WFX

WATER FINANCE EXCHANGE

NO COMMUNITY LEFT BEHIND

REGIONAL WATER AND WASTEWATER MANAGEMENT SOLUTIONS

Fellowship Report

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Executive Summary

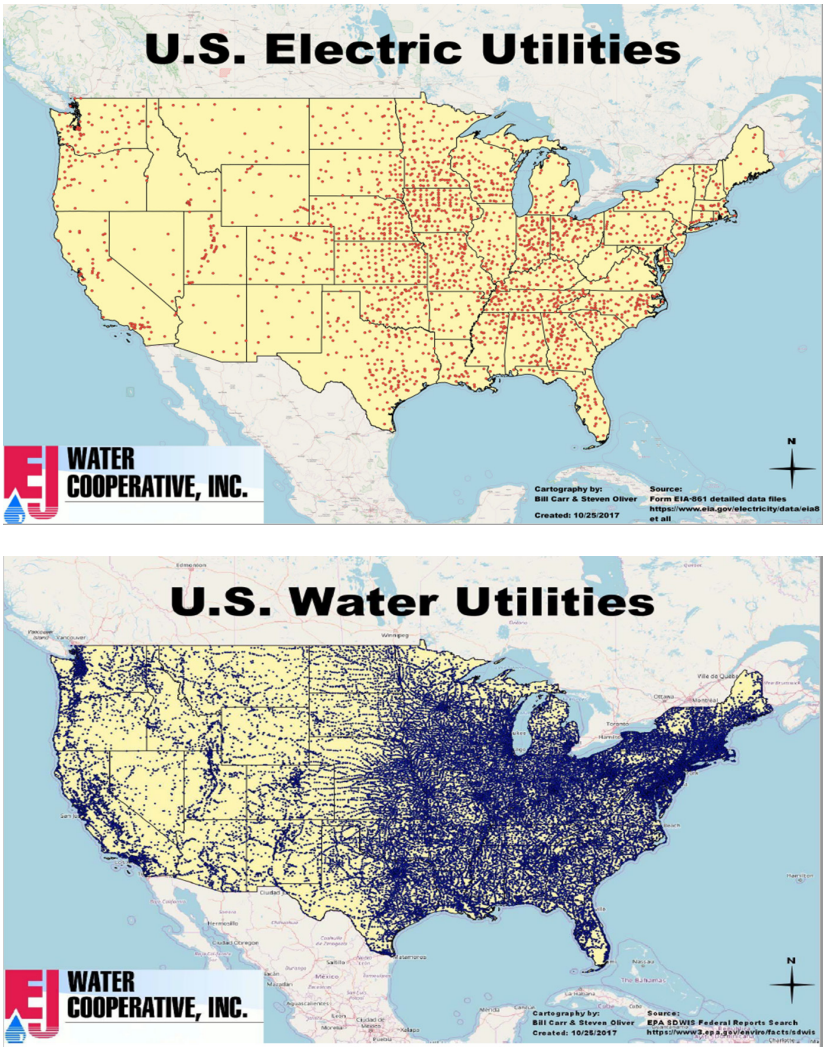
Regional solutions[1] can take many forms with varying degrees of autonomy and complexity, ranging from agreements and partnerships to ownership transfer and consolidation with unified governance. Estimates suggest that there are over 51,000 regulated community water systems, 15,000 wastewater treatment plants, and more than 1,000 stormwater utilities in the US.[2] Fifty-four percent of these systems serve fewer than 500 people.[3]

Given the large number of water systems, regional solutions could improve economies of scale and efficiency, to address challenges around deteriorating water infrastructure and water affordability.[4] The wide range of regional solutions allow for a tailored approach for each community.

While regional collaboration is a choice that should be made by all relevant communities, the experience of Water Finance Exchange (WFX) and other intermediaries suggest that regionalization opportunities may have been overlooked because the diverse forms and the benefits of regional solutions are not well cataloged and understood.

This paper is designed to build on existing research and publications by organizations like EPA, Rural Community Assistance Partnership (RCAP), US Water Alliance and others to create a shared practical understanding of regional solutions, where they are useful, and how to approach them and manage them sustainably. Increasing understanding of how regional solutions work and deliver benefits will enable communities to make informed decision when implementing sustainable regional water infrastructure.

Figure 1: Comparison of Electric Utilities, and Water Utilities in the US



Source: EJ Water Cooperative

Key Findings

There are many different forms of regional solutions that have different levels of effort required to implement, as well as different benefits, and challenges.

Regional solutions can help:

- Achieve economies of scale and operational efficiencies
- Improve water quality compliance and water quantity issues
- Access lower cost capital while maintaining customer rates and stabilizing revenue across a more diverse customer base
- Reduce exposure to regulatory penalties and improve reliability and service

1 Regional solutions are also referred to as Water System Partnerships by the Environmental Protection Agency (EPA): Environmental Protection Agency. Learn About Water System Partnerships. (2022).

2 US Water Alliance & UNC Environmental Finance Center, Strengthening Utilities Through Consolidation: The Financial Impact. (2019).

3 Dig Deep; US Water Alliance. Closing the Water Access Gap in the United States. (2019).

4 US Water Alliance & UNC Environmental Finance Center, Strengthening Utilities Through Consolidation: The Financial Impact. (2019).

Literature Review

The following are in the order of solutions that allow for greater autonomy and simple operating arrangements to less autonomy with more complex operating arrangements.[1]

Informal cooperation is where systems work together without contractual obligations. For example, sharing equipment and bulk supplies, or creation of mutual aid agreements for emergency assistance.[2]

Contractual assistance is where systems have a contract to formalize their cooperation, either with another system or a service provider that also serves other systems.[3] This approach allows individual systems to maintain their independence, while benefiting from improved efficiency through increased access to staff and skill sets. Examples include contracting operation and management to share staff such as engineers, back-office operations and system operators, outsourcing engineering services and purchasing water from each other.

