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Water Rate Setting in Northwestern, Central, and Southern Illinois

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EXECUTIVE SUMMARY

In 2021, the Illinois General Assembly commissioned the Government Finance Research Center (GFRC) at the University of Illinois Chicago (UIC) to conduct a "Water Rate Setting Study." This three-year project produced a series of deliverables, including reports, datasets, presentations, and other dissemination products. The first report, published in June 2023, focused on Northeastern Illinois, or the Lake Michigan Service Area (LMSA). This second report provides a comprehensive review of rate setting in Northwestern, Central, and Southern Illinois (NCSI). Throughout this study, the GFRC researchers received guidance from an advisory committee composed of representatives from state government agencies, municipal and private water utilities, environmental justice and consumer advocacy organizations, and others.

In this study, the GFRC researchers employed a mixed-methods research approach that applied both quantitative and qualitative techniques. The qualitative analysis was based on reviews of municipal documents—including ordinances and water bills—as well as interviews with representatives at both system and municipal levels. The quantitative analysis utilized both primary and secondary data from a variety of sources. Some of these data were publicly available, while others were obtained through Freedom of Information Act (FOIA) requests or by scraping the web.

The GFRC researchers also constructed an original dataset of water rates directly collected from communities between July 2023 and March 2024. Through this effort, which included contacting 859 municipalities where residents receive drinking water from municipal systems or water commissions and districts, the GFRC researchers were able to collect water rates from 595 or 70% of municipalities. This water rate collection initiative is the single largest in Illinois and only the third effort among researchers nationwide to collect water rate data outside of urban areas.

Major Findings

The major findings from this study are grouped into seven areas of interest to policymakers:

Water Rate Setting Process

Rate structures vary across the 595 municipalities, with over 93% using a two-part rate structure, only 4% using a flat rate structure, and less than 3% solely using a volumetric rate structure. To facilitate comparisons across the region, the GFRC researchers calculated a standardized water bill equal to the price residents would pay for 5,000 gallons per month. Across NCSI, the median standardized bill is about $45. Incremental rate increases are used to avoid sudden and significant financial burdens on customers. However, in some municipalities, rates are increased only when necessary, often as a

reaction to infrastructure needs or regulatory requirements. Many municipalities face budget limitations that prevent them from adopting well-established best practices or building sufficient reserves for infrastructure improvements.

Water Billing

Billing frequency shows little variation. Approximately 91% of municipalities bill monthly, about 6% bill every two months, and just over 3% bill quarterly. Bimonthly billing is associated with approximately $9 in monthly savings for the average consumer, and quarterly or annual billing with approximately $22 in monthly savings. Municipalities that do not have automatic billing regularly struggle with overdue bills and the need for staff to initiate contact with customers to collect payment. Municipalities with no staffing capacity or technology to read meters generally do not include water usage information on bills.

Water Affordability

Only 3 of 595 NCSI municipalities have a standardized water bill that exceeds 2.5% of median household income. However, 122 municipalities (over 20%) have a standardized water bill that exceeds 2.5% of income at the 20th percentile. Examining 365 municipal ordinances representative of NCSI, only 7% of them describe payment assistance plans. On average, higher water bills are associated with higher deposits and stricter payment schedules, compounding barriers to affordable water access. While there is no universally accepted definition of water affordability, municipalities often benchmark against other communities. Many municipalities try to minimize the water bill burden for customers and recognize the need to support vulnerable populations.

Economically Disadvantaged Communities

There is no statistically significant association between median household income and monthly water bills. However, a one percentage point increase in the poverty rate is associated with an additional $1.60 required to initiate water service. A ten-percentage point increase in the share of residents with elderly status is associated with a 2-day shorter bill payment window. Small and rural municipalities face significant challenges in water provision due to lower economies of scale, limited administrative and technical capacity, and fewer opportunities for intergovernmental cooperation. In some municipalities, the physical landscape limits expansion and restricts their ability to add customers to offset system costs.

Federal, State, and Local Policies

Less than 10% of Illinois' lead service lines are located in NCSI. However, incomplete records and limited capacity create disparities in identifying and reporting lead service lines for lower-income communities. Between April 2023 and July 2024, there were 943

boil orders in NCSI, averaging 63 orders per month. Lead service line inventories, replacement costs, and compliance with guidelines for per- and polyfluoroalkyl substances present challenges for setting water rates. Even water systems with newer infrastructure struggle to comply with recent mandates. Privatization has some advantages, including infrastructure improvements and municipal debt relief. However, it can adversely impact water affordability for residents.

Water Rate Increases

It is the least costly for municipalities to source from groundwater and self-produce, which is reflected in water rates. For every million dollars borrowed from the state revolving fund (SRF), municipalities charge $0.34 more monthly on average. However, for every million dollars borrowed, municipalities require an average of $1.56 less from customers to initiate service. Inflation, infrastructure upgrades, and compliance with regulations are among the key drivers of water rate increases. Municipalities are often required to raise water rates to receive SRF funding for system upgrades and necessary infrastructure repairs. When wholesalers increase their rates, municipalities purchasing water often pass these increases on to residents.

Intergovernmental Coordination

Municipalities purchasing water wholesale have $5 lower standardized water bills on average. Over 66% of municipalities have at least one water operator working for another system. Wholesalers selling water to neighboring communities can boost their revenues while leveraging economies of scale and maximizing the unused capacity of their treatment plants and distribution systems. Municipalities engage in formal arrangements with water districts, commissions, and cooperatives. These arrangements are beneficial because they can stabilize rates for some time. Less formal intergovernmental arrangements also benefit communities through sharing resources.

Policy Recommendations

Overall, these findings suggest the need for the following policy recommendations:

Increasing Municipal Capacity, Expertise, And Knowledge

Training for municipal staff and local elected officials involved in water rate setting can alleviate challenges ranging from system financial management to affordable program design. Templates, web hosting services, and technical assistance for communities could help with establishing municipal websites.

Enhancing State-Level Policies and Programs

A state-level affordability program co-designed with municipal representatives can decrease household water burden. Reducing the upfront costs of engineering plans and

administrative burdens could increase financing access, particularly for water systems servicing a smaller and/or lower-income customer base in rural areas.

Increasing Support for Intergovernmental Coordination

There are opportunities to enhance existing coordination and cooperation in NCSI. Transparency in rate setting by wholesalers can alleviate concerns for municipalities considering engaging in formal agreements. Having more readily available grants or low-interest loans can mitigate coordination risks, particularly for smaller and lower-resourced communities. The common practice of operator sharing can be supported by establishing a system for training a network of experienced water operators.

Establishing Strategic Investment & Support for Disadvantaged Communities

Decreasing the administrative burden of intergovernmental coordination can allow water systems in lower-resourced communities to benefit from various sources of state financing and intergovernmental coordination efforts.

Ensuring Communication Standards for Water Bills

Establishing regional or state-level support can help implement best practices for water billing and promote the adoption of automatic billing systems and meter reading technologies.

Facilitating Consistent Data Collection

Training for municipal staff on the type of information to collect and partnerships with educational institutions can facilitate knowledge transfer and the creation of data dashboards and educational tools.

1. INTRODUCTION

In 2021, the Illinois General Assembly commissioned the Government Finance Research Center (GFRC) at the University of Illinois Chicago (UIC) to conduct a "Water Rate Setting Study." This three-year project produced a series of deliverables, including reports, datasets, presentations, and other dissemination products.[1] The first report, published in June 2023, focused on Northeastern Illinois, or the Lake Michigan Service Area (LMSA).[2] This second report provides a comprehensive review of rate setting in Northwestern, Central, and Southern Illinois (NCSI). As with the first report, this document offers findings pertaining to seven areas of interest to policymakers. These were outlined in Public Act 101-562 and amended by Public Act 102-507, which stipulated that the "Water Rate Setting Study" would address at a minimum:[3,4]

1. The components of a water bill (discussed in Section 4 of this report)
2. Reasons for increases in water rates (Section 8)
3. The definition of affordability throughout the State and any variances to that definition (Section 5)
4. Evidence of rate-setting that utilizes inappropriate practices (Section 3)
5. The extent to which State or local policies drive cost increases or variations in rate-settings (Section 7)
6. Challenges within economically disadvantaged communities in setting water rates (Section 6), and
7. Opportunities for increased intergovernmental coordination for setting equitable water rates (Section 9).

As such, this report includes seven sections, each focused on one of the stipulated thematic areas present in both the legislation and the Memorandum of Understanding (MOU) between the Illinois Emergency Management Agency (representing the State of Illinois) and UIC. Before presenting the findings, this introduction and subsequent methodologies section provide background information and definitions that guide this research. The report concludes with a final section that provides a set of policy recommendations focused on billing communication standards, municipal capacity, equitable water-rate setting, investment and support for disadvantaged communities, and data collection for evaluating gaps in water affordability, among other disparities.

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[1] Government Finance Research Center, "Water Rate Setting Study," accessed December 4, 2024, https://gfrc.uic.edu/our-work/featured-projects/water-rate-setting-study/.

[2] Deborah A. Carroll, Kate Albrecht, Laura Medwid, Christelle Khalaf, Jason Michnick, Dan Huang, Brooke Wetmore, and Jun Li, "Water rate setting in the Lake Michigan service area." (Chicago, IL: Government Finance Research Center, 2023.) https://gfrc.uic.edu/research/water-rate-setting-in-the-lake-michigan-service-area/.

[3] Illinois General Assembly, *Public Act 101-562*, 2019, https://www.ilga.gov/legislation/publicacts/fulltext.asp?Name=101-0562&GA=101.

[4] Illinois General Assembly, *Public Act 102-0507*, 2021, https://www.ilga.gov/legislation/publicacts/fulltext.asp?Name=102-0507&GA=102.

Throughout the project, the GFRC researchers received guidance from an advisory committee composed of representatives from state government agencies, municipal and private water utilities, environmental justice and consumer advocacy organizations, and others. Table 1.1 lists the advisory committee member classifications stipulated in Public Act 102-507, as well as the names of the representatives who graciously volunteered their time. Their feedback and professional connections were essential for the successful completion of this project.

Table 1.1. Water Rate Setting Study Advisory Committee

Member Classification	Representative
The Director of the Environmental Protection Agency, or his or her designee	Gary Bingenheimer Manager, Infrastructure Financial Assistance Section
The Director of Natural Resources, or his or her designee	James Kessen Acting Chief, Lake Michigan Programs (March 2022-July 2023) Russell G. Flinchum Section Chief, Lake Michigan Programs (August 2023-December 2024)
The Director of Commerce and Economic Opportunity, or his or her designee	David Wortman Deputy Director for Community Assistance
The Attorney General, or his or her designee	Susan Satter Public Utilities Counsel
At least 2 members who are representatives of private water utilities operating in Illinois	Sean Flynn Director of Government Affairs, Illinois American Water Keli Hodges Customer Care Coordinator, Aqua Illinois, Inc.
At least 4 members who are representatives of municipal water utilities	Todd LaFountain Water Division Manager, City Water, Light and Power Paul May General Manager, DuPage Water Commission Kelly Saunders Chief Executive Officer, North Park Public Water District Allison Swisher Director of Public Utilities, City of Joliet David Stoneback Deputy City Manager, City of Evanston (October 2022-February 2024) Robert Weil Water Production Manager, Water Utility, City of Decatur (March 2024-December 2024)
One member who is a representative of an environmental justice advocacy organization	Frank Dunmire Executive Director, Illinois Rural Water Association (June 2022-January 2024) Don Craig Executive Director, Illinois Rural Water Association (February 2024-December 2024)
One member who is a representative of a consumer advocacy organization	Maggie Bruns Executive Director, Prairie Rivers Network
One member who is a representative of an environmental planning organization that serves northeastern Illinois	Margaret Schneemann Water Resource Economist, Illinois-Indiana Sea Grant
The Director of the Illinois State Water Survey, or his or her designee	Steve Wilson Groundwater Hydrologist
The Chairperson of the Illinois Commerce Commission, or his or her designee	Rochelle Phipps Senior Financial Analyst

1.1. Study Area & Water Provision

In the first phase of the project, the State of Illinois tasked the GFRC with completing a comprehensive analysis of rate setting in the "Lake Michigan Service Area" (LMSA); however, it did not provide a specific definition of the LMSA. When determining the appropriate geographic boundaries, the GFRC researchers considered multiple definitions and ultimately defined the LMSA as the region of municipalities currently relying on Lake Michigan water and those that Lake Michigan could feasibly serve in the future. In the first report, the LMSA included 284 municipalities located within a seven-county region (Cook, DuPage, Kane, Kendall, Lake, McHenry, and Will).[5]

In the second phase of the project, culminating with this report, the GFRC researchers examined rate setting throughout the remainder of the state outside the LMSA, including the Northwestern, Central, and Southern Illinois (NCSI) regions.[6] Figure 1.1 maps the distribution of municipalities across all four Illinois regions (Northeastern, Northwestern, Central, and Southern).[7] About 22% of all municipalities in the State are concentrated in the Northeastern (LMSA) region. The remaining 1,010 municipalities are distributed across the NCSI regions.

Given the small size of municipalities in NCSI compared to the large areas of unincorporated land surrounding them, instead of illustrations showing municipality boundaries like in Figure 1.1, hexagonal and proportional symbol maps are used throughout the report from Figure 1.2 onward.[8]

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[5] This LMSA definition is also consistent with the Chicago Metropolitan Agency for Planning (CMAP)'s definition of Northeastern Illinois.

[6] The regional definitions used here are aligned with the areas served by Illinois Environmental Protection Agency (IEPA)'s Public Water Supply regional offices. Illinois Environmental Protection Agency, "Public Water Supply Offices," accessed December 4, 2024. https://epa.illinois.gov/about-us/locations/public-water-supply-offices.html.

[7] The Northwestern Illinois region includes the area served by the Rockford regional office, which encompasses Boone, Bureau, Carroll, DeKalb, Henry, Jo Daviess, LaSalle, Lee, Marshall, Mercer, Ogle, Putnam, Rock Island, Stark, Stephenson, Whiteside, Winnebago, and Woodford Counties, as well as Grundy and Kankakee Counties that the Elgin regional office serves. The remaining seven counties (Cook, DuPage, Kane, Kendall, Lake, McHenry, Will), also served by the Elgin office, form the Northeastern Illinois region. The areas served by the Champaign and Springfield regional offices, which include Champaign, Clark, Coles, Crawford, Cumberland, DeWitt, Douglas, Edgar, Effingham, Ford, Iroquois, Jasper, Livingston, McLean, Macon, Moultrie, Piatt, Shelby, Vermilion Counties as well as Adams, Brown, Cass, Christian, Fulton, Hancock, Henderson, Knox, Logan, McDonough, Macoupin, Mason, Menard, Montgomery, Morgan, Peoria, Pike, Sangamon, Schuyler, Scott, Tazewell, Warren Counties, form the Central Illinois region. Finally, the areas served by the Collinsville and Marion regional offices, which includes Bond, Calhoun, Clinton, Fayette, Greene, Jersey, Madison, Marion, Monroe, Randolph, St. Clair, and Washington Counties, as well as Alexander, Clay, Edwards, Franklin, Gallatin, Hamilton, Hardin, Jackson, Jefferson, Johnson, Lawrence, Massac, Perry, Pope, Pulaski, Richland, Saline, Union, Wabash, Wayne, White, and Williamson Counties, form the Southern Illinois region.

