because it’s just the source of all life in this part of the world. And in lots of others too. It was like accidents of background and past experience put together with whatever elements of, well, I really like living in this place and I like my neighbors and sure if there’s something I can do to help, I’ll do it.”
Maintaining Local Control

Managers seemed highly motivated to keep local control, maintaining sovereignty over their water. Both with regards to water rights and on the topic of regionalization. The few exceptions tended to be managers that were weary of their position and felt trapped in it.

Though managers were often found to have some self-organized regionalization, were it sharing an operator, knowledge, physical labor, parts, or water itself, they did not react positively to formal government oversight and control. “That’s the good thing about water systems like this. They know the problems that we have, they know that eventually there’s going to be a problem that will require some help from each other.” Ultimately, most managers were motivated to maintain local control over their systems. “You’re better if you’re on your own and you’re doing your own thing. You’re more aware of what’s going on in your system.”

There is a strong sense of lacking trust for agencies, for hired personnel, for experts in water but a strong motivation to keep local control as a fix to the distrust. There was also repeated mentions of too much government oversight already and that agencies wouldn’t have enough local knowledge, care for community, or response time. One manager said, “State does not need to come in here and control every aspect because they don’t understand. I really don’t think that they understand the rural communities.” Another manager, on the topic of regionalization, said,
“Regional office, I don't see the benefits of it because they won't be living here. They won't see what's going on. They won't have their hands on. I don't think it would be a benefit. It may be a necessity at one point for us for something like that. A benefit? No. We have enough government control as it is.”

One interviewee expanded by saying,

“The problem down here, I want them to live here. They weren't looking for an operator when I came here, and they weren't getting any candidates that could actually do the job. I've run every type of sewer plant there is, so that was the biggest thing. Running a water system is easy. Just stay on top of it, know what's going on. Same with this. As old as this plant is, everybody asks me how I get my numbers I get. It's because I don't walk away and leave it. We're here. Saturday and Sundays we come in and do our rounds, which includes the sewer plant and the water system. About two hours, even on those days, whoever's on call runs that on the weekend. Everything is managed every day and then that guy is on call 24/7.”

A resounding motivation for maintaining local control was tied to community care and obligation, managers felt that government agencies would not care for their systems and communities at the same level they did.
Discussion

Whether discussing the challenges small, rural water system managers face or what motivates them to take on their roles, in either category of findings there is much overlap and patterning. The challenges managers face are frequently inseparable from one another or beget the next challenge, making them interrelated and cyclical. Manager motivations seemed oftentimes tied to challenges. Motivated managers performed their roles with strong ties to their communities especially for those communities. It was clear that water managers operate on a kind of survival mode, making sure water is delivered to their communities no matter what they face or how difficult and thankless their role feels.

Delivering Safe Water

Rural water managers appear to be facing so many challenges at once, with so little support or resources that they are barely meeting regulations and often behind on reporting or not in compliance. Not for lack of effort of their part, but for an institutional system that performs better for larger drinking water systems. Managers are highly motivated to deliver safe, clean drinking water to their communities and understand the importance of regulations. However, the reporting and certification requirements are burdensome for small systems without the resources larger systems have. Most of the systems covered by these interviews with water managers in this study showed noncompliance due to reporting issues, according to the violations on the NM Drinking Water Watch.
website. These are not violations that indicate unsafe water delivery to communities but are tied to agency processes. As one manager said,

“Then the only other compliance issue we have is if I could get the CCR [Consumer Confidence Report] in on time. I don’t think it’s fair. This is where I have to take exactly what the state already has, and I have to put it into another form. Then if their form doesn’t work and it’s not calculated correctly how they want it, then they throw it back. Even though I’ve submitted it and without the corrections because it wasn’t submitted correctly in a timely manner, then we get violation for it, and I don’t think that’s right. I don’t think I should have to provide that information when it’s already input into the system. Why should I have to recreate the wheel? I just feel that it’s recreating the wheel all the time and I don’t… A lot of small systems, we don’t have time. If that’s all I had to do, I’d be Johnny on the spot. That’s fine, but when I got 15 million other things to do, it’s like, why am I recreating the wheel?”

The solution seems obvious that managers simply need more resources and facilitation of reporting requirements and processes. Issues like the one above shows how agencies like NMED should streamline processes of reporting and reduce requirements that are repetitive or redundant. Managers noted frequently that getting answers or assistance from agencies was difficult and untimely. Agencies should have staff dedicated to reducing difficulty in reporting, as it ultimately increases public safety. Agencies serve the people to ensure safe water, as do managers, and this relationship needs rehabilitated
with regards to small and rural water systems. The primary goal here for both parties is public safety, but the scale and process are off.