Shared governance is where systems create a joint powers agency, establishing a shared entity that exist independently.[4] Systems maintain their autonomy but work together to establish and manage the new entity. The newly established arrangement could provide shared system operators, run a treatment facility, enable access to source water that would have been impossible for one system to tap into on its own, and may be able to apply for and access funding more easily. The newly established entity may own, build, manage, and operate utilities under an agreement made by the communities that formed it. Examples of shared governance models include regional water or wastewater authority, or a special utility district.[5]

Ownership transfer is where a system takes over an existing or newly created entity. This usually involves a merger process where one system assumes the assets and liabilities of another system, or a new structure is established to allow regional partners to merge into.[6] Ownership transfer can also involve a physical interconnection or managerial consolidation. Consolidation is where two or more legal entities become one operating under the same governance, management, and financial functions. This can be achieved through direct acquisition, where higher-capacity utility acquires the assets, operations, and customers of another system and absorbs them; or a joint merger, where two or more relatively equal partners adjust governance, operations, and financial frameworks to create a new entity that is owned and controlled by the previously separate parties; or a balanced merger, where two or more entities consolidate with the goal of establishing a governance structure that provides a basis for at least some direct participation by the pre-existing utility in future decision-making.[7]

Drivers of Regional Solutions

Small systems can face a lack of technical, managerial, or financial capacity due to declining funding, shrinking tax bases, persistent poverty, and understaffing.[8] Cost considerations and regulatory pressures often drive regional solutions.[9] Cost considerations include cost savings from economies of scale and reduced duplication, as well as eligibility for funding large or regional projects.[10] Regulatory pressures include water quality improvement, watershed planning, stormwater regulations, water loss regulations, reliable water supply and resilience.[11] Shared regional concerns, such as drought or increase in demand from industry, can also be a strong motivation for regional solutions.[12]

1 River Network. State Action on Water System Regionalization and Consolidation. (2022).
2 Rural Community Assistance Partnership (RCAP), Resiliency through Water and Wastewater System Partnerships: 10 Lessons from Community Leaders. (2020).
3 Ibid.
4 Ibid.
5 Ibid.
6 Ibid.
7 US Water Alliance & UNC Environmental Finance Center, Strengthening Utilities Through Consolidation: The Financial Impact. (2019).
8 Dig Deep; US Water Alliance. Closing the Water Access Gap in the United States. (2019).
9 Rural Community Assistance Partnership (RCAP), Resiliency through Water and Wastewater System Partnerships: 10 Lessons from Community Leaders. (2020).
10 Tran, T.; Carpenter, A.; Kenel, P. Doing More With Many: Case Studies of Regional Collaboration in Management and Shared Infrastructure. Journal AWWA. (2019).
11 Ibid.
12 Ibid.

Benefits of Regional Solutions

Financial benefits of regional solutions include[1]:

- **Economies of scale and operating efficiencies**, for example through bulk purchases of chemicals, maintenance of larger network of assets instead of isolated assets, and decreased duplication of labor. Economies of scale could also apply in building a larger treatment plant, as fixed costs of construction such as permits, mobilization costs and overhead costs are similar regardless of the size of the plant.[2]
- **Improved water quality and quantity**, as well as **compliance** with water quality regulations
- **Increased access to lower cost capital**, as larger pools of assets can receive better lending terms or qualify for public funding
- **Access to innovative technologies** as a result of economies of scale and improved access to resources. The scale of regional solutions can facilitate the demonstration and deployment of innovative technology
- **Lower or equal customer rates**, from lower capital and operating costs. As the rate base increases, the burden of administrative and operational costs is shared more widely, and these costs do not tend to vary with the size of the plant.[3] That said, rates may rise in the short-term for immediate costs of consolidation or addressing overdue issues
- **Revenue stability**, due to a larger and more diverse customer base
- **Reduced exposure to regulatory penalties**, through more cost-effective regulatory compliance and regulatory approvals, as well as improved public health
- **Improved planning and risk management**, from a more comprehensive and less piecemeal strategy across multiple systems
- **Improved reliability and service**, from improved planning and access to resources[4]
- **Increased opportunities for economic development**, by addressing water supply or infrastructure issues.

Costs and Challenges of Regional Solutions

Challenges include local political interests, lack of trust, concerns about loss of autonomy and the unknown, financial challenges around funding projects, distribution of costs and benefits, and diseconomies of scale.[5]

Negotiating a long-term contract between communities is time and resource intensive, with many stakeholders.[6] Communities that have a relatively disadvantaged starting point are likely to require strong accounting and negotiating skills to reach an agreement. Disagreements can arise from the inherent challenges of regional solutions, such as[7]:

- **Up-front costs** from initial investment, including costs from preliminary planning, studies, and staffing. It is also common for consolidation to require infrastructure improvements, new projects, or physical interconnections between infrastructure assets.
- **Real or perceived unequal distribution of benefits** as financial benefits of regional solutions are not always distributed equally across communities or utilities. It may be difficult for a community to agree to regional solutions if it makes a financial loss, even if there are financial benefits for the larger region. It may also be difficult to address inconsistencies across customers and systems.
- **Different starting points** of communities and utilities: for example, a higher-capacity, financially healthy utility may have little incentive to work with utilities in worse positions. Points of difference include different rate schedules, asset values, savings, and liabilities.
- Concerns about **loss of control and independence**. Regional solutions can create a perception that the parties are giving up control of their water utilities, including their ability to set rates, or that they would be treated unfairly by a larger regional partner.[8]

1 US Water Alliance & UNC Environmental Finance Center, Strengthening Utilities Through Consolidation: The Financial Impact. (2019).
2 Dunn D. & Filip D. Wastewater Regionalization – Interim Report to the Legislature Department of Ecology Water Quality Program. (2008).
3 Ibid.
4 Rural Community Assistance Partnership (RCAP), Resiliency through Water and Wastewater System Partnerships: 10 Lessons from Community Leaders. (2020).
5 Ibid.
6 Dunn D. & Filip D. Wastewater Regionalization – Interim Report to the Legislature Department of Ecology Water Quality Program. (2008).
7 US Water Alliance & UNC Environmental Finance Center, Strengthening Utilities Through Consolidation: The Financial Impact. (2019).
8 Dunn D. & Filip D. Wastewater Regionalization – Interim Report to the Legislature Department of Ecology Water Quality Program. (2008).

These challenges affect the **political incentives** of elected leaders to support regional solutions, as the benefits tend to be long-term and may not be realized during the leader's term in office.[1]

As a result, **initial conversations** between communities can be the first hurdle, especially as water systems tend to operate in a competitive culture, often arising from competition for attracting talent or economic opportunities.[2] A shift to a more cooperative culture can be facilitated by rotating meeting locations, transparent information sharing, and an identification of shared objectives.[3] Trust-building, or coalition-building, is crucial to overcome the inherent challenges of regional solutions.