[8] Helen Thompson, Gemma Goodale-Sussen, and Sarah David, "An Authoritative Guide to Hexagons in Business Analyst: Mapping and Analysis," ArcGIS Blog, March 6, 2024, https://www.esri.com/arcgis-blog/products/bus-analyst/analytics/hexagons-guide-mapping/#:~:text=to%20standard%20geographies%3F-,Why%20should%20I%20use%20hexagons%20in%20mapping%20and%20analysis%3F,place%2Dbased%20data%20in

Figure 1.1. Illinois Municipalities by Region[9]

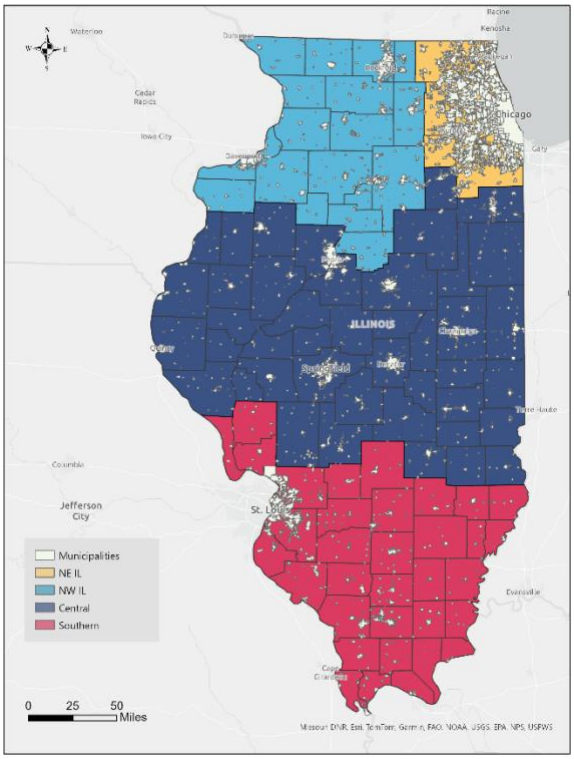


Figure 1.2, Panel A, illustrates the distribution of water production and provision practices across the NCSI regions.[10] Over 56% of municipalities (571) rely on self-produced *groundwater*, while about 21% of municipalities (210) purchase *surface water*. In addition, over 12% of municipalities (122) purchase *groundwater*. About 11% of municipalities self-produce *surface water*. In NCSI, groundwater and purchased surface water are most prevalent in the Northwestern (90%) and Southern (48%) regions, respectively (see Figure 1.2, Panel B).

Among the 1,010 municipalities in NCSI, about 15% (151) rely on private water sources. Specifically, 93 municipalities are served by private utilities, while 58 municipalities rely on private wells. To compare, only 6 municipalities in the LMSA are served by private utilities, and 29 municipalities rely on private wells, which equates to over 12% of LMSA municipalities relying on private water sources. Figure 1.3, Panel A, illustrates the geographic distribution of water systems by type of water source (through municipalities, private utilities, or private wells) in NCSI. Drinking water provided by

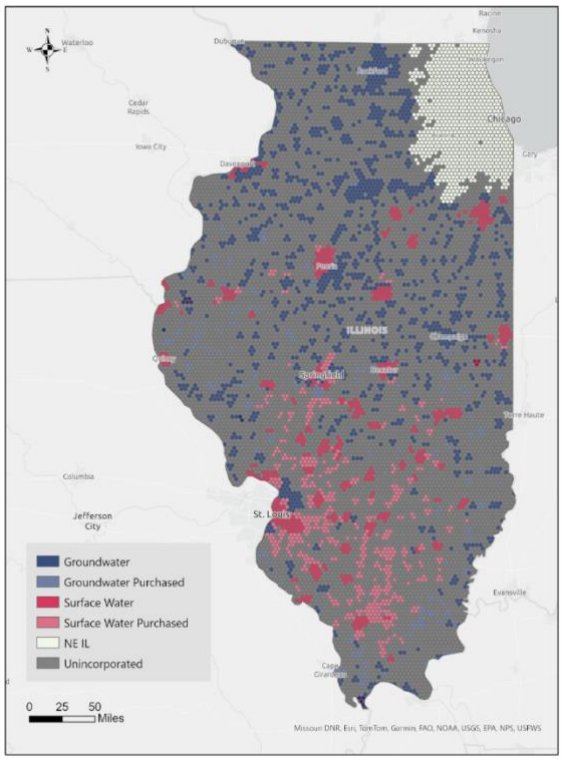
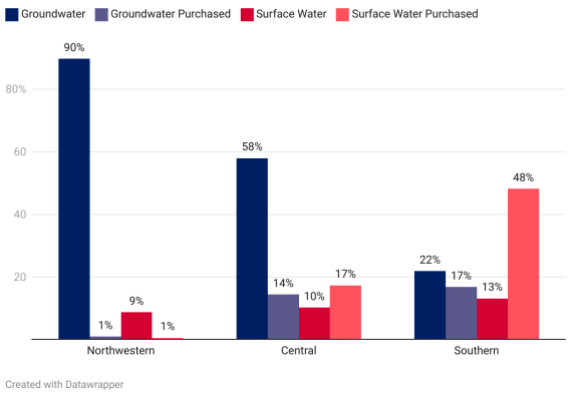
%20analysis. Heather Smith, "ArcGIS Pro: The Many Ways to Symbolize by Size," ArcGIS Blog, May 26, 2018, https://www.esri.com/arcgis-blog/products/arcgis-pro/mapping/arcgis-pro-size-guide/.

[9] This figure maps Illinois municipalities across four regions (Northeastern, Northwestern, Central, and Southern) using information from the Federal Geographic Data Committee and the Illinois Environmental Protection Agency.

[10] US Environmental Protection Agency, "SDWA Data Download Summary and Data Element Dictionary," accessed December 4, 2024, https://echo.epa.gov/tools/data-downloads/sdwa-download-summary.

private utilities is more prevalent in Northwestern and Central Illinois (see Figure 1.3, Panel B).

Figure 1.2. Production and Purchase of Water[11]

Panel A. Spatial Distribution	Panel B. Regional Aggregates
	

Notably, the landscape of municipal water systems in the state is undergoing a transformative privatization shift, with American Water and Aqua Illinois purchasing 59 systems since 2013, when legislation was enacted allowing private water companies to pass acquisition costs on to residential water customers.[12] Private water companies are more likely to modernize system infrastructure, although residential water prices are often higher to facilitate this goal.[13] Nonetheless, the allure of short-term financial solvency leads municipal systems to privatize, although some evidence suggests that

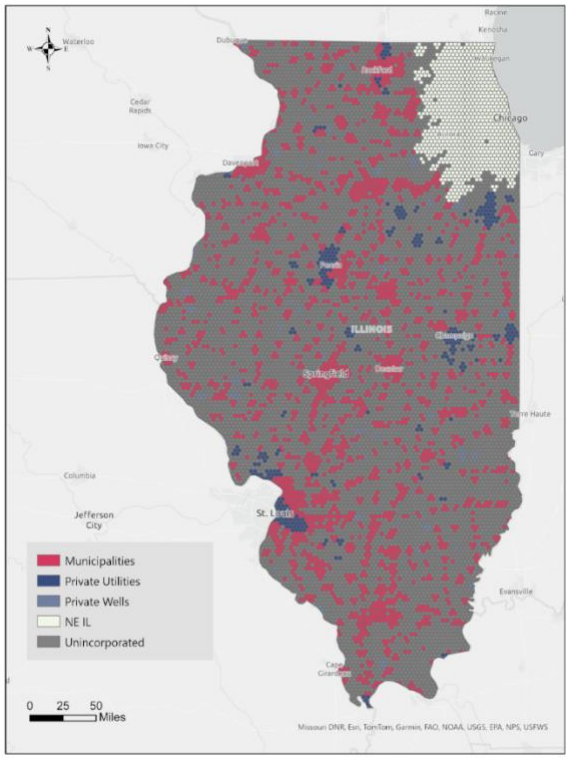
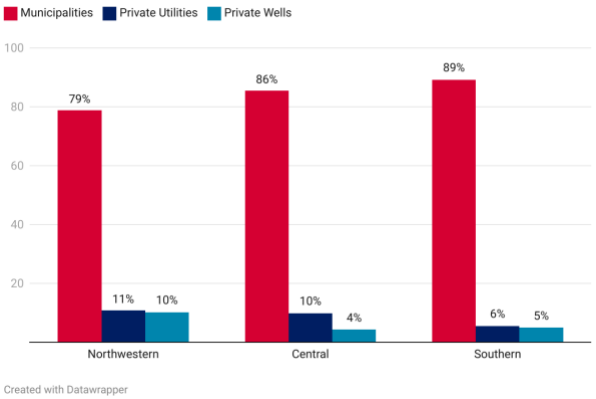
[11] This figure illustrates the distribution of water production and provision practices across 1,010 municipalities in NCSI using information from the U.S Environmental Protection Agency Safe Drinking Water Information System. Northwestern Illinois includes 194 municipalities, while the central and southern regions include 602 and 214 municipalities, respectively.

[12] Citizens Utility Board, "Big Profits, Big Bills: Tracking Illinois' Water Privatization," accessed December 4, 2024, https://www.citizensutilityboard.org/water-privatization-in-illinois/.

[13] Francisco González-Gómez and Miguel A. García-Rubio, "Prices and Ownership in The Water Urban Supply: A Critical Review," *Urban Water Journal* 15, no. 3 (February 19, 2018): 259–68, https://doi.org/10.1080/1573062x.2018.1436187.

the promise of long-term infrastructure improvement may not always materialize.[14] As this project is focused on municipal water systems, the 151 municipalities relying on private utilities or wells are excluded in this report's analyses.

Figure 1.3. Public and Private Provision of Water[15]

Panel A. Spatial Distribution	Panel B. Regional Aggregates
	

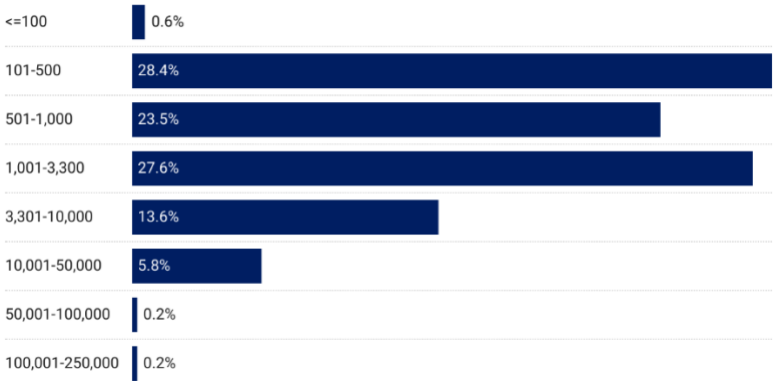
1.2. Demographic & Economic Characteristics

In addition to water source and provision, NCSI diverges from the LMSA in terms of demographic and economic characteristics. Figure 1.4 illustrates Environmental Protection Agency (EPA) defined categories of population served by municipal water systems, where it is evident that the region mostly consists of systems serving about 100 to 3,300 people (over 80%). In fact, the median population served is equal to 943 residents. The Cities of Rockford and Springfield serve the largest populations, at 147,051 and 117,428 residents, respectively. They are the only two municipalities in NCSI serving more than 100,000 residents.

[14] F. L. K Ohemeng and J. K. Grant, "Has the Bubble Finally Burst? A Comparative Examination of the Failure of Privatization of Water Services Delivery in Atlanta (USA) and Hamilton (Canada)," *Journal of Comparative Policy Analysis: Research and Practice* 13, no. 3 (June 24, 2011): 287–306, https://doi.org/10.1080/13876988.2011.565915.

[15] This figure illustrates the private and public provision of water across 1,010 municipalities in NCSI using information from the U.S Environmental Protection Agency Safe Drinking Water Information System. Northwestern Illinois includes 194 municipalities, while the central and southern regions include 602 and 214 municipalities, respectively.

Figure 1.4. Population Served Categories by Municipal Water System[16]



The NCSI regions include about 77% of Illinois municipal water systems but only serve about 26% of residents receiving municipal water. Stated differently, the average number of people served by a municipal water system in NCSI is 3,197 compared to 31,936 in the LMSA. Moreover, about 81% of municipal water systems in the NCSI regions serve 3,300 people or less compared to less than 15% in the LMSA. It should be noted that smaller systems, like the ones prevalent in NCSI, often struggle to provide affordable water as they experience high costs per capita.[17]

The MOU for the "Water Rate Setting Study" required the GFRC researchers to define "high poverty communities" using the US Department of Housing and Urban Development (HUD)'s definition of Qualified Census Tracts (QCTs). Census tracts are geographic units used to collect statistical information, with a population size between 1,200 and 8,000 people, and they often cover a contiguous area, though their spatial size will vary depending on population density within a tract.[18] HUD uses information on household income at the census tract level to identify an income standard that accounts for average household size.[19] Then, the agency identifies the percentage of households with an income less than 60% of the income standard, also known as the Area Median

[16] This figure illustrates the share of municipal systems by EPA categories of population served using information from the U.S Environmental Protection Agency Safe Drinking Water Information System. In NCSI, there are 798 municipalities with their own water systems. Some of these (14) sell water to a neighboring municipality. The rest (47) procure water through water commissions or districts, which are forms of intergovernmental coordination discussed in Section 9 of this report. The total number of municipalities obtaining water from municipal systems or water commissions and districts is 859.

[17] Allison, Perch, "Why Being Small Is Hard; Big Challenges of Small Water Systems – Environmental Finance Blog," July 10, 2017, https://efc.web.unc.edu/2017/07/10/small-hard-big-challenges-small-water-systems/.

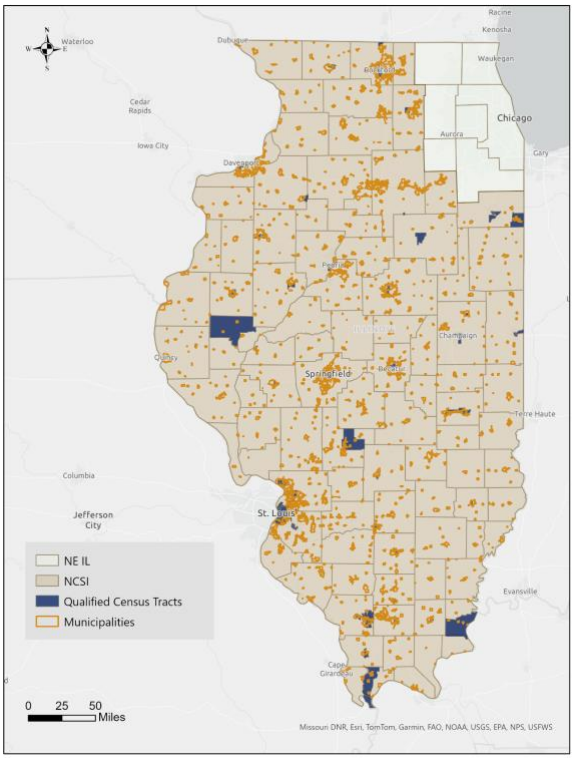
[18] US Census Bureau, "Glossary," Census.gov, accessed December 4, 2024, https://www.census.gov/programs-surveys/geography/about/glossary.html#:~:text=Census%20Tracts%20are%20small%2C%20relatively,Statistical%20Areas%20Program%20(PSAP).

[19] Office of the Assistant Secretary for Policy Development and Research, Housing and Urban Development (HUD) et al., "Statutorily Mandated Designation of Difficult Development Areas and Qualified Census Tracts for 2022," Federal Register 86, no. 172 (September 9, 2021): 50548–49, https://www.huduser.gov/portal/Datasets/qct/QCTDDA2022_Notice.pdf.

Gross Income (AMGI), as well as the percentage of households with a poverty rate of at least 25%. QCTs are tracts in which 50% or more of the households are income or poverty-eligible, and the population of all census tracts that satisfy these conditions does not exceed 20% of the total population of the respective area, either a metropolitan area or a non-metropolitan county. In areas where more than 20% of the population qualifies, HUD undertakes additional analytical steps to identify the census tracts to be designated as qualified.

Illinois has 708 QCTs; most of these are in the LMSA, with only 209 QCTs (or about 30%) in NCSI. Figure 1.5 maps these QCTs across the NCSI regions. Out of the 859 municipalities where residents receive water from municipal systems or water commissions and districts, only 74 (about 9%) overlap with a QCT. In comparison, among the 93 municipalities receiving water from private utilities, 25 (about 27%) overlap with a QCT.