If more assistance and resources were afforded these small systems, scaled to system sizes, drinking water systems would run on a more equitable scale in New Mexico. In 2022, “a Water Policy and Infrastructure Task Force of water and natural resources experts, senior state agency staff, and stakeholders from around New Mexico” was formed “to study the problems and recommend actions the state can take” (Utton Center 2022). This was a large undertaking, where “the 29 Water Task Force members, representing diverse expertise, geographies, and community interests, examined New Mexico water management and governance challenges” (Utton Center 2022). This task force, however, did not approach problems and recommended solutions informed by small and rural water managers. The report noted issues found here like capacity and a need for community engagement, and that “solutions cannot be imposed from above, they must draw on knowledge and values of those closest to the problems and potential solutions,” yet the list of members did not note anyone with the role of being a small, rural water manager to give such insight (Utton Center 2022).

Safe, clean water delivery needs to be priority, with processes that fit all the systems. Solutions should be informed by managers, their resources, and their capacity. Another top-down approach will not be as successful as a collaborative and bottom-up informed process of reaching recommended actions.
Overburdened and Underfunded

Financial burdens were one of the challenges that threaded through every challenge managers faced. Funding resources were difficult to find, grant matches often impossible to meet with the small number of users paying into the system, and revenues most usually being used for emergencies instead of being able to carry out necessary future planning and infrastructure replacement that were long overdue. Managers could not afford to pay for personnel necessary for compliance or to leave their positions, having to wear multiple hats and stay in roles longer than is healthy or wanted. In one interview it was explained,

“The younger generation is not as volunteer driven as maybe the older people were. And we often get that threat, "Well, what happens if we walk away?" Well, it's your community. [You] can’t.”

As another manager illustrated, “I don’t take any administrative fees or anything out of it because we try to build up that fund. I have to do a match fund for this project that we're doing and that's kind of [going to] wipe out my savings.” They couldn’t offer paid positions to younger generations, providing rural employment to combat brain drain. Rural systems rely too heavily on their impoverished communities to work for free, solidifying low community engagement. Managers were unable to plan ahead for future environmental concerns or replace infrastructure that is doomed to fail at any time, for lack of funding.

Most of the challenges that small, rural water managers face could be lessened with financial assistance. Funding that is currently available does not
meet the needs of small systems who cannot match grants when their rate base is only a few people. One manager said, “But these really small systems are so tight on funds. Even $150 to go to training is more than they can afford.” Matching fund requirements could be waved for low-income communities, systems with a low number of connections, and for rural water systems. Agencies could do the same for the costs associated with certification.

Managers are regularly looking for funding in order to get other funding. As another manager explained,

“There's a lot of sources of funding, which money is the big issue of course, but you can't qualify for any of them until you get a preliminary engineering report. That's a $50,000 item. There are grants out there that we should be eligible for that I'm in the process of trying to apply for to get some money, but once you get the government money, you have to go through the government's procurement policy thing, which adds time and money to the policy. You've got to go select an engineer and get the engineering report done. And until you get that report back, the other sources of funding you got, whether they're grants or loans, won't consider you until you've had that part done. So, that's where I'm at right now is trying to get a grant to get a preliminary engineering study.”

Managers that were most successful with funding could afford grant writers, had more staff, and were larger in size with a solid rate base and a higher number of connections. Often these are municipalities, which are not the majority of small, rural systems.
Most of the managers that were interviewed also reported about systems with infrastructure in desperate need of replacement, huge overhauls that are extremely costly and will eventually result in failed water systems if not addressed. Systems were commonly put in half a century ago or more with few or only partial upgrades. Aging and failing water system infrastructure is a statewide issue. It is also a known issue, agreed upon by water experts and managers. Infrastructure replacements and upgrades are necessary across rural New Mexico to continue to deliver clean, safe drinking water and managers need assistance. This issue is beyond the scope of what volunteer water managers should be facing.