A challenge in designing a solution is **diseconomies of scale**, which can arise depending on the projects. The scale of regional collaboration can create the risk that if something goes wrong, waste or pollution volumes may be larger.[4] That said, scale should also facilitate better preparation for outages. The **extent and location** of existing infrastructure can also be a barrier.[5]

The US Water Alliance also warns that regionalization projects that are not community-driven can weaken or destroy community representation, with detrimental impacts on communities of color.[6] A community's accurate understanding of its quality of current and future water services is also crucial to reduce pushback.[7] The US Water Alliance argues that the communities with successful water system consolidation share the following characteristics: understanding financial impacts, patience, long-range planning, external incentives, and leadership.[8]

Case Study Review - Methods

Key trends and observation from case studies of regionalization, such as forms, type of initiation, and any changes to water rates, are summarized below. The case studies in this note are from the United States Environmental Protection Agency (EPA)'s series of case studies on regional solutions.

The case studies were assessed using the following questions:

- What were the drivers / triggers for regionalization?
- What did the timeline for the process look like, with a focus on major milestones?
- Why was the form of regionalization selected by the communities?
- What were the barriers, and how were they overcome?
- What facilitated the regionalization process?
- Were there any intermediaries or technical assistance providers involved?
- Have the communities solved (or are continuing to solve) the specific problem(s) that the regional solution was intended to solve?
- Are there any lessons in terms of resources that would be useful to communities looking to regionalize?

While a potential approach is to consider and compare the socio-economic contexts of communities before and after regionalization, this may be difficult as socio-economic metrics, such as median household income, can be driven by factors outside water infrastructure; and regionalization solutions involve multiple communities, which makes comparisons more complex. Instead, the focus of this review is on a qualitative assessment of whether the regional solution addressed the specific issues that the communities intended to target.

1 Ibid.
2 Tran, T.; Carpenter, A.; Kenel, P. Doing More With Many: Case Studies of Regional Collaboration in Management and Shared Infrastructure. Journal AWWA. (2019).
3 Ibid.
4 Dunn D. & Filip D. Wastewater Regionalization – Interim Report to the Legislature Department of Ecology Water Quality Program. (2008).
5 Ibid.
6 US Water Alliance. Catalyzing Community-Driven Utility Consolidations and Partnerships. (2022).
7 US Water Alliance. Utility Strengthening through Consolidation: A Briefing Paper. (2019).
8 US Water Alliance & UNC Environmental Finance Center, Strengthening Utilities Through Consolidation: The Financial Impact. (2019).

WFX approaches communities looking to encourage or facilitate regional collaboration along watershed use or where regional partnerships can come together to promote resilient water practices with infrastructure solutions that are more cost effective. This partnership can take different forms as each community present different opportunities and challenges. Working together to manage watershed impact, buying supplies, blending complimentary infrastructure need are a few of the foundational ways in which WFX has helped to solidify regional collaborations. WFX has been successful in catalyzing partnerships in Presidio County, Jim Wells County and the South Texas Water Authority. Often regional collaborations already loosely exist, WFX formalizes and leverages those collaborations. The opportunities and benefits of regional collaborations are further detailed in the WFX Community Resources Library. This work takes from and adds to the EPA case studies detailed below.

Regionalization Case Study Review Summaries

Informal Co-operation Case Study

Community[1]	Form	Cooperation
Northeast/Merrimack Valley Consortium of Water and Wastewater Facilities (MVC), Massachusetts	Informal cooperation to purchase supplies in bulk	35 towns and their water and wastewater systems

Purpose: Each of the water systems paid high prices for supplies such as treatment chemicals and laboratory supplies, due to individual negotiations and relatively limited individual needs.

Regionalization Process: Community leaders from the water systems drove the process and the chief operator of one of the water treatment plants catalyzed organizing of founding cities and towns. MVC was formed in mid-1980s but evolved over time as its scope of bulk-buying expanded from laboratory supplies to treatment chemicals, and other goods and services. It also became an information sharing forum. Some systems have left to form smaller consortiums, but MVC has been so successful that it had to limit membership to communities and systems in a defined geographic area.

The MVC is governed through self-enforcement, without requiring communities to give up control of their water systems – although members cannot pursue vendors outside MVC. Every year, one system serves as the "buying agent" and two other systems provide support so that over the next two years, they have the necessary skills and knowledge to negotiate purchase agreements (when they become the buying agents). This ensures all systems share responsibilities, with each system taking turns to lead the buying process. This helps maintains institutional knowledge and continuity in negotiating with vendors.

MVC has five annual meetings, where they determine their needs, negotiate, and finalize agreements with vendors. These meetings are also information sharing forums to share best practices and challenges. Members are expected to meet American Water Works Association standards and honor contracts made through the consortium.

Outcomes

- **Shared service**, with MVC's bulk purchases enabling it to establish contracts with supplies and maintain a secure supply of treatment chemicals
- **High-quality products and service** from MVC's ability to hold vendors accountable when contractual obligations are not met
- **Information sharing** from regular meetings to share systems' experiences, challenges, and best practices
- **Economies of scale**, with MVC communities reducing the average long-term costs of treatment plant operations by purchasing treatment chemicals in bulk. Vendors are now competing for MVC's business, which increases MVC's options when soliciting bids.
- **Reduced costs** from purchasing in bulk and ability to allocate those resources to other system needs.

This case study demonstrates how informal cooperation can help address common needs of water systems and lower operating costs, without requiring communities to give up local control of water system.

1 https://www.epa.gov/sites/default/files/2017-07/documents/p1006md0.pdf

Contractual Assistance Case Studies

Community[1]	Size	Contractual Assistance
Aurora, South Dakota	Small residential town, population 500 and 250 water connections	City of Brookings – a city with population 22,000 and a local university
Atoka County Rural Water District (RWD) #1, Wardville, Oklahoma	75 customers	Pittsburg County RWD #11 – purchase water
Lee County Water Plant, Sanford, North Carolina	149 customers, 60 residential connections, a large poultry company	Private-sector operations and maintenance firm – management, operations, and maintenance

Purpose: All three case studies shared compliance and water quality concerns, staffing challenges, financial concerns, water infrastructure challenges, and water source issues.

Aurora lacked capacity to provide water that met the National Primary Drinking Water Regulations, persistently violating the maximum contaminant level (MCL) for nitrate. Water nitrate levels exceeded MCL by up to 50%. Aurora lacked financial resources to install nitrate treatment and could not easily find a new water source as nearby wells also had high nitrate levels. Its treatment plant operator was also not adequately certified and had a range of municipal responsibilities.