Figure 1.5. Qualified Census Tracts[20]

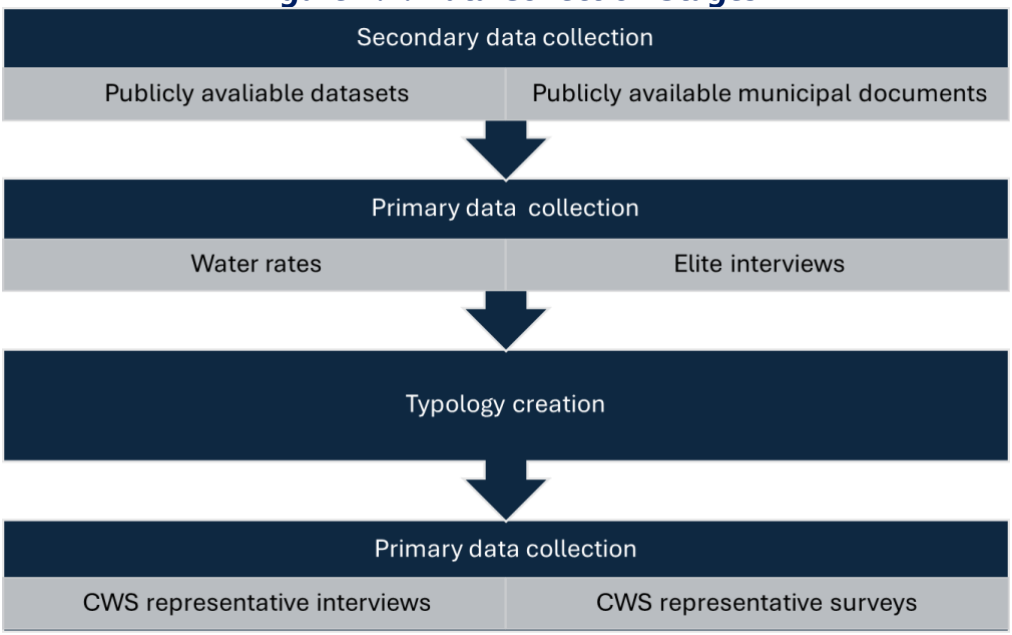


[20] This figure illustrates the overlap between 859 municipalities and QCTs across NCSI, using 2023 information from the Federal Geographic Data Committee and the US Department of Housing and Urban Development.

2. DATA & METHODOLOGIES

Throughout this report, the GFRC researchers employed a mixed-methods research approach that applied both quantitative and qualitative data analysis techniques. The quantitative analysis utilized primary and secondary data from a variety of sources. The qualitative analysis relied on a review of municipal documents and semi-structured interviews with system-level and municipal-level representatives. Figure 2.1 displays the stages of both quantitative and qualitative data collection. The extensive dataset, combining primary and secondary sources, laid the groundwork for in-depth interviews regarding water rate policymaking, aiming to cover a representative sample of municipalities.

Figure 2.1. Data Collection Stages



2.1. Data Collection

Publicly Available Datasets

Secondary data collection included assembling information on (1) water system characteristics from EPA, (2) source and system characteristics from the Illinois State Water Survey (ISWS), (3) financial metrics from the Illinois Comptroller database, (4) State Revolving Funds (SRF) information from IEPA, (5) household income from the US Census Bureau's American Community Survey (ACS), and (6) QCTs from HUD.

Publicly Available Municipal Documents

Municipalities have wide leverage in the types of laws enacted regarding water provision policies and how they are presented to the public. Municipal ordinances are often used in academic literature to provide insight into local municipal policy and outreach on

topics related to the environment, water resources, and zoning.[21,22,23] The GFRC researchers used municipal ordinances to collect information on required deposits, days until shutoff, and a series of other variables.

Water Rates

Researching water rate setting in NCSI required the GFRC researchers to first construct an original dataset of water rates directly collected from communities because no such dataset existed outside of the Northeastern (LMSA) region of the state. Water rates were collected using a multi-stage process from July 2023 to March 2024. First, contact information for municipalities in the NCSI regions was compiled. Then, the GFRC researchers called municipalities to request up-to-date water rates. Phone conversations were conducted with city clerks, municipal treasurers, public works directors, and mayors. Rates collected by phone were added to the dataset produced by this project.

Second, if municipal representatives were not accessible by phone after three contact attempts, the GFRC researchers consulted publicly available municipal ordinances. If water rates were stipulated in municipal ordinances, the GFRC researchers incorporated the rates into the dataset.

Third, if municipal ordinances were not publicly available or did not contain water rates, an email was sent to municipalities requesting water rates and ordinances using municipal contact information from the Illinois State Comptroller. Finally, individual follow-up emails were sent to municipalities for which rates were not obtained in the first three stages of data collection. Rates were incorporated into the dataset as received through these final collection efforts.

In total, 595 water rates were collected from 859 municipalities (69.27%) where residents receive water from municipal systems or water commissions and districts. This water rate collection initiative is the single largest in Illinois and only the third effort among researchers nationwide to collect water rate data spanning the majority of a US state.[24,25]

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[21] Rolston St Hilaire et al., "Efficient Water Use in Residential Urban Landscapes," *HortScience* 43, no. 7 (December 1, 2008): 2081–92, https://doi.org/10.21273/hortsci.43.7.2081.

[22] Lin A. Ozan and Kamal A. Alsharif, "The Effectiveness of Water Irrigation Policies for Residential Turfgrass," *Land Use Policy* 31 (October 13, 2012): 378–84, https://doi.org/10.1016/j.landusepol.2012.08.001.

[23] Edward J. Jepson and Anna L. Haines, "Zoning for Sustainability: A Review and Analysis of the Zoning Ordinances of 32 Cities in the United States," *Journal of the American Planning Association* 80, no. 3 (July 3, 2014): 239–52, https://doi.org/10.1080/01944363.2014.981200.

[24] Ahmed Rachid El-Khattabi, Kyra Gmoser-Daskalakis, and Gregory Pierce, "Keep Your Head Above Water: Explaining Disparities in Local Drinking Water Bills," *PLOS Water* 2, no. 12 (December 21, 2023): e0000190, https://doi.org/10.1371/journal.pwat.0000190.

[25] Richard E. Thorsten, Shadi Eskaf, and Jeffrey Hughes, "Cost Plus," *Public Works Management & Policy* 13, no. 3 (October 7, 2008): 224–38, https://doi.org/10.1177/1087724x08324302.

This foundational water rates dataset, produced by the Water Rate Setting Study and now publicly available from the GFRC, also combines data collected from the US Census Bureau, US Environmental Protection Agency (EPA), Illinois State Water Survey (ISWS), IEPA, and the Illinois State Comptroller.

Elite Interviews

While primary quantitative and secondary data collection was underway, the GFRC researchers identified system-level representatives for elite interviews. System-level respondents who participated in this phase of primary data collection represented one of the following five groups:

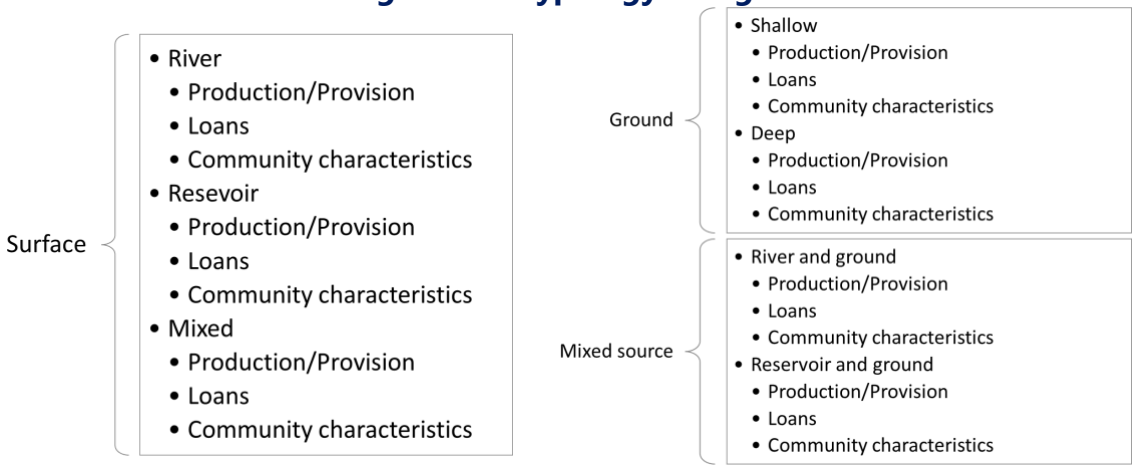
1. Illinois Department of Natural Resources
2. Illinois Rural Water Association
3. Public Water Districts
4. Rural Water Districts
5. Wholesale Providers

These preliminary interviews were conducted to gain insight into the broad challenges and opportunities in water rate setting across NCSI. Information from these elite interviews informed the creation of a sampling typology, as well as the types of questions used in the second phase of primary data collection (i.e., Water System Representative Interviews and Surveys).

Typology Creation

The primary and secondary data collection allowed the GFRC researchers to create a typology of municipalities utilizing a five-step categorization strategy: 1) primary water source, 2) production versus purchase of water, and further wholesaling, 3) municipality overlap with QCTs, 4) distribution of standardized water rates, and 5) the number of SRF loans received. This typology was used to identify a list of representative municipalities to interview. Full details of the typology creation are available in the appendix.

Figure 2.2. Typology Categories



The goal of the typology was to identify the "average" and the "outliers" across NCSI municipal water systems. Through this process, the GFRC researchers established a sampling strategy for the case study interviews. Figure 2.2 displays a visual representation of the distinct typology categories that were used for case study interview selection. The appendix contains the final list of municipalities that were sampled for data collection interviews or returned a short survey with qualitative data.

Water System Representative Interviews & Surveys

Using the typology, the GFRC researchers recruited municipal representatives for in-depth interviews. First, the contact information of municipal representatives was collected. These included municipal finance directors, water directors, and public works directors, as well as elected officials like town mayors and treasurers. In addition, members of the advisory committee provided contact information for potential interviewees. Further, the GFRC researchers collaborated with the Illinois Municipal League (IML) on outreach.

In reaching out to potential interviewees, personalized emails were sent to municipalities with information about the aim of the project, the source of funding, and endorsements from the IML and Illinois Government Finance Officers Association (IGFOA). For email recipients who did not respond, the GFRC researchers followed up with phone calls and reminder emails, which were sent biweekly up to four times. Once these efforts were exhausted, members of the advisory committee directly reached out to representatives of municipalities with whom they had working relationships.

In total, 14 interviews were conducted by video conference and each lasted from 60 to 90 minutes. Municipal interviewees included a variety of staff positions, ranging from council or board members to city clerks and professional water operators. Interviews were transcribed, and the GFRC researchers de-identified all transcripts before analysis. The appendix lists the semi-structured interview questions. In response to representatives indicating they would like to participate but did not have the time to dedicate to an interview, an email was sent with a survey link that included a condensed subset of interview questions. In total, qualitative data collection through interviews and surveys was completed for 25 representative municipalities between March 2024 and October 2024.

2.2. Supporting Data

Water Bills

The GFRC researchers also collected a sample of 100 municipal water bills to better understand public outreach and transparency between community water systems and their customers. Anonymized samples of municipal water bills were requested by phone

in tandem with water rate collection efforts. Subsequently, the GFRC researchers systematically analyzed the water bill formats and items included. The presence or absence of information related to billing clarity and transparency, including billing periods and due dates, were recorded, as well as less commonly included information such as per-unit charges and neighborhood usage statistics. The coded data also included documentation of the presence of billing-related information on municipal websites, focusing on price transparency and online payments. The variables produced were refined through multiple rounds of iterative coding.

Boil Water Notices

Boil water orders are issued by water suppliers in response to potential microbiological contamination, compromised sanitary conditions in the water system, or drops in water pressure.[26] The GFRC researchers created a boil order dataset by combining secondary data from municipalities reporting orders to state agencies with primary data from a sample of municipalities that did not report their orders to agencies but shared notices online or to media sources. By synthesizing boil orders issued over a 15-month period in NCSI, this effort (1) provided a preliminary analysis of descriptive trends related to the scope of boil orders, reasons for their issuance, and duration of impact in the region, and (2) identified challenges in compiling statewide boil order data.

Boil Order Records from IEPA and the Illinois Emergency Management Agency

In adherence to regulatory requirements, Illinois water suppliers are required to report all boil orders to IEPA, regardless of an order's scope or duration.[27] For orders issued outside of regular working hours, suppliers must instead report to the Illinois Emergency Management Agency (IEMA). While IEMA has maintained a long-term record of these reports, the IEPA only recently began stringently enforcing Illinois Administrative Code Title 35 Section 607.103, requiring systems to report boil orders to them.[28] The GFRC researchers obtained boil order notices reported to these two agencies through Freedom of Information Act (FOIA) requests, adding to a dataset of boil orders issued by municipal water suppliers in NCSI from April 1, 2023, to July 1, 2024.[29] The data included the name of the issuing municipality and, when available, the start and end dates, along with the reason for each boil order. The data did not indicate the number of households impacted by a particular order.

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[26] Illinois Environmental Protection Agency, "Sample Collector's Handbook," accessed December 4, 2024, https://epa.illinois.gov/topics/compliance-enforcement/drinking-water/sample-collectors-handbook.html.

[27] Illinois Environmental Protection Agency, "Emergency Response," accessed December 4, 2024, https://epa.illinois.gov/topics/drinking-water/field-operations/emergency-response.html

[28] Illinois EPA, "Emergency Response," The State of Illinois, 12,12,2024, https://epa.illinois.gov/topics/drinking-water/field-operations/emergency-response.html#:~:text=35%20Ill.,is%20endangered%20for%20any%20reason.

[29] The starting month was chosen as April 1st since IEPA's record keeping only began in the middle of March. The ending month corresponds to when the GFRC researchers submitted the FOIA requests.

Boil Order Records Scraped from Online Sources

The IEPA and IEMA's record-keeping provides a valuable archive for estimating the scope of boil orders across the region and for understanding factors such as the reasons for these orders and their durations. However, non-compliance in reporting presents a notable challenge to data completeness, as agencies rely on municipalities to self-report. If reporting compliance varies systematically between water suppliers of differing characteristics (capacity, size, area etc.), non-compliance introduces systemic biases into the analysis.

To address gaps in the secondary data and to estimate reporting compliance levels, the GFRC researchers undertook a primary data collection process to gather boil order notices posted online from a random sample of 250 municipalities, stratified based on the size of the population served. The sample was randomly drawn from municipalities in NCSI that did not report boil orders to the IEPA or IEMA. This data collection effort had two key objectives: (1) to assess reporting compliance levels and uncover patterns of non-compliance, and (2) to expand the boil order dataset by incorporating data from a sample of municipalities excluded from the IEPA and IEMA records.

Municipal water suppliers who announce boil orders online typically leverage municipal-run social media accounts, websites, and local press platforms. Scraping these sources constituted the bulk of the primary data collection effort. Some suppliers announce all boil orders publicly, while others practice a mix of strategies: public announcements for wider orders and direct contact methods, such as door tagging and text alerts, for limited-impact ones. A key limitation of gathering boil order data through online sources is the likely underrepresentation of limited impact orders. Similarly, orders issued by small municipalities without websites, social media, and ties to news media are likely to be underrepresented.

For both the primary and secondary data, to the extent possible, the GFRC researchers classified the reasons underlying the orders into discrete category codes such as "break," indicating a water main break, and "replacement" for necessary water infrastructure replacement initiatives. The affected infrastructure, if specified, was noted separately.

2.3. Analysis

Quantitative

The data discussed above were used for a variety of quantitative analyses presented throughout this report. For these analyses, the GFRC researchers used the municipality as the unit of observation. Descriptive statistics were used to identify patterns and trends in numerical or graphical forms, such as measures of central tendency (mean,

median), frequency distributions, measures of variability (range, standard deviation, variance), and measures of position (percentiles and quartiles). Spatial representations of data were used to illustrate geographic variation. Regressions were used to estimate the relationship between one or more independent variables and a dependent variable. This allowed the GFRC researchers to examine the statistical significance, direction, and magnitude of relationships between independent variables and a dependent variable.

Qualitative

Interview transcripts were coded for analysis using Dedoose qualitative data coding software. The GFRC researchers used an inductive content analysis approach. This approach is appropriate when a qualitative study has an inductive starting point where the data collection approach is open and follows loosely defined themes. This form of content analysis is suitable when the phenomenon under study has not been covered in previous studies or when prior knowledge is fragmented.[30]

The inductive content analysis was performed according to the following phases: data reduction, data grouping, and the formation of concepts to address the research questions. During the analysis process, the GFRC researchers first read multiple transcripts and created codes for the main concepts and sub-concepts. Next, the GFRC researchers met to discuss code definitions and applications. Third, the GFRC researchers returned to the data to re-read transcripts and code additional ideas or themes that emerged from the data based on researcher discussions. Fourth, the GFRC researchers organized the coded excerpts and reviewed them based on each researcher's content expertise. Then, the researchers wrote overall summaries from their analysis and shared these summaries to clarify concepts and organize findings for each section of this report. Throughout this process, the GFRC researchers achieved empirical rigor through the process of meeting criteria for qualitative trustworthiness based on credibility, dependability, confirmability, transferability, and authenticity.[31]

[30] Margrit Schreier, *Qualitative Content Analysis in Practice* (Thousand Oaks, CA: Sage Publications, 2012).
[31] Branda Nowell and Kate Albrecht, "A Reviewer's Guide to Qualitative Rigor," *Journal of Public Administration Research and Theory* 29, no. 2 (April, 2019): 348–63, https://doi.org/10.1093/jopart/muy052.