**Rural Retainment**

Aging populations in rural areas is not isolated to New Mexico, but as noted early in this paper, it occurs more often in New Mexico. Coupled with poverty and a lack of educational opportunities, the issue is only going to accelerate. Water management in rural communities offers a trade that is accessible to younger generations, if only it was a paid position. Several managers had interest in trying to recruit and train subsequent generations in water management if they simply had the means to pay them and pay for their training and certification. As one manager said,

“We're talking about educating a young person. "We'll pay for all of your courses and education if you will stick with us for five years or three or whatever." It's one of our ideas to develop a water operator that might stick with us.”
The repeated feedback from managers was younger people needed paid work to support themselves and a family to stay in the area. If there was an educational funding program for rural areas to recruit, train, and hire younger generations it would offer a solution to several challenges facing managers. Managers would have funding for paid personnel, it would offer an opportunity for youth to stay in rural areas, lower the feelings of managers obligated to stay in their roles longer than they want, and lessen the overburden placed on volunteer managers. This would also help with elders in the community being forced to stay in their roles because no one will step up for the volunteer work or had the knowledge to take over.

Looking to what motivates managers to hold the roles they do can also lend insight in how to motivate future generations. Fostering that sense of community stewardship and trust, pride in knowledge, and local sovereignty and control over the water system that serves their area are all foundations that could be built into a funded educational program for rural water systems. Community loyalty and civic service are commonly innate in rural areas. The opportunity to sustain a livelihood is what is typically missing.

**Local Sovereignty**

Intimate knowledge of local systems, no travel time to address emergencies, and a greater sense of obligation to do right by one’s own community are all positive outcomes of locally organized water systems. These can also be fostered through an educational program and ties to the manager motivation themes discovered through these interviews. Managers were
motivated to maintain sovereignty over these water systems for these outcomes and sometimes had self-organized into regional systems of support. By sharing resources, personnel, and knowledge, small water systems have increased their resiliency to hardship.

By understanding manager motivations to maintain local control of their systems, agencies who would like to move forward with regionalization could work with rural systems to ensure that the benefits remain with a sense of sovereignty. Small, rural systems are already organizing informally with nearby systems and would be understanding of shared resources and funding especially. As one manager explained,

"I don’t want that to happen at all because every time the government steps in and does something they make it expensive, inefficient, and unreliable. I don’t necessarily want to give up all my power. I just want to give up the responsibility and work."

Several overextended managers were open to regionalization just to get some relief from having too much on their plate at once. There is resistance due in part to dealing with burdensome and inefficient reporting requirements and a lack of trust in agencies to do what is best for small communities. Yet, if regionalization included an increase in funding and resources, without giving up as much of their sense of local control and oversight, small, rural systems might be more open to it. As another manager illustrated,

"I remember hearing something years ago that it costs a lot of money to be poor. And you know it really does. And I really feel that's how it is for
this, for a lot of rural communities. You know their water systems, even their water systems. So that's what worries me. That's what keeps me up at night. And in addition to having to report and provide all the documents and meet all the other requirements, EPA requirements and they should happen. I mean you should test your water; you should make sure it's safe. You should be accountable for the revenue that comes in and goes out and answer to the state for that you should. You should have oversight."

Again, managers agree with safe water delivery and understand the requirements, and they also intimately know the social justice issues that their communities face and how water systems are woven into these issues.

**Connecting Challenges and Motivations**

It would not be possible to examine manager motivations without looking at the challenges managers face. In the same way, challenges for rural water managers should not be addressed without understanding what motivates managers in their roles. Solutions to issues faced throughout the state by this group of public service providers requires investigating both above topics for a holistic representation of what is happening with rural water management.

There are key takeaways when the relationship between challenges and motivations are researched and questioned. This study has demonstrated how each challenge informs how water managers approach them, and what motivates them the most in their decision making and management of water. These themes of manager challenges and manager motivations, in the interviews, are intermixed and clearly tied together.
Overall, helping rural water manager face the current challenges outlined in this study behooves asking what motivates them to meet those challenges. It also requires understanding their motivations to meet future challenges. Understanding that these two themes are intersecting is key to increasing resiliency in small and rural community water systems. Knowing the true challenges water managers face, instead of what is perceived from outside of their experience is extremely important. And knowing exactly what will continue to motivate managers to meet those challenge head on is just as important to build flexibility and resilience into water systems for future challenges.