Atoka RWD had frequent turbidity violations, with the system under boil water order for more than a year. In 2003, the Atoka RWD system was placed under regulatory consent order from Oklahoma Department of Environmental Quality. Atoka RWD's lack of long-term planning resulted in no alternative water source being identified until the issue became extremely urgent. Atoka RWD also faced a depleting water source. Atoka RWD had inadequate rates, no reserve funds, and no access to capital financing. The high turbidity was from inadequate infrastructure, as Atoka RWD's surface water treatment plant lacked a settling tank. The treatment plant had not been upgraded since the 1980s and was treating over 20,000 gallons a day when it was designed to process only 12,000 gallons per day. Leaks from 40-year-old distribution lines amounted to approximately half of finished water.

Lee County Water Plant had numerous monitoring and reporting violations. It lacked regular supervision of a qualified operator, from a lack of resources to hire a qualified operator and expertise needed to make operational improvements. Technical assistance was periodic, from a circuit rider.

Regionalization Process: The process differed across all three case studies.

Aurora shared the cost of constructing transmission pipeline with Brookings to interconnect the two systems, to provide Aurora residents with drinking water meeting nitrate MCL.

Atoka RWD was placed under regulatory consent order from Oklahoma Department of Environmental Quality in 2003, and the National Guard had hauled drinking water to the community as emergency water source. Atoka RWD then considered extending a pipeline to Stringtown (Oklahoma)'s water system. This was not pursued because it required construction of several miles of 6-in diameter water line, along with other improvements, costing an estimated $680,000. Instead, in 2005, it chose to build a 4-in diameter pipeline tied to Pittsburgh County RWD #11, which had a distribution main 3 miles away. They entered into an agreement to purchase water from Pittsburg County RWD #11. This cost $86,000. The cost of building of a pipeline to Pittsburgh was mostly funded by Oklahoma Water Resources Board emergency grant.

Lee County Water Plant's arrangement with a private-sector firm, included the firm hiring and supervising the system's three full-time employees, and providing part-time qualified operator with extensive technical expertise. Lee County Water Plant benefited from the firm's economies of scale for activities such as financial management and billing, through its central office. This contract with the private-sector maintenance and operations firm was renewed through 2002.

1 https://www.epa.gov/sites/default/files/2017-07/documents/p1006md0.pdf

Outcomes:

- **Water quality** improved to comply with water quality requirements in all three cases.
- **Reliability** of water source improved for Aurora (with Brookings' back-up systems for power outages and redundant treatment facilities), and Atoka RWD.
- **Cost savings** were realized through: avoidance of expensive nitrate treatment for Aurora; and installation of master meter to measure water usage and assess leakages, for Atoka RWD; and bulk-purchase agreements arranged by the private-sector firm for Lee County Water Plant.
- Lee County Water Plant benefited from the ability to work with the private-sector firm to **plan for capital improvements** and secure local and federal **funding**.
- **Increase in utility rates** for Aurora and Atoka RWD. For Aurora, the increase was less than what it could have been, had it installed nitrate treatment equipment. Atoka RWD initially had inadequate rates before regionalization. After regionalization, residents paid reasonable rates that covered the cost of purchased water and sustaining the system.

These case studies demonstrate how contractual assistance can help improve water quality and compliance, through partnerships with various entities – from public utilities to private firms. It is also worth noting that water rates tended to increase after these changes, which implies a need for community buy-in.

Joint Powers Agency / Shared Governance Case Studies

Community[1]	Size	Shared Governance
Logan-Todd Regional Water Commission (LTRWC), Kentucky	Each system serving between 395 to 3,300 customers (meters). 7 out of the 12 systems serve fewer than 1,000 customers.	12 municipal and county water systems.
Jefferson Communities Water System (JEFCOM), Florida	Rural, economically distressed area in Florida panhandle with ~13,000 residents. Lloyd Water Works Authority (LWWA) was a small water system in Jefferson County, serving 32 residential connections.	JEFCOM was created to serve 1,000 connections and approximately 2,500 customers.

Purpose: In both cases, the major trigger was water quality. Aside from water quality, LTRWC was motivated by external factors and JEFCOM was motivated by internal shortcomings of LWWA.

LTRWC suffered from water quantity issues and was concerned about drought, business prospects, and the situation of surrounding water systems. A drought in 1988 prompted Russellville, Logan County, and neighboring communities to look for new water supplies. In 1990, a poultry company was willing to locate a processing plant in Russellville if the city could deliver 1 million gallons of water to the plant each day. Around this time, several other water systems in Logan and Todd counties were struggling with poor raw water quality. Oak Grove, Christian County, was also searching for an alternative water supply after realizing it was vulnerable to drought.

For JEFCOM, Jefferson County residents not connected to LWWA were facing acute health risks from using private ground water wells with high concentrations of coliform bacteria – the private ground water wells lacked depth and proper casing to avoid contamination from nearby septic tanks and were susceptible to surface runoff, petroleum leaching from underground gasoline tanks, and a potential leak from an area chemical plant. LWWA did not have the capacity, facilities, financial resources and formal management structure to extend service to other areas of the County.

Regionalization Process: Both regional solutions were community-led and were financially assisted through drinking water state revolving funds and the United States Department of Agriculture (USDA).

LTRWC - The LTRWC process began in 1988 as the drought prompted systems to consider alternative water sources. The Logan County Chamber of Commerce, worried about water supply shortage and constraints on economic development, formed a committee in 1990 to develop long-term study of water in region. This generated information that facilitated formation of LTRWC.

1 https://www.epa.gov/sites/default/files/2017-07/documents/p1006md0.pdf

In 1995, the LTRWC was formed. Construction began in 2000, with water delivery beginning in 2003. As the transmission line was being developed, Oak Grove was added: although it had planned to build a new treatment plant for its current source, it recognized that the current source was inadequate and decided to join the LTRWC.

After the LTRWC determined that the Cumberland River in Clarksville, Tennessee, was the best available source of water, they found that this required several infrastructure projects – including a treatment plant at the source, a transmission line, and interconnections between water systems. $77.5 million in funding was needed, due to the scale of these projects.

This was overcome by dividing the project into multiple phases and funding each phase separately, with the state's financial assistance. Kentucky's Drinking Water State Revolving Fund (DWSRF) and the state rural development agency each had a limit of $1.5 million on its loans but changed their approach after seeing the prospective benefits of LTRWC. In addition, the USDA Rural Development Office committed $49.8 million in long-term financing and the governor provided state budget surplus grants to the projects in 1998 and 2000.

JEFCOM - Jefferson County residents, unhappy with quality of their water, initiated the development of a new county-wide system to replace and expand LWWA. Public awareness campaign including community meetings, political and health department support, and newspaper coverage led to the development of JEFCOM, a new system.

JEFCOM received grants and loans from the DWSRF and USDA Rural Development for chlorine treatment and system expansion.