3. THE WATER RATE-SETTING PROCESS

Drinking water rates have been increasingly making headlines as systems grapple with outdated infrastructure and new regulations. For example, the City of Quincy recently increased its rates to afford $30 million in improvements to its water system.[32,33] This follows a $9 surcharge to utility bills that the city added in 2022, citing increases in the prices of chemicals, energy, and fuels.[34] Similarly, Springfield has also raised the price of its water substantially. In Illinois' capital, a 32% increase was reported in 2024, with another 32% increase planned for 2025, making a bill of $14.78 become $25.75 in just two years.[35] Increases like these have been partly spurred by the need to pay for the state-mandated lead service line replacements, discussed further in Section 7.[36] These two examples of recent rate hikes highlight the importance of understanding rate structures used by water systems to recuperate the costs of water provision. As such, this section examines water rate structures across NCSI using the foundational water rates dataset discussed in Section 2. In addition to the quantitative results, this section presents insights derived from interviews with municipal representatives.

3.1. Quantitative Results

Rate structures are the framework used by water providers to determine the rates or bills that households pay, which are intended to recuperate the costs of operating and maintaining water systems. In addition to ensuring that systems can adequately fund water services, the design of these structures, which depends on the priorities of providers, can promote efficient water use and fairness, among other goals.

3.1.1. Rate Structure Elements

In general, rate structures vary across the 595 municipalities for which the GFRC researchers were able to collect rates, with over 93% using a two-part rate structure and only 4% using a flat rate structure, followed by less than 3% solely using a volumetric rate structure (see Figure 3.1). For municipalities using a flat rate structure, expected annual system costs are divided by the number of residents served, and residential

[32] J. Robert Gough, "Quincy City Council Approves $14.15 Water Rate Increase, $5.5 Million for City Hall Repairs," *Muddy River News*, April 9, 2024, https://muddyrivernews.com/top-stories/quincy-city-council-approves-14-15-water-rate-increase-5-5-million-for-city-hall-repairs/20240409074237/#:~:text=City%20Hall%20repairs-,Quincy%20City%20Council%20approves%20%2414.15%20water%20rate%20increase,million%20for%20City%20Hall%20repairs&text=QUINCY%20%E2%80%94%20The%20Quincy%20City%20Council,not%2Dfor%2Dprofit%20users.

[33] David Adam, "'That's What Keeps Me Up at Night': Director Of Public Works Explains Need For Water/Sewer Rate Hike in Quincy," *Muddy River News*, March 11, 2024, https://muddyrivernews.com/top-stories/thats-what-keeps-me-up-at-night-director-of-public-works-explains-need-for-water-sewer-rate-hike-in-quincy/20240311160726/.

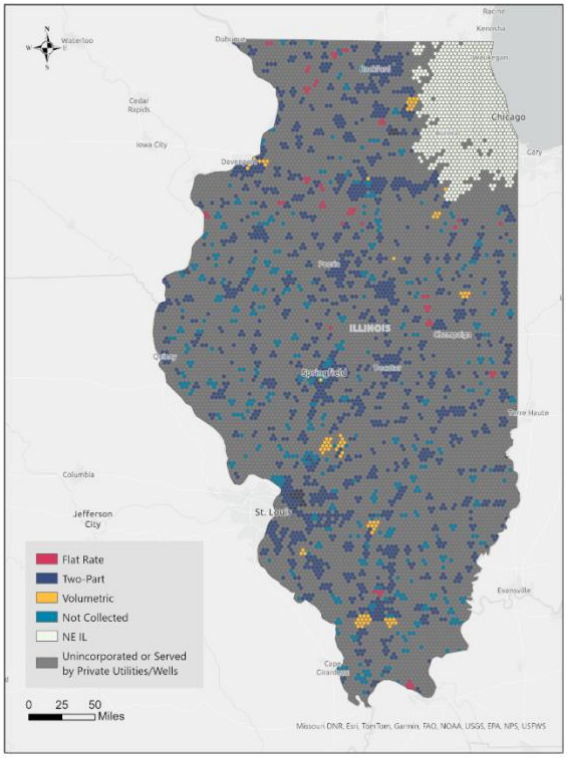
[34] Ibid.

[35] Steven Spearie, "Springfield Water Bills to Increase Starting Friday. Here's Everything You Need to Know," *The State-Journal Register*, March 1, 2024, https://www.sj-r.com/story/news/local/2024/02/29/water-bills-to-increase-in-springfield-march-1-what-you-need-to-know/72736625007/

[36] Ibid.

customers pay the same bill regardless of the amount of water consumed. This framework is simple to implement from an administrative perspective, e.g., no meter reading is needed, although it creates a free rider problem where households can overuse water. As expected, 80% of the 25 NCSI municipalities using a flat rate structure serve 1,000 residents or less. In the LMSA, only two municipalities used this structure.

Figure 3.1. Rate Structure Elements: Flat, Volumetric, or Two-Part[37]



Among the 16 municipalities in NCSI using a volumetric rate structure, only one serves 1,000 residents or less. A volumetric rate structure charges customers based on their consumption volume. The main concern with this type of structure is that the water system's revenue is completely dependent on the volume of water consumed. Therefore, if a system overestimates consumption in a given year, it may end up with insufficient revenue for operations and maintenance. In the LMSA, the City of Chicago and five other municipalities are the only ones using this rate structure.

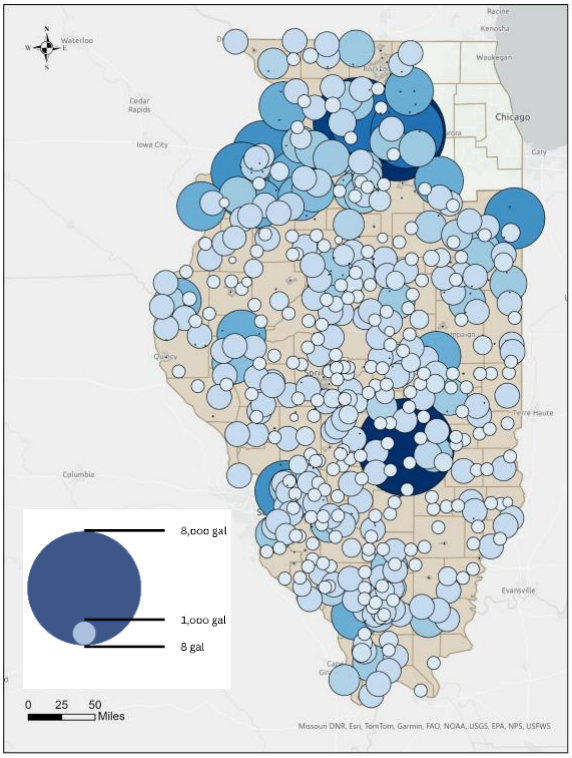
A two-part rate structure combines flat and volumetric rates, and it is the most common across Illinois, with 554 municipalities using it in the NCSI regions and 240 municipalities in the LMSA region. The flat rate, more commonly known as a base charge, serves as a minimum bill that all customers pay regardless of the amount of water consumed. In

[37] This figure illustrates the distribution of rate structure across 595 municipalities in NCSI, using information from the original dataset produced as part of this Water Rate Setting Study.

addition to the base charge, customers also pay an amount that reflects their volumetric water usage.

Depending on the municipality, the base charge sometimes includes a water consumption allowance so that households are not charged a volumetric component until they exceed the base charge consumption threshold. Over 18% of municipalities relying on a two-part rate structure do not include a water allowance in the base charge. For these, the base charge ranges from $3 to $51, with a median of about $15 and an average of $17. Figure 3.2 illustrates the water allowance included in the base charge for those municipalities in NCSI that include this rate structure element, which ranges from 8 to 8,000 gallons. For the 454 NCSI municipalities that include a water allowance, the base charge ranges from $5 to $130, with a median of $22 and an average of about $26.

Figure 3.2. Rate Structure Elements: Water Allowance with Base Charge[38]

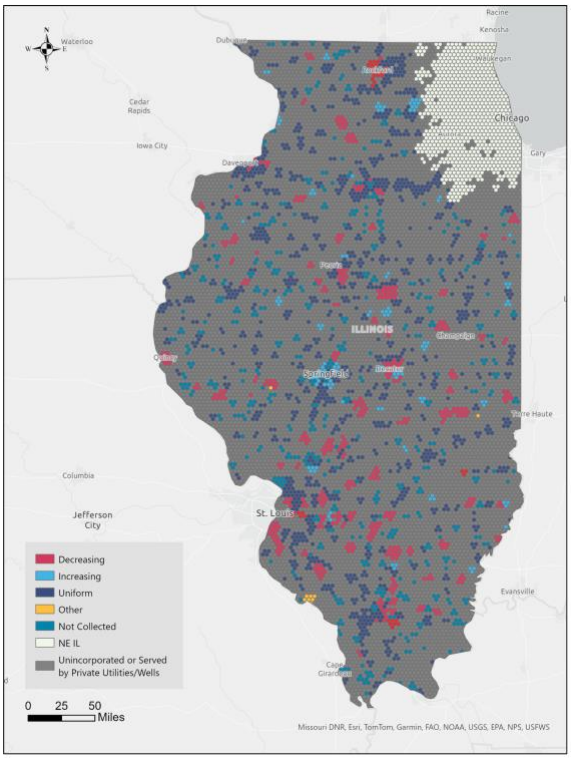


Another element of rate structure is the inclusion of blocks among municipalities that use a volumetric or two-part rate. Using these blocks allows a municipality to charge a varying rate depending on a resident's level of consumption. In NCSI, about 76% of

[38] This figure illustrates the distribution of water allowance included within the base charge across 454 NCSI municipalities billing their residents using a two-part rate structure. The figure uses information from the original dataset produced as part of the Water Rate Setting Study. The larger the proportional symbol and the darker the color, the greater the water allowance included in the base charge.

municipalities using a two-part rate structure do not incorporate blocks, while over 17% use decreasing blocks, over 6% use increasing blocks, and less than 1% (3 municipalities) use separate pricing blocks that do not follow consistent increasing or decreasing trends (referred to as other in Figure 3.3). Among municipalities using a volumetric rate, about 44% do not incorporate blocks, 50% use decreasing blocks, and 6% (1 municipality) use increasing blocks.

Figure 3.3. Rate Structure Elements: Block Design[39]



Notably, rate structure best practices do not recommend the use of decreasing blocks for residential consumption; these are instead usually used to provide price incentives for large commercial users.[40] In contrast, increasing block rates are applied to spur conservation or to target irrigation, with best practices encouraging significant rate differentials across blocks as long as block sizes do not burden large families.[41] Further, several studies suggest that fixed water charges disproportionately burden low-income households as they weaken demand elasticity, although these charges enhance revenue

[39] This figure illustrates the distribution of block design across 570 municipal water providers that apply a two-part or volumetric rate structure in the NCSI regions, using information from the original dataset produced as part of this Water Rate Setting Study.

[40] Environmental Finance Center Network (EFCN), "Designing Water Rate Structures that Support Your Utility's Objectives," July 24, 2017, https://efcnetwork.org/wp-content/uploads/2017/07/DesigningAppropriateRateStructures.pdf.

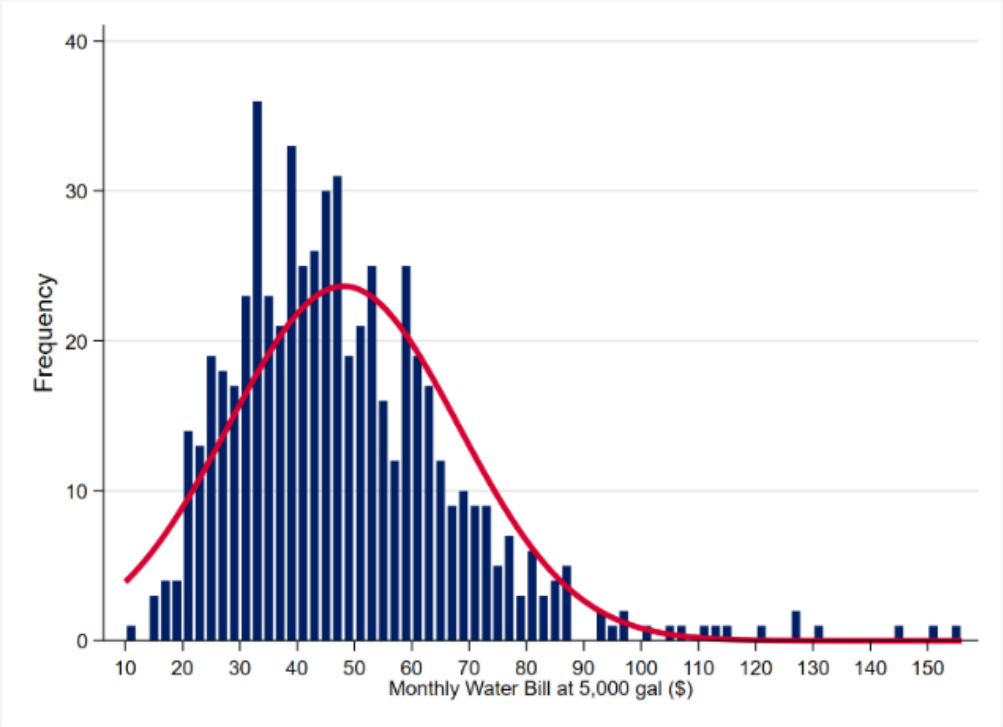
[41] Ibid.

stability for utilities.[42,43,44] This tradeoff between the financial viability of systems and the burden on residents is a recurring theme in water policy and one we discuss further in Section 5. Worth noting, some researchers have suggested tiered fixed rates as a solution that offers better alignment between revenue stability and affordability.[45]

3.1.2. Standardized Water Bills

Given the variation in rate structures across NCSI municipalities, the GFRC researchers use a standardized water bill for analysis. This bill reflects what residents would pay for 5,000 gallons per month. Figure 3.4 presents the distribution of water bills in NCSI. The average monthly standardized water bill is about $48, and the median is $45, while the lowest and highest bills are $11 (Scales Mound) and $155 (Makanda), respectively.

Figure 3.4. Distribution of Standardized Water Bills[46]



[42] Gregory Pierce, Nicholas Chow, and J.R. DeShazo, "The Case for State-level Drinking Water Affordability Programs: Conceptual and Empirical Evidence from California," *Utilities Policy* 63 (January 26, 2020): 101006, https://doi.org/10.1016/j.jup.2020.101006.

[43] Gregory Pierce et al., "Solutions to the Problem of Drinking Water Service Affordability: A Review of the Evidence," *Wiley Interdisciplinary Reviews Water* 8, no. 4 (March 25, 2021), https://doi.org/10.1002/wat2.1522.

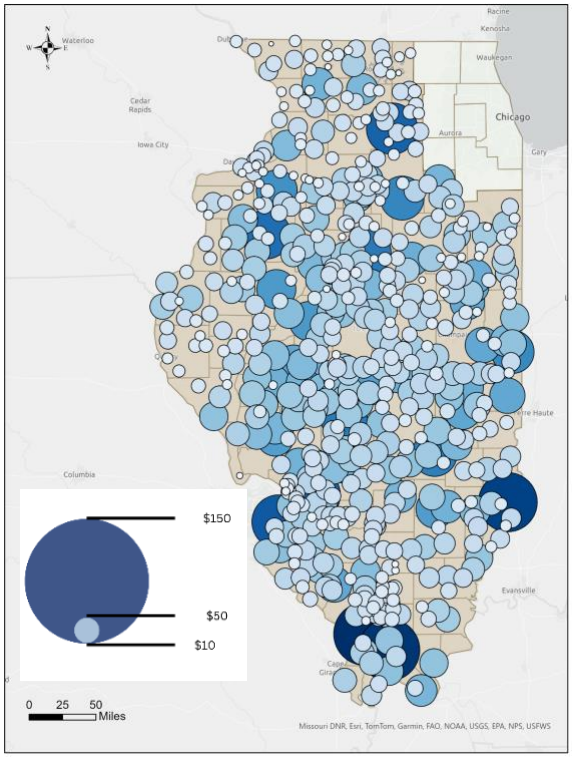
[44] Janice A. Beecher, "Primer on Water Pricing." *Institute of Public Utilities Regulatory Research and Education, Michigan State University, East Lansing, MI, 2011.*

[45] Amy Schmidt and Lynne Lewis, "The Cost of Stability: Consumption-Based Fixed Rate Billing for Water Utilities," *Journal of Contemporary Water Research & Education* 160, no. 1 (April 1, 2017): 5–24, https://doi.org/10.1111/j.1936-704x.2017.03237.x.