Assisting water managers to meet current and future challenges to deliver safe drinking water would be better approached by the strongest motivation they have in common; community. The word community was one of the top significant words in a query of the interviews, found 526 times and within all interviews. Managers are motivated to help their communities with the most basic of human needs, water, by almost any means, continually going above and beyond. As one interviewee stated, “I considered it an honor to be able to serve the people in this community because they’re so good.” They are motivated to maintain their own systems at lengths out of loyalty, comradery, and community trust. Another manager said,

“If somebody said he want to do it tomorrow, feel free. But it’s for the good of the community and stuff. Why do you give blood? Because you want help somebody.”
Rural water systems' strong foundations are their managers. No one will work harder for their systems and their communities; they just need the resources to do so. Put in the simplest terms by this manager, “And finally, we are where we are because of the hard work of a lot of people. Our community is very special, because we have community-minded people…”
Conclusion

New Mexico is facing critical issues with its drinking water systems. The future of rural drinking water is at a decisive point in our history. Circumstances of New Mexico’s rural areas have provided an important field of study regarding community water managers and their systems. Rural demographics further complicate providing for health and services like water in rural areas. Water managers lend a direct insight into the challenges they face in delivering safe, clean drinking water to their communities. Water managers also provided explicit understanding of the motivations behind the role.

Through this study, water managers have provided a collective and candid account of what is needed to help them be successful in upholding the regulations which they are beholden to. Managers have outlined their challenges and how they intersect or become cyclical. The interview data revealed that manager motivations are often created out of manager challenges. Data also pointed to solutions born out of manager motivations.

The leading challenges discussed by water managers were a general lack of resources and personnel, issues of community engagement, lack or loss of institutional knowledge, compliance difficulty, and aging populations. These challenges were found to be the most common and widespread. For manager motivations, the principal themes that emerged were community trust and loyalty, knowledge, community obligation or civic service, and an interest in
maintaining local control. Each of these themes was tied to or born from the challenges small system water managers face.

For further research, spatial and temporal investigation could supplement the work done through this study. With small systems failing through no fault of rural and small water managers, but due to lack of resources and aging infrastructure, examination of violations could help to inform current and future areas to concentrate on assisting. Temporal studies of violations for the state would help to determine which systems are no longer able to meet safe drinking water standards. Mapping of contamination types and violation locations could also lend to the spatial data available on the topic and assist in predicting areas of risk for certain violations. Lastly, temporal data on water sources and infrastructure would be helpful to see the aging of rural systems and help to predict future needs and issues from community systems that have infrastructure improvement needs.

Through the insights unique to this study, the goal is to impart direct and positive impacts for rural water systems in New Mexico. This paper gives a comprehensive overview of motivations and challenges of water managers from the actual source. There is no singular solution, but there are a few recommendations that can begin a step in the direction of addressing multiple issues at once.

First, rural and small water system managers should be a paid a salary, especially as they are providing a public service. The demographic and statistic data of rural areas already demonstrates that there is a lack of opportunities
that cause population decline which is reinforced by rural managers most often going unpaid. This would help retain personnel, encourage younger generations to take on the role, decrease feelings of overextension, provide rural employment opportunities, and assist in meeting certification regulations.

Second, a free educational or training program specific to small, rural systems with a pathway into a management or staff role would also help to keep younger generations in rural areas by providing an opportunity for education and employment. It would also assist with issues surrounding loss or lack of institutional knowledge. It would build a dedicated rural area pathway to employment. The program could be a regional resource along with other assistance needed in these areas to make reporting and other regulations less burdensome for small systems. Training assistance is also mentioned as a recommendation in the New Mexico Water Policy and Infrastructure Task Force report (Utton Center 2022).

Last, and tied to the regional program above, would be for regulatory bodies such as the NMED to provide more assistance to small and rural systems based on the size of the system. Regulatory bodies listed in the New Mexico Water Policy and Infrastructure Task Force report should provide more assistance to small, rural systems (Utton Center 2022). The program could aid managers based on the size and location of the system, have a scale according to number of connections, and meet rural systems where they are in their capacity to meet standards and regulations. The smaller the system, the more assistance provided to meet those standards and regulations.
These few suggestions do not solve all the problems confronting rural water managers and their systems, but they are examples of ways to address multiple challenges and motivations at once. The solutions to the critical state of rural water delivery are going to have to address the complications and interwoven nature of the challenges and motivations of the managers. Engaging in active resolutions for water management needs to happen now, it is already overdue in rural New Mexico.
Appendix

Figure 1: Map of active drinking water systems in New Mexico.

Corresponding colors represent source type; blue depicting groundwater, pink indicating surface sourcing. Source: New Mexico Environment Department OpenEnviroMap, https://gis.web.env.nm.gov/oem/
Table 1: Interview Codes

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<th>Regionalization</th>
<th>Systems</th>
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<td>Already Regionalized</td>
<td>Finances</td>
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<td>Community Relations</td>
<td>Agency Interaction</td>
<td>Local Control</td>
<td>History</td>
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List of interview codes, in columns of research focus topics and water systems data.
Citations


NMRWA. (n.d.). About Us. https://nmrwa.org/about/