Outcomes:

- **Higher water quality**, with LTRWC also benefiting from a higher quantity of water and its source water changing to a more sustainable source. LTRWC also installed better treatment technologies, with state-of-the-art filtration plant that uses membrane micro-filtration after conventional pre-treatment.
- **Shared infrastructure** of 85-mile transmission line that provides LTRWC customers with ample, high-quality water supply.
- **Local control**. LTRWC consists of 12 autonomous water systems that maintain ownership, operating and maintenance responsibility for their distribution infrastructure. This includes autonomous decision-making about decommissioning unneeded treatment plants and retiring remaining debt on those facilities.
- **Efficiency from reliance on a single large water source** instead of nine smaller, lower quality sources allows each LTRWC system to focus on distribution, rather than treatment. It also eliminates unnecessary duplication of services and use of resources.
- **Economies of scale**, with decreased long-term average costs associated with purchasing supplies, contracting, and allocating resources to construction, and operational improvements, for LTRWC.
- **Reduced long-term costs** from each partner distribution system paying the same wholesale rate for water, regardless of size or location. This reduces predicted future water costs compared to other alternatives, for LTRWC.
- **Water bills** for JEFCOM customers were expected to be between $20 to $25 per month after regionalization.
- **Local support**. The involvement of customers in planning and development of JEFCOM is likely to provide a benefit of receiving widespread support in the future.

The EPA suggests that the success was driven by local initiative and involvement, with several water systems realizing that they shared common goals. Support from state water officials and top elected officials led to a funding strategy that helped the communities overcome the financial barriers.

Interconnection without Ownership Transfer Case Studies

The forms of regional co-operation described above, can also be combined with interconnection between communities. Two case studies illustrate this form of regionalization.

Community[1]	Type	Size	Partnership
City of Panora Water System, Iowa	Informal Cooperation / Contractual assistance with interconnection.	12 municipal and county water systems.	With both public and privately owned neighbors in central Iowa.
Tripp County Water User District (TCWUD), South Dakota	Interconnection of stand-alone systems. Water systems operate and maintain their own distribution systems.	Serves over 2,700 customers in southern South Dakota.	Between 8 interconnected, independent systems.

Purpose: Both Panora and systems in TCWUD had experienced high nitrate levels. Panora experienced high nitrate levels in its water during the spring and early summer, exceeding MCL by 20 to 40%. Panora also struggled to retain operators and was relying on operators from the Des Moines Water Works (DMWW) to fill in occasionally, as it lacked the financial resources to pay competitive wages to attract a grade 3 certified operator and install nitrate treatment.

For TCWUD, many of the systems had nitrate concentrations approaching MCL. Furthermore, in the town of Burke, 2 of its 7 wells became infected with iron-eating bacteria and no longer met drinking water standards. Four counties had water shortage and contamination problems.

Regionalization Process: In both cases, the regional solution was driven by community leaders.

Panora - The city of Panora completed a joint water study with Lake Panorama and Xenia Rural Water Association to assess potential partnerships based on source water and system needs. The study demonstrated that the most cost-effective, long-term solution was to connect to and purchase water from Lake Panorama's low-nitrate source water and blend with current source.

In 2002, Panora interconnected with the Lake Panorama Water Company by installing a water line between the systems, to buy water to blend with its high-nitrate source water as needed.

In 2003, Panora and DMWW drafted a memorandum of understanding to allow the systems to work together to operate the treatment plant, and DMWW started to remotely monitor Panora's treatment plant. This reduced the full-time attention required of an onsite operator to about 2.5 hours a day.

While this process yielded benefits, in hindsight, Panora would have ideally liked to lay two parallel pipes that interconnects to LPWC – to transport raw water from the LPWC wells, treat it at its water treatment plant, and send the finished water to LPWC for distribution. LPWC's own treatment plant is much older than Panora's, so this could have been more economical to operate and provide backup to the LPWC plant.

TCWUD - TCWUD's expansion was triggered by a request from the nearby Rosebud Sioux Tribe to extend service to one of its communities. During the planning and proposal phase, rural farmsteads and communities that depended on confined aquifers or limited surface water opted to interconnect and buy water from TCWUD. Eventually, the expansion project included the original Sioux area and 7 additional communities.

The cost of expansion and consolidation was over $6 million. This was partly overcome in 2002, when the state approved $3,648,000 in DWSRF loans for TCWUD to expand its rural water systems and extend its service line to connect with 7 other communities in the area. The DWSRF gave significant point value in funding priority rating systems to proposals that include expansion of rural water systems, to encourage consolidation.

TCWUD was also assisted by the state Consolidated Water Facilities Program, which provides funding for water, wastewater and watershed projects across South Dakota. In 2006, TCWUD received a $350,000 grant to expand to a system serving 155 customers, via interconnections. This project was also supported by top elected officials when Governor Mike Rounds endorsed it.

The systems are served by TCWUD but continue to operate and maintain their own distribution systems, without TCWUD's involvement.

1 https://www.epa.gov/sites/default/files/2017-07/documents/p1006md0.pdf; https://www.epa.gov/sites/default/files/2017-07/documents/p1009vcn.pdf

Outcomes:

- **Shared Infrastructure**. Panora's installation of a water line to interconnect its clear well at the treatment plant with the LPWC, allowed it to purchase water from the LPWC's low-nitrate source. TCWUD's communities benefit from TCWUD's treatment plant, and 5 communities share a transmission piping that runs along a local highway.
- **Improved water quality and quantity**. Panora can mitigate periodic high nitrate levels by opening a valve from the new line, to mix in LPWC's finished water to reduce nitrate concentration to acceptable levels. TCWUD communities gained access to higher quantity of source water, allowing them to meet their projected maximum demands for the future. The source water (treated water from wells drilled into the Ogalala aquifer) is also of high quality, avoiding nitrate problems: TCWUD's nitrate concentrations are less than 50% of MCL.
- **Expertise**. Panora's operators obtained additional certifications and worked with DMWW operators to identify ways to streamline operations. The relationship helped Panora quickly build in-house expertise. TCWUD facilitated shared expertise, as it created a forum for the systems to share and work together to solve common problems.
- **Reduced Costs**. Panora reduced long-term costs and demand for on-site operators, freeing employees for other duties, through DMWW's remote monitoring. This allowed Panora to avoid the cost of installing and operating nitrate treatment and hiring extra personnel. TCWUD reduced long-term average maintenance and monitoring costs, helping reduce labor costs. TCWUD's partner systems also reduced costs, as the TCWUD helped them cut operating expenses. Some systems saved around $3,000/year in water testing. The town of Burke (population 680) avoided an upfront investment of approx. $90,000 to dig replacement wells.
- **Continued dialogue** for Panora with its neighboring systems focusing on water efficiency and determining better ways to treat and distribute water in the region.
- **Shift to full-cost pricing and sustainable water management** for TCWUD. Many of the communities spend slightly more per gallon of water than they did as independent systems because TCWUD provides a consistent supply of higher quality water. The higher rates represent a move toward full-cost pricing.