[46] This figure illustrates standardized water bills across 595 municipal water providers in NCSI, using information from the original dataset produced as part of this Water Rate Setting Study.

The standardized water bill used for this analysis is consistent with the literature and the first water rate-setting report that focused on the LMSA.[47,48,49] Figure 3.5 geographically displays these standardized water bills for residential customers in the 595 NCSI municipalities. These standardized water bills are calculated from data collected from communities between July 2023 and March 2024. Since purchased water is more expensive than self-produced water, the average bill among municipalities producing groundwater is equal to about $45 compared to $55 among municipalities purchasing groundwater. Similarly, the average bill among municipalities producing surface water equals $50 compared to over $53 among municipalities purchasing surface water.

Figure 3.5. Standardized Water Bills in NCSI[50]



[47] US Environmental Protection Agency, "DWSRF Disadvantaged Community Definitions: A Reference for States," *US Environmental Protection Agency,* 2022, https://www.epa.gov/system/files/documents/2022-10/DWSRF%20DAC%20Definitions%20Report_October%202022%20Updates_FINAL_508.pdf.

[48] Danielle Gallet, Caroline Pakenham, and Margaret Schneemann. *Water Affordability in Northeastern Illinois: Addressing Water Equity in A Time of Rising Costs* (Metropolitan Planning Council, Elevate Energy, and Illinois Indiana Sea Grant, 2020), accessed December 5, 2024, https://iiseagrant.org/wp-content/uploads/2020/03/mpc_water_affordability_report_web-1.pdf.

[49] Government Finance Research Center, *Water Rate Setting Study*, accessed December 5, 2024, https://gfrc.uic.edu/our-work/featured-projects/water-rate-setting-study/.

[50] This figure illustrates standardized water bills across 595 NCIS municipalities, using information from the original dataset produced as part of this Water Rate Setting Study.

Table 3.1 lists the share of NCSI municipalities, the share of municipal water systems for which the GFRC researchers were able to collect water rates, and their respective standardized water bills, by EPA population categories. The weighted average of standardized water bills ($47.78), adjusted for the proportion of systems within each population category, aligns closely with the unweighted average ($48).

Table 3.1. Standardized Water Bills by Categories of Population Served[51]

EPA Population Categories	Share of NCSI Municipalities	Share of NCSI Municipalities with Collected Rates	Average Standardized Water Bills
<=100	0.63%	0.00%	-
101-500	29.07%	16.26%	$50.96
501-1,000	23.31%	23.53%	$45.47
1,001-3,300	27.69%	34.43%	$48.77
3,301-10,000	12.91%	17.30%	$46.90
10,001-50,000	5.89%	7.79%	$44.76
50,001-100,000	0.25%	0.35%	$37.85
100,001-250,000	0.25%	0.35%	$29.64
Total/Weighted Average	798 municipalities	578 municipalities	$47.78

3.2. Qualitative Results

With this background on rate structures and water bills in NCSI established, the GFRC researchers interviewed municipal representatives to better understand the intricacies of establishing and updating rate structures in the region, as well as the role of personnel involved, the factors that impact rate change implementation, and challenges that hinder the application of best practices.

3.2.1. Rate Setting Personnel

The process of setting water rates involves multiple stakeholders, including municipal staff, elected officials, water boards, and sometimes engaging consultants for water rate studies. Community water system (CWS) representatives described the process, staff, and consultants involved by sharing:

> *"We have a Water and Sewer Superintendent…We have a Board Trustee that is Water and Sewer, as well. So, we kind of have a one-to-one ratio between those folks. So, those two individuals, our finance person, myself [the Water Supervisor], and the Utility Clerk, would all be involved. And we're to the point now, where it's pretty easy."*

[51] This table uses information from the original dataset produced for this Water Rate Setting Study. In NCSI, there are 798 municipalities with their own systems. Some of these (14) sell water to a neighboring municipality. The rest (47) procure water through water commissions or districts, which are forms of intergovernmental coordination discussed later in Section 9. The total number of municipalities obtaining water from municipal systems or water commissions and districts is 859.

Another interviewee added:

> *"I was tasked by the president of the village board to look into what it was costing us to produce the water…I worked in conjunction with the water superintendent with expenses…And that's when we determined, we—including myself [the Village Finance Officer], the operator, and the village board, determined that it was time to make a rate increase."*

On the role of consultants, one CWS representative explained:

> *"Water rates are typically reviewed every 3 years via a water/sewer rate study. A third-party firm is hired to conduct the study, with heavy participation from the water plant director, engineering director, distribution director, finance director, city administrator, and mayor. Once recommended rates are established, they are presented to the city council for approval."*

In some communities, the rate-setting process is proactive, with personnel considering current and future needs. CWS representatives explained:

> *"When we raise rates, we're planning for the long term. So, strategy meetings happen on a yearly basis. And we just talk through, these are the projects that we're expecting for capital. This is what we believe the increase in operations is going to be over the next five years and this is the trajectory."*

Another interviewee added:

> *"For operational costs, it's very easy. So, we can average out over the last five years and then we can predict or calculate what we believe the increase is going to be. So, we might take the average of inflation over the last five years as well."*

In addition, one CWS representative emphasized the importance of financial sustainability:

> *"The way we built our financial structure is that we want each utility to stand on its own. Meaning, the dollars that are brought in for that utility are used to cover the operational cost (daily, weekly, monthly, annual), and then also have the ability to set aside dollars that we put into what we call a Capital Account. And then those dollars are available for future capital projects."*

In many municipalities, water rate-setting processes are informed by benchmarking and the strategic use of consultants for water rate studies. Benchmarking allows municipalities to compare their rates with those of neighboring communities to ensure

competitiveness and fairness. Municipalities often aim to maintain their rates at a similar or lower level compared to nearby communities, minimizing financial burdens on residents and ensuring regional competitiveness. Interviewees shared:

> "*The municipality regularly reviews other communities' water rates (per unit) to gauge range; however, the community's rate is consistently lower than the surrounding areas.*"

Another added:

> *"As far as the rate setting process or the rate increase, certainly we have slides that benchmark our prices versus the surrounding communities, not only here locally but on a statewide basis. Certainly. I don't know how much merit or how much weight the elected officials put on that, but that is certainly part of our presentation."*

3.2.2. Rate Implementation

Through interviews, we confirmed that some community water systems use a decreasing block rate to incentivize water use by the largest industrial users, effectively subsidizing them. Interviewees explained:

> *"We are on a declining block structure which basically incentivizes water use and provides subsidy to our largest industrial users (who are) the people that can afford to pay for the water they are using. If we truly set rates at what is needed, a lot more people would not be able to afford them."*

Another added:

> *"When you get over a certain number of gallons, the water rates get cheaper for obvious reasons. The fixed cost doesn't increase with volume, only the variable costs. So, we pass that increased margin [from economies of scale] onto the customer."*

Another theme that emerged from interviews is the use of incremental rate increases to avoid sudden and significant financial burdens on customers. Gradual and incremental adjustments often help prevent sudden financial strain on customers, allowing municipalities to adapt to rising costs while maintaining affordability. Here, a CWS representative explains:

> *"If we're going to increase rates, it has to be incremental, not monumental. And so, affordable might mean that yes, you are going to pay a little bit more, but it should never mean that you had to make up for the previous generations lack of planning."*

In some municipalities, rate increases only occur when necessary, often as a reaction to infrastructure needs or regulatory requirements. Major infrastructure projects can result in significant one-time rate increases. These increases are often tied to capital improvements that are unavoidable and can place a heavy burden on small systems. This interviewee stated:

> *"We have increased at least twice in the last decade. Just this last year in 2023, we increased our water rates by 15% to cover the cost of water and failing infrastructure in an area with a lot of rocky terrain and significant elevation changes."*

3.2.3. Best Practices in Rate Setting

Best practices in terms of rate setting include maintaining accurate records of expenditure and revenue data over time, setting rates that cover both operating and capital expenses, and regularly assessing system conditions to identify maintenance needs. By incorporating capital funding into annual budgets, municipalities can ensure a sustainable approach to long-term water rate management. Some of these best practices were evident in the interviews where a participant explained:

> *"At our normal committee meetings, we're given a report that shows the outflow, inflow, and current status. So, we have budgeted an operations cost and a capital cost for each month."*

Additional best practices include setting and maintaining reserve targets, conducting yearly rate reviews to stay aligned with changing costs, and preventing the diversion of rate revenue for non-utility purposes. Cost-of-service analyses further support these efforts by ensuring that rate adjustments accurately reflect the operational, maintenance, and capital requirements of the water system, thus avoiding arbitrary increases and promoting accountability. Moreover, accurate record keeping of expenditure and revenue data over time allows municipalities to track financial trends and make informed decisions about rate adjustments that relate to their costs of providing water to customers.

Also, regularly assessing the condition of infrastructure is essential for identifying maintenance needs and ensuring that current and future infrastructure maintenance and improvements are accounted for in rate-setting processes. Some communities are aware of their infrastructure needs but are not certain they can afford future maintenance, as expressed here:

> *"Most people are on traditional copper or galvanized pipes, and that's all aging...we have to stay vigilant with maintenance to keep the system operating, as we don't have the budget for large-scale replacements."*

Interviewees seemed to understand the importance of establishing and adhering to reserve targets for both operating and capital needs, an essential practice for financial stability and preparedness. Building reserves allows municipalities to manage unexpected costs or fund future projects without relying solely on reactionary rate increases. Integrating capital funding into the annual budget is crucial for sustainable water rate management over the long term. By planning for both operational and capital expenses, municipalities can address infrastructure needs proactively, avoiding sudden rate hikes. As one interviewee shared:

> *"The last thing we want to do is increase our rate. So, can we find ways to become more efficient? Can we find ways to lower costs? Can we find ways to do those things, before we get to a rate increase? And some of that is putting away. We put $12,500 a month away for future capital projects. $10,000 of that is going directly to an account for the tower, and another $2,500 for future water line. And I think we've got close to $500,000 in the Illinois Funds account, for future water projects."*

Another interviewee added:

> *"[Water] is an enterprise fund. It's expected to produce enough revenue to make sure that we have reserves for capital replacements, etc. So, again, it's reviewed monthly."*

Conducting a cost-of-service analysis to ensure rates reflect the true costs of providing water services, including operational, maintenance, and capital costs, is also a necessary practice. This ensures that rate changes are justifiable and also avoids arbitrary increases. At this time, no communities that were interviewed indicated they use a cost-of-service approach like that of the American Water Works Association (AWWA).[52] Instead, they do internal analysis or rely on services from for-profit and nonprofit consultants like the Illinois Rural Water Association (IRWA). One interviewee explained:

> *"We typically only change rates when there is justification based on cost. So, if it's not costing us more, then we are not charging any more for the system."*

Another participant shared:

> *"They (Illinois Rural Water Association) will do rate studies for you for nothing. You provide them with the information, they'll do a rate study for it. So, I presented them (the town board) with both copies of that, mine and theirs which really, I was really happy we both coincided pretty doggone close on where we were on it."*

[52] Chicago Metropolitan Agency for Planning, *Full-Cost Water Pricing Guidebook*, (Chicago, IL: Chicago Metropolitan Agency for Planning, 2012), https://cmap.illinois.gov/wp-content/uploads/Full-Cost-Water-Pricing-Guidebook.pdf.

3.2.4. Divergence from Best Practices

In the interviews, some municipalities reported specific challenges that negatively impacted their rate-setting processes. These often arise due to unique budget limitations, political pressures, or administrative or technical capacity limitations. Understanding these challenges and any associated divergences from best practices can help inform targeted interventions to improve rate-setting processes in NCSI.

Many municipalities face budget limitations that prevent them from adopting well-established practices or building sufficient reserves for infrastructure improvements. This can lead to deferred maintenance, which can lead to substantial reactionary rate increases in the future, as expressed here:

> *"We don't repair water lines; we wait for them to break. When water is running down the street…we know we're using more gallons each day, we assume we have a water leak. We're not out there making sure we're not. We're not out there looking to see if the pipes are old and decrepit and need to be replaced. We just wait for water to bubble up out of the ground."*

Some communities use general fund resources to subsidize their water systems:

> *"And we've gotten so far, in recent years to sort of subsidize, like the water utility, for instance, with funds from the general fund, where we have cannabis for instance, a lot of revenue coming in through cannabis sales."*

Political considerations can also lead to municipalities diverging from best practices. Elected officials may be reluctant to approve rate increases due to fears of public backlash, even when such increases are necessary for maintaining system sustainability. This political pressure can hinder the ability of utilities to make proactive adjustments. Two CWS representatives described this challenge. The first sharing:

> *"'Oh, nobody's going to vote for me next election if I raise their rates.' That was their (the Board's) gut reaction to it. (The Board) was in disbelief in what it costs to run the system and provide safe water to the people. There was also the amount of unfunded mandates that we get from the IEPA on the water system. That was the major holdups to it (raising rates)."*

The second added:

> *"It's a delicate balance. And that's an ongoing dialog I have with my Village trustees is they can't afford water increases. Well, as public servants, we have to define a minimum level of service to our constituents. And furthermore, we have to be fiscally responsible to make sure that we're charging rates that will support that minimum level of service. And it's just*

as reckless financially to undercharge as it is to overcharge and waste money."

Another factor contributing to divergence from best practices is limited administrative capacity. Smaller municipalities often lack the staff and technical expertise required to perform complex rate-setting analyses, such as cost-of-service studies or long-term financial planning. In many cases, municipalities rely on a small number of individuals to manage all aspects of the water system, leading to gaps in knowledge and inconsistent application of best practices, as expressed here:

"So, that was based on the death of the previous City Superintendent. So, the Superintendent did all road maintenance, concrete maintenance, even was mowing grass and he was maintaining the water and sewer system. So, when he passed away suddenly…nobody knew how to maintain the system."

4. THE COMPONENTS OF A WATER BILL

Best practices for water billing include (1) conducting regular reviews of effectiveness and accuracy of water billing procedures, (2) providing transparent and detailed bills, (3) establishing a consistent billing schedule, and (4) providing enhanced engagement beyond hard-copy water bills, such as modernized payment options and personalized customer support. Adopting these water billing practices facilitates the maintenance of predictable cash flow, reduces billing errors, and strengthens customer satisfaction.[53]

Interest in the water rate-setting process, and subsequently billing, is growing with rising system revenue needs and increased public awareness of water quality.[54] Generally, water bills continue to act as the primary communication channel between water systems and customers.[55] As municipalities contend with circumstances putting upward pressure on water rates, water bills are increasing.[56] These increases are often essential to address long-deferred water infrastructure maintenance and investments and rising input costs.[57] Communicating these financial needs to the public is key to maintaining their confidence in the system's managerial and financial capacities.

In addition to information about water rate setting and billing being essential for transparency and trust between water providers and customers, it also allows consumers to manage their water use and costs more effectively.[58,59,60] Research studies and AWWA survey data suggest that CWS communication with customers is key for the perception of tap water safety.[61] With new and emerging water contaminants and large water

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[53] Meagan L. Weisner et al., "The Complexities of Trust Between Urban Water Utilities and the Public," *Sustainable Water Resources Management* 6, no. 3 (May 29, 2020), https://doi.org/10.1007/s40899-020-00407-6.

[54] Ahmed Rachid El-Khattabi, Kyra Gmoser-Daskalakis, and Gregory Pierce, "Keep Your Head Above Water: Explaining Disparities in Local Drinking Water Bills," *PLOS Water* 2, no. 12 (December 21, 2023): e0000190, https://doi.org/10.1371/journal.pwat.0000190.

[55] Christine E. Boyle et al., "Mining Water Billing Data to Inform Policy and Communication Strategies," *American Water Works Association* 103, no. 11 (November 1, 2011): 45–58, https://doi.org/10.1002/j.1551-8833.2011.tb11565.x.

[56] Ahmed Rachid El-Khattabi, Kyra Gmoser-Daskalakis, and Gregory Pierce, "Keep Your Head Above Water: Explaining Disparities in Local Drinking Water Bills," PLOS Water 2, no. 12 (December 21, 2023): e0000190, https://doi.org/10.1371/journal.pwat.0000190.

[57] American Society of Civil Engineers, "Drinking Water," ASCE's 2021 Infrastructure Report Card, July 8, 2023, https://infrastructurereportcard.org/cat-item/drinking-water-infrastructure/.