According to EPA, system-driven efforts to cooperate with neighboring systems can lead to more efficient uses of limited personnel resources. Diversifying water sources allowed Panora to address technical treatment challenges from its original water source. This could have been an expensive problem to solve, but working with other systems made it cheaper and lead to small, mutually beneficial changes. The regionalization allowed the communities to continue their dialogue to anticipate and work together to meet future needs.

For TCWUD, the EPA attributes its success to support from local groups and top elected officials. The broad base of support helped TCWUD secure funding from the state. Despite the large upfront costs, the partnership, and associated infrastructure, this regionalization was the most cost-effective method, compared to each system solving their source water problems alone.

Interconnection without Ownership Transfer Case Studies

Purpose: Four of the five case studies cited water quality as one of the triggers. Ellsworth Estates Water Company failed to provide adequate water pressure to its customers, violating water pressure regulations. Ellsworth lacked managerial capacity, from the loss of one of two owner/operators in 1991. The remaining elderly owner notified the State of Connecticut that he was unable to run the system on his own and petitioned the State for transfer of ownership. When the State examined the system, there were old and undersized piping, pressure switches, tanks, and booster and well pumps. The system also lacked air compressor or air control, blow-off valves, meters, hydrants, and standby power equipment; and system's pressure tanks were water-logged. The system suffered from inadequate volume and pressure, and the wells had never been yield tested.

White Sand Beach Water Company (WSBWC) customers were sometimes exposed to health risks associated with high sodium levels, nitrates, and possible contamination from saltwater intrusion and proximity of supply wells to nearby septic systems. Water pressure was also a problem, which depended on number of users: during peak consumption periods, around 4th of July holidays, WSBWC customers experienced pressure problems. The issues stemmed from a lack of historical investment in infrastructure: despite maintaining a positive revenue stream, system maintenance and upgrades had historically been deferred – and the system generally failed to meet current standards designed to protect public health.

Prairieton Water Company 's source water was declining, with routine monitoring between 1997 and 2000 finding nitrate levels exceeding MCL, with the system receiving citations for each of these violations. Prairieton did not have the financial capacity to address its water quality violations.

Community[1]	Type	Size
Ellsworth Estates Water Company / The Connecticut Water Company (CWC), Connecticut	State-mandated ownership transfer with interconnection, of Ellsworth to CWC. First operating as a satellite system but later connected to the CWC due to water quality problems.	Ellsworth: A small privately-owned groundwater system serving 82 homes in north-central Connecticut.
White Sand Beach Water Company, Inc (WSBWC)/ The Connecticut Water Company (CWC), Connecticut	Ownership transfer and interconnection with a satellite system, of WSBSC to CWC.	WSBSC: small, privately owned water system serving 148 seasonal customers in south-central Connecticut. CWC: second-largest investor-owned water system in Connecticut, serving over 286,000 people in 41 communities.
Prairieton Water Company / Indiana American Water Company (IAWC), Indiana	Ownership transfer with interconnection, of Prairieton to IAWC.	Prairieton: small private water system, serving 675 people in western Indiana. IAWC: privately owned, serves over 700,000 people in 35 cities and towns across the state.
Mountain Regional Water Special Service District (MRWSSD), Utah:	Ownership transfer with interconnection.	Composed of more than 12 systems, serving nearly 4,000 connections over most of Summit County. 26 wells and springs, 19 large storage reservoirs, pumping and disinfection stations, and hundreds of miles of pipelines.
Possum Kingdom Water Supply Corporation (PKWSC), Texas	Ownership transfer with interconnection.	More than 60 small, privately owned community and non-community water systems in north-central Texas, approximately 90 miles west of Dallas-Fort Worth; a popular vacation area. Serves over 1,900 connections.

Mountain Regional Water Special Service District (MRWSSD) communities' water quality and quantity diminished over time, due to housing development patterns – developers needed access to water source, and developer-established sources were wells drilled into shallow bedrock aquifers, not high-capacity alluvial aquifers found in region. Many of the systems were understaffed, and only able to afford one part-time employee. There were also histories of litigation over shared water resources and competition in common service areas, across many of the small systems.

Possum Kingdom Water Supply Corporation (PKWSC) communities included trailer camps and individual restaurants spread around the region, and many drew water from a surface reservoir with high levels of dissolved solids. Systems did not adequately address this issue, resulting in most systems treating their water with small pressure filtration systems and chlorination, although state regulations required coagulation and flocculation to be used for treating surface water as well. Over 60 systems were in violation of regulations.

Regionalization Process: Four of the five systems' regionalization was driven by regulatory pressure, while one was driven by community leaders.

Ellsworth - In the 1980s, Connecticut developed a comprehensive approach to compel troubled small system to consolidate with larger well-run systems. Connecticut also adopted regulations to ensure that any new, small systems being developed adhered to strict guidelines to ensure long-term viability.

After losing one of the two owner/operator in 1991, the elderly owner of Ellsworth asked the state to take over. Representatives from two relevant state agencies, Department of Public Health and Department of Public Utility Control, formed the "authority" responsible for determining what water company or municipal system was best suited to acquire Ellsworth. This authority was legally required to consider the technical, managerial, and financial capacity of the acquiring system; and was also required to consider rate differences, and impact of rate changes. Here, the acquiring system would need to address the low-pressure problem, make improvements needed due to the system's age, and build the capacity to provide for future growth in the area.

1 https://www.epa.gov/sites/default/files/2017-07/documents/p1006md0.pdf; https://www.epa.gov/sites/default/files/2017-07/documents/p1009vcn.pdf

The authority chose the CWC (out of five water systems) to acquire Ellsworth as a satellite system – CWC met the outlined criteria, including being near Ellsworth system, and had the financial capacity to make necessary improvements.

Ownership was transferred to CWC with Ellsworth run as a satellite in 1993. A year later, CWC detected nitrate levels nearing the MCL in one of Ellsworth's wells. Since the distribution system did not ensure adequate dilution, CWC took the well offline as a precaution. CWC requested and received state approval for the interconnection, interconnecting Ellsworth to CWC.