[58] Jessica J. Goddard, Isha Ray, and Carolina Balazs, "How Should Water Affordability Be Measured in the United States? A Critical Review," *Wiley Interdisciplinary Reviews Water* 9, no. 1 (December 16, 2021), https://doi.org/10.1002/wat2.1573.

[59] Manuel P. Teodoro, "Measuring Household Affordability for Water and Sewer Utilities," *American Water Works Association* 110, no. 1 (September 25, 2017): 13–24, https://doi.org/10.5942/jawwa.2018.110.0002.

[60] Christine E. Boyle et al., "Mining Water Billing Data to Inform Policy and Communication Strategies," American Water Works Association 103, no. 11 (November 1, 2011): 45–58, https://doi.org/10.1002/j.1551-8833.2011.tb11565.x.

[61] American Water Works Association. "Tap Water Survey Finds Communication Is Key in Consumer Perception of Safety." *AWWA*, October 5, 2024. https://www.awwa.org/AWWA-Articles/tap-water-survey-finds-communication-is-key-in-consumer-perception-of-safety/.

contamination events garnering attention among the public, an intensified focus on building public trust is warranted. This is especially true since trust and risk perception of consuming drinking water is dynamic and can change over time.

However, due to the decentralized nature of water provision, the effectiveness of communication varies across municipal water bills. In Illinois, the information included in water bills is not regulated, which contributes to wide variation in water bill components and formats. Typically, these bills include the total amount due and the payment deadline, water-specific charges, information about penalties and the bill-correction process, customer identifying information, municipal contact information, and non-water-related charges (see Figure 4.1).

Figure 4.1. Typical Water Bill Components and Sample Bill[62]

Information About Penalties and Bill Correction Process

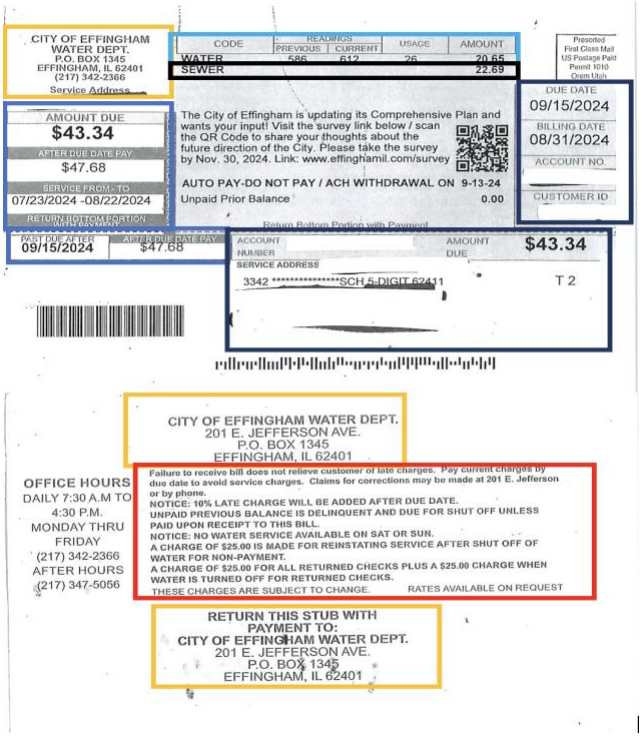
Total Due and Deadline

Name and Address of Municipality

Customer Identifying Information

Water Charges

Non-Water Charges



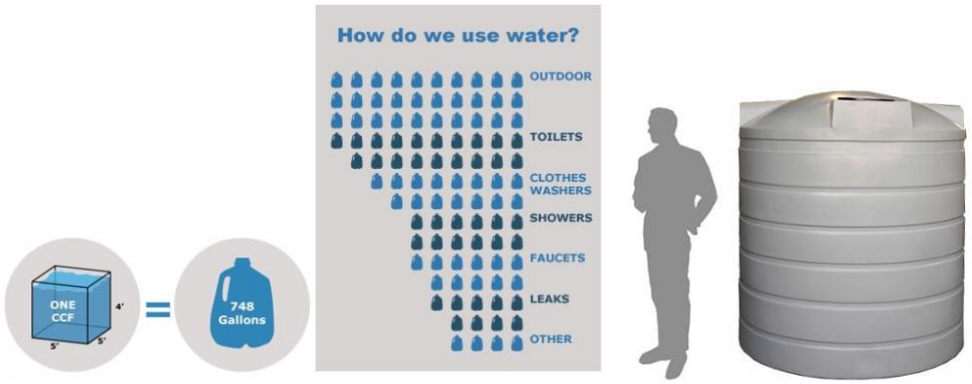
[62] This figure illustrates the typical components contained on a water bill and then uses the same coloring scheme to highlight these elements in an actual sample bill.

In addition to these common components, water bills sometimes include consumption levels, usage trends, rate structure and bill component tabulation, and miscellaneous messaging on topics such as notifications of water rate changes, information on affordability programs, conservation measures, and other community notices.

Consumption Levels

Research suggests that understanding water consumption levels and units is challenging for customers and that grasping how changes in consumption impact water bills is crucial for achieving efficient water use.[63] Therefore, a best practice for billing includes descriptions of the units of measurement for how water bills are calculated. Water usage is mostly measured in 1,000 gallons or 100 cubic feet. Since customers often find it difficult to visualize water units used or understand how water use translates into increased charges on water bills, images are helpful for customers to understand the amount consumed, as depicted in Figure 4.2.

Figure 4.2 Examples of Illustrations Showcasing Units of Water Consumption[64,65]



Usage Trends

Transparency in residential water billing can be enhanced by providing consumers with access to historical usage data, which holds value for both water conservation and understanding bill changes. By comparing current water use with previous billing cycles or with neighbors in the same period, households can track consumption trends and identify areas for conservation, especially if their usage is higher than others. This comparison not only encourages mindful water use but also helps consumers understand shifts in their bills over time, as changes in usage can be directly correlated

[63] Christine E. Boyle et al., "Mining Water Billing Data to Inform Policy and Communication Strategies," American Water Works Association 103, no. 11 (November 1, 2011): 45–58, https://doi.org/10.1002/j.1551-8833.2011.tb11565.x.
[64] US Environmental Protection Agency, "Understanding Your Water Bill," accessed July 12, 2024, https://www.epa.gov/watersense/understanding-your-water-bill.
[65] Duraplas, "R4500 Litre / 1,000 Gallon Upright Rainwater Tank," accessed December 9, 2024, https://www.duraplas.com.au/water-tanks/r4500-litre-1000-gallon-upright-rainwater-tank/.

with billed amounts. This fosters a sense of accountability and trust between consumers and utility providers, promoting more sustainable water habits.

Rate Structure and Bill Tabulation

The water rate structures used to calculate water bills differ significantly by municipality, although there are some common characteristics. On bills, some municipalities will include a rate structure section summarizing how the total amount due for water bills was calculated. The charges are often presented as a combination of fixed fees and variable rates. Figure 4.3 outlines the types of charges that may be reflected on bills.

Figure 4.3. Explanation of Water Rate Structures

Flat Rate Structure — **Households charged the same amount on each water bill**

- **Base Charge** is equivalent to total bill since water bills do not vary depending on water usage.

Volumetric Rate Structure — **Volumetric charge based on water usage**

- **Uniform Volumetric Rate -** A charge based on the volume of water consumed. This uniform usage rate does not change based on amount of water consumed.
- **Variable Volumetric or Block Rate -** A charge based on the per unit of water consumed at various tiers. Tiers are a set charge tied to a range of water consumed by the customer. After the consumer exceeds the upper limit of one tier, the customer will pay the next tier's rate until reaching the maximum tier (consumption level).

Combined Rate Structure — **Combination of volumetric rate and fixed fees**

- **Volumetric Rate -** These charges are the same as in volumetric rate structure and are combined with a base charge that includes fixed fees.
- **Base Charge -** In addition to the minimum usage base charge in the volumetric rate structure, a base charge may also include one or more **fixed fees.** Fixed fees do not vary across residential customers and may include one or more of the following:
  - ***Meter Fee/Tap Fee*** - Charged to recoup the initial costs of connecting households to water and/or wastewater service and any water meter improvements/ replacements.
  - ***Capital Improvement/Debt Service Fee*** - Separate, sometimes temporary fee for funding capital improvement projects or financing loans associated with a capital improvement.
  - ***Administrative/Billing Fee*** - Municipalities recoup administrative costs with billing/ service charges on water bills.

Miscellaneous Fees — **Regardless of rate structure, charges unrelated to water provision are often included in water bills**

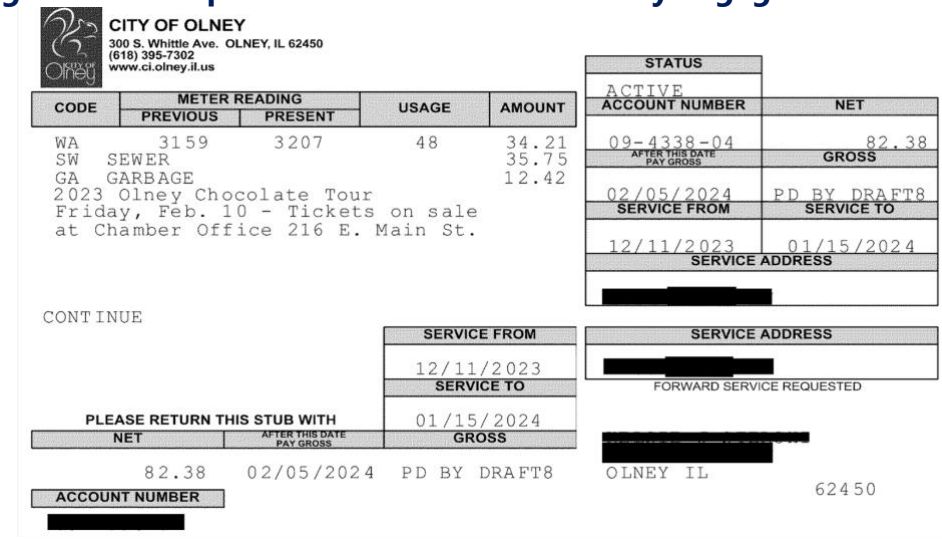
- **Garbage/Refuse Fee:** Municipal garbage/refuse fees are common regardless of whether services are provided by the municipality or contracted.
- **Stormwater Fee:** Charges to cover stormwater services may be included in water bills, typically based on estimates of impervious surfaces.
- **Taxes:** While uncommon, a separate line item for taxes is included in municipal water bills.

Miscellaneous Messaging

Water bills may also include tailored messaging, typically located on the header, back of the bill, or on inserts included in the bill's envelope. These messages not only educate customers but also build awareness and accountability by promoting positive relationships with water providers. These messages inform customers about various topics beyond billing details, including information about rebate programs, promoting water-efficient products, and information about water conservation. They may also explain any changes in water rates, outline conservation requirements or initiatives, advertise employment opportunities, solicit customer feedback, or inform customers about community events related to water provision. Information about water quality and directions for accessing water quality reports may also be featured.

Including these types of tailored messages on water bills offers several benefits, including enhanced communication between utilities and customers by providing a direct and reliable way to share information. For example, explaining rate changes or water quality reports bolsters transparency, helps customers understand the basis of their bills and the necessity of increases where applicable, and increases trust in the safety of their drinking water. Figure 4.4 presents a water bill with a message about an upcoming tour in the community.

Figure 4.4. Sample Water Bill with Community Engagement Message


CITY OF OLNEY
300 S. Whittle Ave. OLNEY, IL 62450
(618) 395-7302
www.ci.olney.il.us

STATUS: ACTIVE

CODE	METER READING PREVIOUS	METER READING PRESENT	USAGE	AMOUNT
WA	3159	3207	48	34.21
SW SEWER				35.75
GA GARBAGE				12.42

2023 Olney Chocolate Tour
Friday, Feb. 10 - Tickets on sale
at Chamber Office 216 E. Main St.

ACCOUNT NUMBER: 09-4338-04
NET: 82.38
AFTER THIS DATE PAY GROSS: 02/05/2024
GROSS: PD BY DRAFT8
SERVICE FROM: 12/11/2023
SERVICE TO: 01/15/2024
SERVICE ADDRESS: [redacted]

CONTINUE

PLEASE RETURN THIS STUB WITH

NET	AFTER THIS DATE PAY GROSS	GROSS	SERVICE FROM	SERVICE TO
82.38	02/05/2024	PD BY DRAFT8	12/11/2023	01/15/2024

ACCOUNT NUMBER: [redacted]

SERVICE ADDRESS: [redacted]
FORWARD SERVICE REQUESTED
[redacted]
OLNEY IL 62450

There are some limitations to relying exclusively on hard-copy water bills. Increasing ease of payment, such as offering an online or automatic payment system, is likely to increase timely payment of bills and reduce costs associated with recouping revenue.[66]

[66] Josses Mugabi et al., "Determinants of Customer Decisions to Pay Utility Water Bills Promptly," *Water Policy* 12, no. 2 (November 9, 2009): 220–36, https://doi.org/10.2166/wp.2009.096.

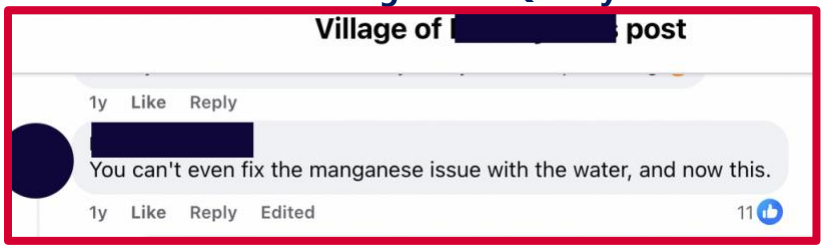
Further, information on water bills is static per billing period and cannot be tailored to individual customers. Many residents may not receive or review a hard-copy water bill and miss critical information, especially if enrolled in an autopay program. Lastly, issuing hard copies of water bills can be costly in terms of calculating bills, printing, mailing, and processing payments. These costs have an outsized impact, especially in low-resourced communities where there are few technical support resources available.

Alternative Communication Methods

Alternatives to using water bills as a communication tool include using municipal websites, social media accounts, and traditional print and broadcast media. Print and broadcast media often provide avenues for messaging related to rate adjustments, water quality, and changes in water system management. Municipal websites allow for comprehensive, customizable information, enabling individual customers to access detailed content, provide feedback, and easily connect with officials. However, like water bills, there are no standard guidelines for website content or layout, resulting in varied quality and accessibility across NCSI where many municipalities do not have a website.

Community water systems also engage with customers via social media, sometimes as the only method of communication with the public. Social media is often important in emergency situations when communications are time-sensitive. Social media also allows suppliers to provide updates on planned maintenance, emergency or water quality advisories, and rate changes, creating a two-way communication channel where customers can raise concerns, share feedback, and ask questions, as illustrated in Figure 4.5[67]. However, prior research shows that except for very large utilities, water suppliers typically do not maintain a consistent, updated social media presence.[68]

Figure 4.5. Illinois Customer Raising Water Quality Concerns on Facebook



Monitoring customer responses on social media can help suppliers identify information gaps, gather feedback, and develop strategies to improve transparency and strengthen customer trust. For instance, Figure 4.6 presents posts from customers seeking

[67] Nelson Mix, Aaron George, and Adam Haas, "Social Media Monitoring for Water Quality Surveillance and Response Systems," *American Water Works Association* 112, no. 8 (August 1, 2020): 44–55, https://doi.org/10.1002/awwa.1555.
[68] Sridhar Vedachalam and Matthew Kirchoff, "Analysis of Water Utility Websites Reveals Missed Opportunities," *American Water Works Association* 112, no. 3 (March 1, 2020): 62–69, https://doi.org/10.1002/awwa.1465.

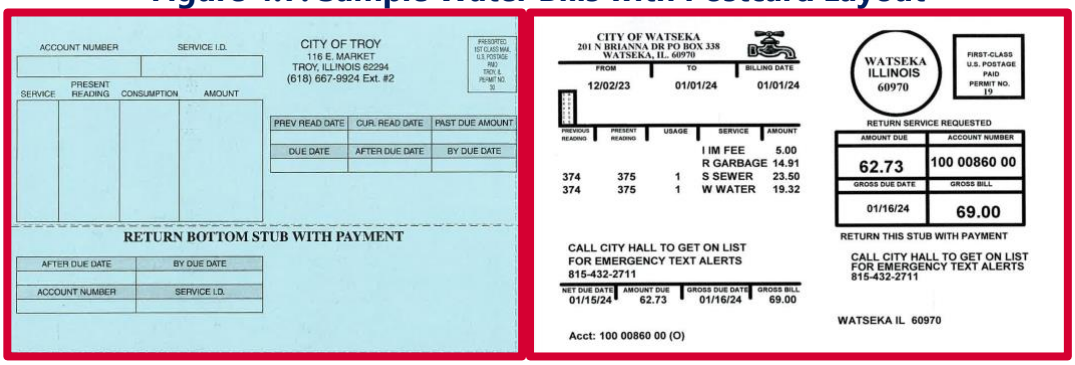
clarification on boil orders, specifically about the lack of notifications, duration, and impacted locations. These examples highlight areas where information dissemination could be improved, highlighting the need for a robust emergency notice dissemination strategy that leverages multiple sources rather than solely relying on social media.

Figure 4.6. Customers Seeking Information About Emergency Notices

Some municipalities use a postcard format to send water bills to residents, primarily for cost-saving purposes (see Figure 4.7). Postcards are cheaper to mail than envelopes and are preferred by small municipalities with limited financial resources. The process of sending postcards is also simpler, eliminating steps such as putting bills in envelopes and then sealing them, which can reduce a municipality's workload and labor costs.

The relatively simple format of postcards also makes the content more intuitive and straightforward. The line items only include essential services like water, sewer, or garbage and only list the current charges, meter readings, and other fees. In addition, these billing postcards typically mention the due date but do not specify overdue penalties or water shutoff dates. Due to their simplified nature, residents are more likely to immediately identify these postcards as water bills and pay them more promptly.

Figure 4.7. Sample Water Bills with Postcard Layout

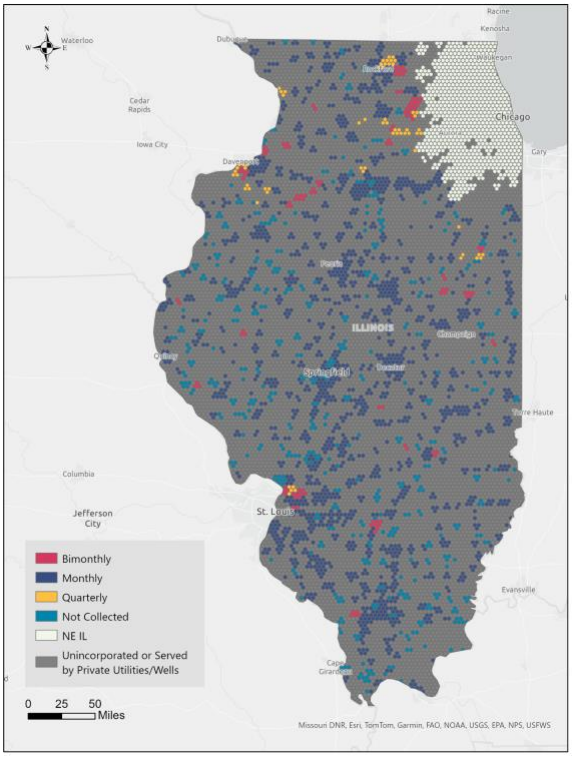


4.1. Quantitative Results

4.1.1. Billing Characteristics

Across NCSI, billing frequency shows little variation: 91% of municipalities bill monthly, about 6% bill every two months, and just over 3% bill quarterly (see Figure 4.8). Best practices recommend using monthly billing, which provides municipalities with steady monthly revenues, promotes regular communication with customers, allows for rate changes to be implemented without delay, and minimizes lost revenue from unpaid bills.[69] For customers, monthly billing allows for increased communication with the water provider and the ability to better manage their household budget as well as monitor their water usage.[70]

Figure 4.8. Billing Frequency[71]



Municipalities with limited staff might prefer less frequent billing as it translates into lower costs. However, households billed quarterly are more likely to consider their water

[69] Environmental Finance Center Network (EFCN), "Designing Water Rate Structures That Support Your Utility's Objectives," July 24, 2017, https://efcnetwork.org/wp-content/uploads/2017/07/DesigningAppropriateRateStructures.pdf.

[70] Stephen Lapp, "Does How Often You Pay for It Matter? The Impacts of Billing Frequency - Environmental Finance Center Network," *Environmental Finance Center Network* (blog), May 11, 2022, https://efcnetwork.org/does-how-often-you-pay-for-it-matter-the-impacts-of-billing-frequency/.

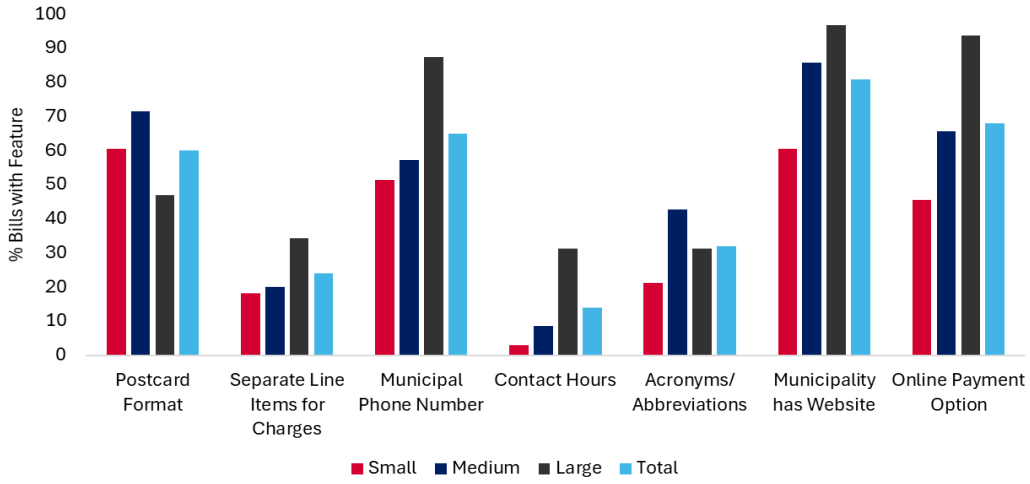
[71] This figure illustrates the distribution of billing frequency across 595 municipalities in NCSI using information from the original dataset produced as part of this Water Rate Setting Study.

bills unfairly high compared to those billed monthly.[72] In NCSI, none of the municipalities billing less frequently (every two months or quarterly) serve more than 50,000 people.

Analyzing water bills from NCSI municipalities illustrates the types of information presented to customers during regular billing cycles. Using the sample of 100 water bills collected, the analysis indicates there are some items included in almost all water bills. Overall, 95 water bills (95%) included a municipal address, provided the usage amount in the billing period, listed the due date, and delineated water and sewer charges as separate line items. Beyond the due date, 88% of water bills specified the date a late fee would be charged. An email address was listed on 94% of water bills.

However, variation in the presentation of water bills is also evident (see Figure 4.9). To examine how bill features vary in NCSI, municipalities were split into three groups based on the size of the population served. Municipalities are designated small if serving 1,000 or fewer residents, medium if serving 1,001-3,300 residents, and large if serving 3,301 or more residents. In the sample of bills collected, 33 municipalities are ranked as small, 35 as medium, and 32 as large.

Figure 4.9. Water Bill Features Across Size of Population Served[73]



With increased service population size, municipalities are more likely to be professionalized, and the billing data reflect this, with larger municipalities often providing additional information on water bills. While 60 municipalities (60%) provide bills in a postcard format, only 47% of the large municipalities rely on this simplified

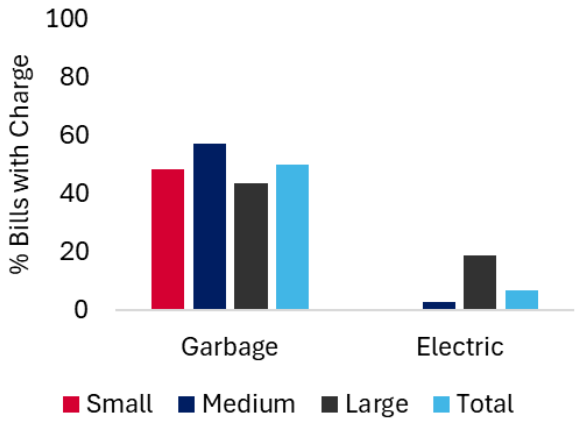
[72] Laura Medwid and Elizabeth A. Mack, "An Analysis of Household Perceptions of Water Costs Across the United States: A Survey Based Approach," *Water* 14, no. 2 (January 15, 2022): 247, https://doi.org/10.3390/w14020247.
[73] This figure illustrates the percentages of collected water bills containing various features among municipal water providers grouped by the size of their population served.

framework. Separate line items for various fixed charges were included for 24 (24%) municipalities overall; however, only 18% of small municipalities have these separate line items, while the percentage rises to 34% for large municipalities. In terms of contact information, 65 (65%) listed a municipal phone number, and 14% listed the contact hours of the municipality overall. Small municipalities provided a phone number on 52% of their bills and provided contact hours on 3% of bills. In comparison, large municipalities included phone numbers and contact hours on 88% and 31% of bills, respectively.

There were additional differences in water bill components that might impact the ease of understanding of water charges. For example, acronyms and jargon that may be difficult for the average customer to understand were found on 32 (32%) of water bills. Interestingly, these were most prevalent in medium-sized water systems at a rate of 43%. Acronyms were typically used for differentiating water and sewer charges, such as "D SEWER F, R PICKUP, S USAGE, W USAGE." While it is beneficial to have separate line items for different charges, some benefits may be lost if customers are unable to understand the acronyms used.

Many municipalities included charges not related to water on their bills, as illustrated in Figure 4.10. Garbage was most common, with 50% of municipalities including this fee, whereas only 7% of municipalities included charges for electricity. Large municipalities were more likely to include electricity charges on water bills at a rate of 19%, while none of the small municipalities did so. Including charges unrelated to water and sewer services may confuse customers and present a barrier to efficient use or budgeting for household water services.

Figure 4.10. Non-Water Fees on Water Bills[74]



[74] This figure illustrates the percentages of collected water bills containing non-water-related charges among municipal water providers grouped by the size of their population served.

4.1.2. Association with Water Rates

Regression analysis of water rates collected for this report (see Table 4.1) revealed that billing policies are statistically significantly associated with monthly water rates. Billing frequency has a notable impact, with more frequent billing associated with higher bills and a monthly billing schedule resulting in the highest standardized water rates (reflecting 5,000 gallons monthly consumption). After controlling for social and demographic characteristics, as well as water system characteristics, bimonthly billing is associated with approximately $8.43 in monthly savings for the average consumer ($p<0.01$), and quarterly or annual billing at approximately $21.69 ($p<0.01$) less than monthly billing. These findings likely reflect the administrative cost savings from less frequent issuing of bills.

Table 4.1. Hierarchical Linear Model Estimates of Water Bill[75]

Water Billing Features	Coefficients	Standard Errors
Billing Frequency: Bimonthly	-8.431***	(3.155)
Billing Frequency: Quarterly/Annually	-21.691***	(4.000)
Water Billing Structure: Flat Rate	-14.985***	(3.606)
Water Billing Structure: Block Rate	-2.792	(1.749)
Sewer Service	-4.159*	(2.300)
Sewer Rates	0.092**	(0.039)

Note: *** $p<0.01$; ** $p<0.05$; * $p<0.10$

Table 4.1 also shows that the rate structure has a similarly strong correlation to water bills, with flat-rate billing associated with an approximately $14.99 reduction per month ($p<0.01$) compared to two-part and volumetric billing. This finding likely reflects the savings from reduced administrative costs and lower meter and maintenance costs.

Providing sewer services in addition to drinking water is negatively correlated with water rates. Municipalities offering sewer services charge approximately $4.16 less on monthly water bills ($p<0.10$), yet the sewer rate itself is positively correlated with water rates ($p<0.05$). A $1 increase in sewer fees is linked to an approximate $0.09 higher water bill. Together, these results suggest that providing both water and sewer services may be associated with economies of scale, as municipalities may save on overlapping operations and infrastructure costs.

4.2 Qualitative Results: Billing Systems

During interviews with NCSI municipal representatives, components of water bills and billing practices were often mentioned alongside issues of administrative capacity and outdated billing systems. For example, some communities do not have the ability to

[75] Full regression results are provided in Appendix A.

conduct automatic billing, which results in overdue bills and the need for staff to contact households frequently to collect payments. One billing clerk shared:

> *"They [customers] sit it [water bill] on their counter, and they probably got a million things on the counter, and they just forget about it. Or another big excuse is, "Well, can you take it out automatically?" And we can't, we don't have the means for that."*

Related to issues of billing is the way in which communities measure water use. In some areas, the communities do not have the staffing capacity or technology to read meters. In communities without meters, customers are often charged a flat rate, and their bills often have no information about water usage. One interviewee shared:

> *"They've discussed meters…Meters, sewers, they've all been a concern. But the board has been–we don't have a big budget and as you can see from your angle, this has not been managed well enough to pay for the upkeep–to pay to meter everybody."*

Another interviewee added:

> *"We don't have meters. It's always been a flat rate bill. And right now, the flat rate is $50.00, which is regardless of any usage or type of business. So, if you are the little local Methodist Church with seven people who come on Sundays, your monthly water bill is $50.00, even though there's really never a time when people are there using it, as it is with a family of five or six kids."*

5. THE DEFINITION OF WATER AFFORDABILITY

Residential water affordability is emerging as an increasingly urgent problem. EPA estimates that between 12.1 million and 19.2 million households in the US lack access to affordable water.[76] Municipal providers set rates according to idiosyncratic factors like water source, infrastructure needs, and debt service requirements. Where infrastructure outlays, water scarcity, or treatment costs are high, water pricing that guarantees a system's sustainability might be difficult to achieve while maintaining affordability. This challenge is particularly acute for small, rural systems, where shrinking and high-poverty populations must support relatively fixed operational and infrastructure costs.[77,78] Since smaller systems do not benefit from economies of scale like larger systems, they are burdened with higher per-capita costs.[79] Yet, water rate setting and affordability for small, rural water service providers remain largely unexplored, with only two prior studies focusing on water systems outside of large metropolitan areas.[80]

In general, although water affordability is a growing concern, there is no universal definition or metric for measuring and comparing affordability across communities.[81,82] However, most measures of affordability depend on a system's customer base.[83,84] The most commonly used affordability threshold sets water bills at no more than 2.5% of a

[76] U.S. Environmental Protection Agency, "Water Affordability Needs Assessment: Report to Congress," December 2024, https://www.epa.gov/system/files/documents/2024-12/water-affordability-needs-assessment.pdf.
[77] Robert S. Raucher, Scott J. Rubin, Douglas Crawford-Brown, and Megan M. Lawson, "Benefit-Cost Analysis for Drinking Water Standards: Efficiency, Equity, and Affordability Considerations in Small Communities," *Journal of Benefit-Cost Analysis* 2, no. 1 (January 3, 2011): 1–24, https://doi.org/10.2202/2152-2812.1004.
[78] Lauryn Spearing, Khalid K. Osman, Kasey M. Faust, and Daniel Erian Armanios, "Systems Vary, Affordability Should Not: Trends of Water Sector Affordability Based on City Attributes," *Construction Research Congress 2022*, November 9, 2020, 627–35, https://doi.org/10.1061/9780784482858.068.
[79] Robert S. Raucher, Scott J. Rubin, Douglas Crawford-Brown, and Megan M. Lawson, "Benefit-Cost Analysis for Drinking Water Standards: Efficiency, Equity, and Affordability Considerations in Small Communities," *Journal of Benefit-Cost Analysis* 2, no. 1 (January 3, 2011): 1–24, https://doi.org/10.2202/2152-2812.1004.
[80] Ahmed Rachid El-Khattabi, Kyra Gmoser-Daskalakis, and Gregory Pierce, "Keep Your Head Above Water: Explaining Disparities in Local Drinking Water Bills," *PLOS Water* 2, no. 12 (December 21, 2023): e0000190, https://doi.org/10.1371/journal.pwat.0000190.
[81] Jessica J. Goddard, Isha Ray, and Carolina Balazs, "How Should Water Affordability Be Measured in the United States? A Critical Review," *Wiley Interdisciplinary Reviews Water* 9, no. 1 (December 16, 2021), https://doi.org/10.1002/wat2.1573.
[82] Thalita Salgado Fagundes, Rui Cunha Marques, and Tadeu Malheiros, "Water Affordability Analysis: A Critical Literature Review," *AQUA - Water Infrastructure Ecosystems and Society* 72, no. 8 (July 31, 2023): 1431–45, https://doi.org/10.2166/aqua.2023.035.
[83] Jessica J. Goddard, Isha Ray, and Carolina Balazs, "How Should Water Affordability Be Measured in the United States? A Critical Review," *Wiley Interdisciplinary Reviews Water* 9, no. 1 (December 16, 2021), https://doi.org/10.1002/wat2.1573.
[84] Ahmed Rachid El-Khattabi, Kyra Gmoser-Daskalakis, and Gregory Pierce, "Keep Your Head Above Water: Explaining Disparities in Local Drinking Water Bills," *PLOS Water* 2, no. 12 (December 21, 2023): e0000190, https://doi.org/10.1371/journal.pwat.0000190.

community's median household income (MHI), a metric initially developed by the EPA for small water systems (<10,000 people served) (see Table 5.1).[85,86]

Table 5.1 Common Household Affordability Metrics

Metric	Equation	Description/Uses
Water Bills as a Share of MHI	$\frac{\text{Total Annual Household Water Charges}}{\textit{Annual Median Household Income}} \times 100$	• Used by EPA to determine if the costs to operate and maintain a small water system (<10,000 people served) leads to unaffordable water, defined as a household drinking water bill in excess of 2.5% of the national MHI.[87]
Water Bill as a Share of Household Income by Quintile	$\frac{\textit{Annual Cost of Household Water Bills}}{\textit{Household Income by Quintile}} \times 100$	• Water bills as a proportion of household income by income quintile group. • The National Association of Clean Water Agencies evaluates projected water bills by income quintile.[88] • Literature suggests use of the Affordability Ratio focusing on the bottom 20th percentile of household earners.[89]
Water Bills as A Percentage of Income for Households with Poverty Status	$\frac{\textit{Annual Cost of Household Water Bills}}{\text{Household Income if<Poverty Level}} \times 100$	• Some metrics evaluate household water bills in proportion to household incomes for those whose income falls at or below the poverty level, or alternatively households with deep poverty (income at or below half of the poverty level).[90]

[85] Robert S. Raucher, Scott J. Rubin, Douglas Crawford-Brown, and Megan M. Lawson, "Benefit-Cost Analysis for Drinking Water Standards: Efficiency, Equity, and Affordability Considerations in Small Communities," *Journal of Benefit-Cost Analysis* 2, no. 1 (January 3, 2011): 1–24, https://doi.org/10.2202/2152-2812.1004.