WSBWC – WSBWC, which is also in Connecticut, had determined that the best way to solve its problems was to sell itself to a large system. CWC operated the nearby Sound View Water System as a satellite system and was interested in acquiring WSBWC. In 2000, WSBWC and CWC jointly approached the state, and received approval of the sale and interconnection of WSBWC to CWC.

Prairieton - For Prairieton, the State of Indiana helped facilitate the discussions between Prairieton and IAWC. Prairieton violated the Nitrate Rule in 1999, and in 2000, an agreement was worked out between Prairieton, IAWC, and the State: to transfer ownership, interconnect, and retire the old, low-quality well field. The State also funded the interconnection with a DWSRF. Ownership transfer and interconnection were completed in 2001. The State of Indiana helped fund the interconnection with a $500,000 DWSRF loan – the first time it was issued to a private water company. Prairieton qualified for the lowest available loan rate, 2.9% because its median household income was $11,973. The loan enabled Prairieton to abandon its plant and connect to the IAWC.

MRWSSD - MRWSSD resulted from the State of Utah's effort to establish regional plans. The State of Utah's Regional Management Plan initiative led the development of regional plans, that were completed in 1998. Planning committees, composed of local volunteers who were recruited by a regional coordinator, authorized those plans. Consultants helped regions analyze the technical and financial capacity of existing water systems and helped committees prepare the regional plans that discussed the prospects for sharing equipment, operators, managers, and facilities among water systems. Systems commented on draft regional plan, and these comments were incorporated into the final regional management plan. MRWSSD was formed in 2000, with 3 goals:

- Fix water problems in the western side of Summit County by regionalizing small and struggling water systems into the MRWSSD and improving the long-term level of service through economies of scale.
- Help the systems in the area import water.
- Organize water conservation efforts.

MRWSSD consists of more than 12 systems, owned by a combination of entities, which included private companies set up by a housing developer to serve individual developments as well as two large private systems. Flows to and among systems are managed by a computer control system that monitors the entire basin and delivers the right amount of water when needed. The systems have a mechanism to pool resources and share cost.

PKWSC - For PKWSC, the State of Texas helped initiate the formation of PKWSC in 1992 by focusing attention on local systems' water problems. Small systems that recognized common shortcomings teamed together to form PKWSC, a single regional distribution system. In 1998, PKWSC secured federal and state funding for new treatment plant and interconnection. Further funding for additional interconnections were secured in 2005, and PKWSC secured state funding for additional treatment and continued expansion in 2006. State and federal funding sources facilitated the PKWSC treatment and distribution project. Loans that helped finance the new water treatment plant and first 3 phases of interconnections included $6.5 million in 1998, from USDA Rural Development funds, $4.7 million in 1998, from DWSRF, and $1.7 million loan and $900,000 grant from USDA in 2005. In 2006, Texas Water Development Board authorized $1.6 million DWSRF loan to help finance additional improvements to PKWSC system, to be used for expanding water treatment capacity, purchase support equipment, and extend service to a housing development and skate park.

Outcomes: Water utility rates increased after regionalization for Ellsworth, WSBSC, and Prairieton customers, with WSBSC and Prairieton moving towards full-cost pricing.

Ellsworth- Ellsworth customers now have access to safe and adequate water supply in addition to improved fire protection services along the new main, ensuring community's safety. The CWC built a 6,400-foot interconnection to Ellsworth from the CWC's northern region – a region with a sufficient surplus for Ellsworth and future growth (10.0MGD demand vs 15.25MGD total supply).

CWC took over Ellsworth with more than 30 highly trained and certified operators and had technical and managerial expertise to provide reliable and efficient service to current Ellsworth customers, with enough staff capacity to serve additional customers in the future. CWC offers 24-hour customer services, possession of inventory of repair and replacement parts, and knowledgeable, experienced staff and engineers – activities that were beyond capacity of independent systems.

CWC was chosen because of its financial and managerial resources to improve Ellsworth, that could be used to implement a capital improvement program to meet growing demand and ensure future regulatory compliance. The costs for interconnection and upgrades were spread over a larger consumer base after the consolidation. The rate increase needed to pay for improvements was applied to all 59,540 CWC customers as well as customers of Ellsworth. This meant that Ellsworth customers experienced an increase in water rates from $31/quarter to CWC's rate of $80/quarter. This increase is less than if the 82 Ellsworth customers were required to bear the cost of the necessary capital improvements alone – this would have been $250 / quarter.

CWC also reduced costs of operating Ellsworth by connecting the satellite to the main system. CWC received an engineering bid of $272,000 for the interconnection, compared with $290,000 to $416,000, the estimated cost of capital improvements for running Ellsworth as a satellite system (depending on treatment needs). The annual cost of operating Ellsworth as a satellite system could have reached $81,000, while the annual cost of maintaining the interconnection was approx. $1,011.

WSBWC - CWC completed a $412,000 infrastructure improvement project after the sale. CWC also installed 7,800 feet of 8-inch main to connect the WSBWC to the CWC satellite system.

WSBWC system shifted closer to full-cost pricing. Prior to the ownership transfer, WSBWC customers paid $109.44/year for water service between April and November. After the consolidation, customers' rates were raised to $302.61/year for seasonal use. The rate hike was necessary to complete necessary infrastructure improvements, ensure a continued safe supply of water, and provide WSBWC customers with increased service.

Prairieton - Water quality improved for Prairieton customers, as IAWC delivered high-quality drinking water and offers a level of managerial expertise that ensures more reliable and more efficient service.

IAWC spent $961,205 to construct a pipeline and connect to the Prairieton system and replaced miles of water mains and installing meters at each customer connection. This allowed Prairieton to reduce long-term average costs by interconnecting to a larger system instead of developing and maintaining its own water supply. The IAWC also benefited as the customer base increased along the transmission line at reduced cost, because of the infrastructure built for the Prairieton interconnection.

The ownership transfer led to a shift towards full-cost pricing, with the ownership transfer allowing installation of water meters and change in rate structure. Before regionalization, customers paid a flat fee for water. After the installation of water meters, IAWC charged customers based on use. The rates for Prairieton customers rose, especially for high-volume water users, but the rate now more accurately reflect the cost of providing high-quality water to the area.

MRWSSD - Water quality improved as MRWSSD, as a Special Services District, is a more viable public entity that can meet EPA and state regulations more easily, relative to small, independent systems.

The shared infrastructure in MRWSSD allows for more redundancy of water source, storage, and distribution elements: when systems have shortfalls, adjoining or interconnected partners can help meet the shortfall. The systems also benefit from safe water and fire protection from interconnections across systems, and projects can now be scaled to make all investments count.

Small water systems that could only employ one operator now have full resources of the MRWSSD, with 14 employees in 2001. All the operators and management staff have extensive training, and over 130 years of combined water experience.

Access to funds improved, as the MRSWDD created a mechanism to pool resources and share the cost of initiating a major water importation project. MRSWDD also enjoys economies of scale in managing its pool of assets, making it easier and more cost effective.

PKWSC - Access to safe and reliable water supply for PKWSC customers. PKWSC was awarded the 2006 DWSRF Award for Sustainable Public Health Protection because of its significant technical improvements that give residents safe, high-quality drinking water.

PKWSC maintains a larger staff with more expertise than independent systems. This allows for better customer service, more effective management of assets, and long-term planning. Benefits from economies of scale include greater purchasing power, allowing for decreased long-term average costs associated with treatment and distribution, by pooling financial and technical resources.

PKWSC maintains 1.0 MGD surface water treatment plant and more than 325 miles of distribution pipe. The treatment plant consists of two modular water treatment trains containing 0.5 MGD reverse osmosis units each. The third module, soon to be added to the plant, will operate at almost 90% capacity.

These case studies show the importance of the state's approach and legal framework in facilitating regional solutions, while also showing that a state-led ownership transfers can benefit all parties. The main benefit of an ownership transfer appears to be economies of scale, from spreading costs over a larger base. Customers of the acquired system can benefit from safer drinking water, while the acquiring system gains customers, and the acquired system itself benefits from the financial support to make improvements. State and federal financial support, such as DWSRF funding, played an important role in alleviating the financial barriers to regional solutions.

Ownership Transfer - Acquisition and Satellite Operation Case Study

Community[1]	Acquisition	Size
Pittsfield, New Hampshire	Pennichuck Water Utility acquired Pittsfield Aqueduct Company, an investor-owned utility that was designed to provide water to several textile mills.	1,860 residential customers (620 connections; 75% residential).

Purpose: Pittsfield consumers were exposed to high levels of bacterial contamination and high turbidity levels due to unfiltered surface water supply. Pittsfield's transmission and distribution systems had an oversized capacity, with stagnation of water in distribution system potentially leading to microbial contamination. Pittsfield also experienced frequent water main breaks and was in violation of Surface Water Treatment Rule requirements and facing heavy fines.

Pittsfield began construction of a treatment plant but could not secure a low interest loan, and its part-time operator did not have time to adequately oversee system operation or communicate with customers.

Regionalization Process: Investors put the Pittsfield Aqueduct Company up for sale. After a year on the market, nearby Pennichuck water utility purchased the system. Pennichuck water utility was a larger utility with substantial technical, managerial, and financial resources. Pennichuck was also able to secure a state grant and refinanced a loan procured to complete the new Pittsfield filtration plant. Pennichuck also received a HUD Community Development Block Grant to upgrade the distribution system and improve water quality.

Pennichuck installed a computer control system to monitor the facility remotely and designated an operator to make daily visits to the plant.

Outcomes: Following the ownership transfer, Pittsfield customers benefited from a 5% reduction in water rates. The treatment facility was constructed, and the distribution system was upgraded. This led to improved water quality. A customer service program to educate Pittsfield customers about their water system was also implemented.

The ownership transfer allowed Pittsfield to leverage Pennichuck's size and access to resources, to improve water quality and distribution.

1 https://www.epa.gov/sites/default/files/2017-07/documents/p1009vcn.pdf

Ownership Transfer - Privatization Case Study

Community[1]	Ownership Transfer	Size
Clarion Township General Authority (CTGA), Pennsylvania	CTGA purchased drinking water from the Pennsylvania-American Water Company (PAWC), a large investor-owned system. CTGA sold water system to PAWC for amount of debt owed.	Rural community in western Pennsylvania, 203 connections.

Purpose: CTGA was unable to cost-effectively provide water to households that were inadequately served by private wells. Some private wells had microbial contamination, high levels of iron and manganese, and some could not produce adequate quantities of water. The distribution system needed upgrades – water loss from leaks was high and meters did not function properly. Main breaks would sometimes go unnoticed until major portions of the distribution system lost service.

CTGA also became unable to meet their financial obligation to PAWC for purchased water. CTGA was managed by a board of part-time volunteers, who were unable to address the technical and financial difficulties of the system.

Regionalization Process: CTGA was unable to pay its debts to PAWC, and PAWC bought CTGA for the debt. CTGA obtained a low-interest loan from PENNVEST (the DWSRF in Pennsylvania) for service connections to households with contaminated and inadequate wells.

Outcomes: PAWC assigned a part-time certified operator to oversee the system. PAWC extended service to 148 households in the Clarion Township, increasing the number of people with safe drinking water. PAWC also conducted a comprehensive leak detection survey to investigate the high rate of water loss and replaced critical sections of distribution piping and system's aging meters. They also installed equipment to automate the water distribution system.

Before the regional solution, CTGA's water rates were approximately 20% higher than PAWC's statewide single tariff pricing. After regionalization, PAWC reduced rates for Township customers to the statewide single tariff price of $5 per 1,000 gallons, or $100 per household per year.

1 https://www.epa.gov/sites/default/files/2017-07/documents/p1009vcn.pdf

Conclusion

An examination of a sample of published case studies on regional solutions across the US, both historical and recent, illustrate the diverse range of regional solutions, and show how they could improve water quality, reliability, and access to resources for communities – in terms of funding, expertise, and lower cost of operations. Regional solutions could be driven from the community-level or mandated by State agencies, although the latter is more common in cases with severe water issues.

Various organizations have also published lessons from regionalization, such as barriers and common factors for success.[1] Practical resources, such as a step-by-step guide to consolidation and California Water Board's interactive map to identify nearby water systems, are also available.[2]

With the various resources on regional case studies, communities can utilize a practical guide on the various forms of regional solutions, mapped to typical issues or characteristics that they are suitable for[3], which could act as a primer on a more comprehensive handbook from the EPA that helps identify, assess, and launch partnerships.[4]

WFX, alongside its partners, aims to create a community of practice for regional solutions and also to create a user-friendly index that can be accessed based upon types of water system challenges or governance challenges relating to the process of setting up systems and creating fair allocation of responsibilities.

1 For example: US Water Alliance's Catalyzing Community-Driven Utility Consolidations and Partnerships, which looks at California

2 California Water Boards. Consolidation Approach – Step by Step. (2022).

3 Typical issues faced by small water systems can be found in EPA's research, case studies, or reports from US Water Alliance and RCAP that are cited in this document.

4 Environmental Protection Agency. How to Support Water System Partnerships. (2020).