[86] Ahmed Rachid El-Khattabi, Kyra Gmoser-Daskalakis, and Gregory Pierce, "Keep Your Head Above Water: Explaining Disparities in Local Drinking Water Bills," *PLOS Water* 2, no. 12 (December 21, 2023): e0000190, https://doi.org/10.1371/journal.pwat.0000190.

[87] National Association of Clean Water Agencies, "The Evolving Landscape for Financial Capability Assessment–Clean Water Act Negotiations & the Opportunities of Integrated Planning," *National Association of Clean Water Agencies*, April 2013, https://www.nacwa.org/docs/default-source/news-publications/White-Papers/2013-05-31affordability-whitepaper.pdf?sfvrsn=2.

[88] Ibid.

[89] Manuel P. Teodoro, "Measuring Household Affordability for Water and Sewer Utilities," *American Water Works Association* 110, no. 1 (September 25, 2017): 13–24, https://doi.org/10.5942/jawwa.2018.110.0002.

[90] Daniel Irvin, "Is Percent MHI the Best Way to Measure Affordability?" August 31, 2017. https://efc.web.unc.edu/2017/08/31/percent-mhi-best-way-measure-affordability/.

US Environmental Protection Agency, Office of Water, and Office of Wastewater Management. "Combined Sewer Overflows: Guidance for Financial Capability Assessment and Schedule Development." February 1997. https://www.epa.gov/sites/default/files/2015-10/documents/csofc.pdf. Schneeman, Margaret. "Defining and

Metric	Equation	Description/Uses
Water & Sewer Costs as Hours of Minimum Wage Labor (HM)	$\frac{(\#\ in\ Household) * (Per\ Capita\ Cost\ of\ Water\ \&\ Sewer)}{Hourly\ Minimum\ Wage\ in\ Labor\ Market}$	• Hours of labor earning minimum wage required to pay for basic residential water and sewer use. • Water bills based on basic single-family essential residential water and sewer service for low-income households.
Household Affordability Rate (AR)	$\frac{(\#\ in\ Household) * (Per\ Capita\ Cost\ of\ Water\ \&\ Sewer)}{Household\ Income - Essential\ Household\ Expenses}$	• Measures water and wastewater bills within the context of the overall household expenditures and tradeoffs. • It is a variation on the EPA's National Drinking Water Advisory Council's Household Relative Affordability metric.[91]
Percentage Of Population Who Had Water Shutoff or Lien Placed on Real Estate	$\frac{Liens\ on\ Real\ Estate\ in\ Past\ Year}{\text{Total Population}} \times 100$ $\frac{Water\ Shutoff\ in\ Past\ Year}{\text{Total Population}} \times 100$	• Percentage of households who have had liens on real estate or experienced household water shutoffs, due to non-payment, can be used to understand ability to pay for water.[92]

Alternate metrics include the household affordability rate, which accounts for other essential spending.[93] Research shows that in the event of an increase in monthly water bills by $36 or more, survey respondents reported they would have to cut back spending on essential goods and services such as groceries, doctor visits, and car payments.[94] Affordability measures that examine the water burden for the median or average household have several shortcomings.[95] Thus, Table 5.1 also lists metrics that focus on sub-populations that may be facing affordability issues masked by the more

Measuring Water Affordability: A Literature Review." University of Illinois Extension, accessed January 22, 2023. https://iiseagrant.org/wp-content/uploads/2019/08/DMWA_FINAL.pdf.

[91] National Drinking Water Advisory Committee. "Recommendations of the National Drinking Water Advisory Council to the US EPA on its National Small Systems Affordability Criteria." Accessed May 21, 2023. https://www.epa.gov/sites/default/files/2015-09/documents/recommendations-of-the-ndwac-to-us-epa-on-its-nssa-criteria.pdf

[92] American Water Works Association, "Improving the Evaluation of Household-Level Affordability in SDWA Rulemaking: New Approaches. An Expert Panel Report." April 2021, https://www.asdwa.org/2021/04/16/awwa-publishes-new-affordability-in-sdwa-rulemakings-report/. https://www.awwa.org/Portals/0/AWWA/Government/ImprovingtheEvaluationofHouseholdLevelAffordabilityinSDWARulemakingNewApproaches.pdf.

[93] Laura Medwid and Elizabeth A. Mack, "A Scenario-based Approach for Understanding Changes in Consumer Spending Behavior in Response to Rising Water Bills," *International Regional Science Review* 44, no. 5 (September 3, 2020): 487–514, https://doi.org/10.1177/0160017620942812.

[94] Ibid.

[95] Manuel P. Teodoro, "Measuring Household Affordability for Water and Sewer Utilities," *American Water Works Association* 110, no. 1 (September 25, 2017): 13–24, https://doi.org/10.5942/jawwa.2018.110.0002.

central metrics. Specifically, these targeted metrics of water affordability use income quintiles, focus exclusively on those at or below the poverty rate, or calculate the number of hours one would have to work earning minimum wage to pay a typical bill.

Delinquent water payments are another affordability metric.[96] As water systems pass along higher operations and maintenance costs to customers, subsequent higher delinquency rates and increased shutoffs can impact community trust and public health.[97] An in-depth analysis of eight urban water systems across the US revealed the average unpaid water bill ranged from $200 to almost $2,000, with some cities having consumer debts of over $50,000 in arrears.[98] In another investigation of 12 major US cities, water debt represented over a billion dollars of past-due water bills. Of these cities, Chicago had the highest residential water debt, totaling over $341 million, with 17% of households in arrears.[99] Not only is there variation in water debt and service disconnections across systems, but there are spatial clusters of delinquency in low-resourced neighborhoods.[100] These areas are overlooked when only examining the MHI affordability metric. Thus, gaining a comprehensive understanding of a community's water affordability landscape requires an examination of multiple metrics.

5.1. Quantitative Results

5.1.1. Standardized Water Bill as a Percentage of Household Income

First, using the water rate data the GFRC researchers were able to collect across the NCSI regions and combining it with MHI at the census tract level, Figure 5.1, Panel A, illustrates the share of monthly MHI spent on a standardized water bill. Of the 595 NCSI municipalities, only three have a standardized water bill that exceeds the EPA's 2.5% threshold: Buncombe Village at 2.7%, Cahokia Heights City at 3.5%, and Lawrenceville City at 3.6%. To compare, based on the most recently available 2021 water rate data for the 249 municipalities in the LMSA, only one municipality (Robbins Village) had a standardized water bill that exceeded 2.5% of MHI.

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[96] Jennifer B Skerker, Aniket Verma, Morgan Edwards, Benjamin Rachunok, and Sarah Fletcher, "Alternative Household Water Affordability Metrics Using Water Bill Delinquency Behavior," *Environmental Research Letters* 19, no. 7 (June 10, 2024): 074036, https://doi.org/10.1088/1748-9326/ad5609.

[97] Anisha I. Patel, Christina E. Hecht, Angie Cradock, Marc A. Edwards, and Lorrene D. Ritchie, "Drinking Water in the United States: Implications of Water Safety, Access, and Consumption," *Annual Review of Nutrition* 40, no. 1 (September 23, 2020): 345–73, https://doi.org/10.1146/annurev-nutr-122319-035707.

[98] U.S. Water Alliance, *The Path to Universally Affordable Water Access: Guiding Principles for the Water Sector*, 2023, https://uswateralliance.org/wp-content/uploads/2023/09/The-US-Water-Alliance-The-Path-to-Universally-Affordable-Water-Access%E2%80%94Guiding-Principles-for-the-Water-Sector_0.pdf.

[99] Brett Walton, "Chart: Customer Water Debt Data in 12 U.S. Cities," Circle of Blue, October 15, 2020, https://www.circleofblue.org/2020/world/chart-customer-water-debt-data-in-12-u-s-cities/.

[100] Jennifer B Skerker, Aniket Verma, Morgan Edwards, Benjamin Rachunok, and Sarah Fletcher, "Alternative Household Water Affordability Metrics Using Water Bill Delinquency Behavior," *Environmental Research Letters* 19, no. 7 (June 10, 2024): 074036, https://doi.org/10.1088/1748-9326/ad5609.

Figure 5.1. Standardized Water Bill as a Percentage of Household Income[101]

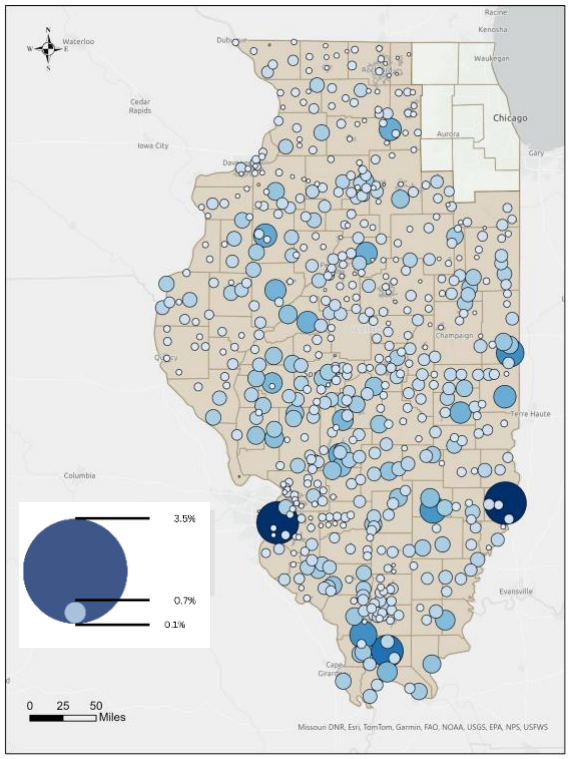
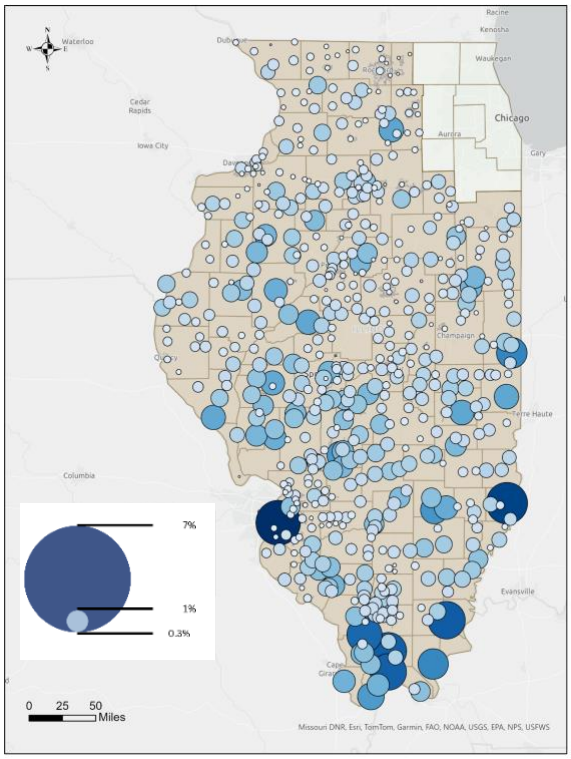
Panel A. MHI	Panel B. Income at 20th Percentile
	

Figure 5.1, Panel B, illustrates the share of monthly household income at the 20th percentile spent on a standardized water bill. Of the same 595 NCSI municipalities, 122 (over 20%) have a standardized water bill above 2.5% of income at the 20th percentile. In the LMSA, over 16% of municipalities (41 of 249 based on 2021 water rate data) had a standardized water bill exceeding 2.5% of household income at the 20th percentile.

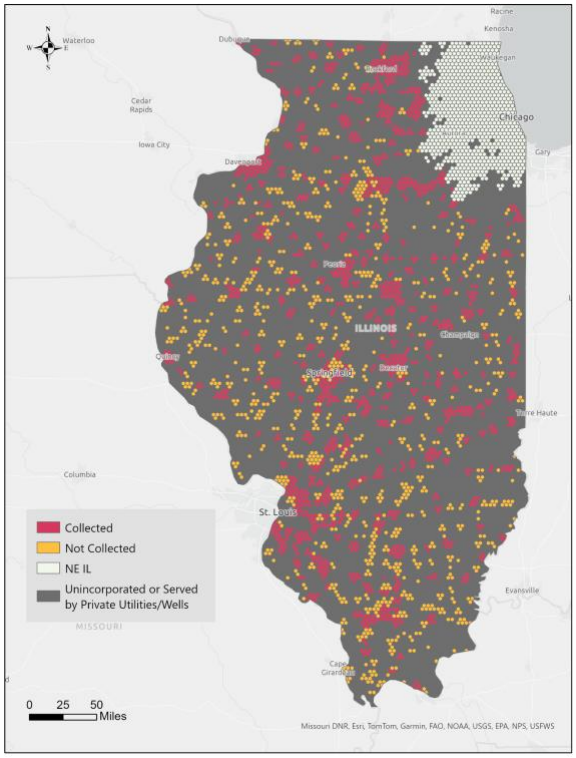
5.1.2. Deposits, Penalties, & Payment Assistance Programs

Next, the GFRC researchers collected and analyzed 365 municipal ordinances to evaluate fees, penalties, and payment assistance plans in NCSI, as these are central to understanding water burdens. While there is a relatively robust literature using municipal ordinances to examine questions related to water conservation and environmental policy, ordinances have rarely been used to investigate water policy

[101] These figures illustrate standardized water bills as a percentage of household income (at the median and 20th percentile) across 595 municipalities in NCSI, using information from the original dataset produced for this Water Rate Setting Study, which includes income information from the 2022 American Community Survey: 5-Year Data (2018-2022, Tracts & Larger Areas).

related to penalties, charges, and enforcement procedures.[102,103] Figure 5.2 illustrates the spatial distribution of ordinances collected.

Figure 5.2. Ordinances Collected[104]



Seeking to prevent at-risk customers from facing undue burdens with water bills, some municipalities offer payment assistance plans to some of their customer base, often in the form of a percentage discount on regular water bills. Eligibility is typically determined by income or age, with many municipalities using crossover eligibility from the Low Income Home Energy Assistance Program (LIHEAP), a separate program that helps eligible low-income households pay for home energy services.[105] Payment assistance plans may sometimes include options for penalty waivers or structured

[102] Rolston St. Hilaire, Michael A. Arnold, Don C. Wilkerson, Dale A. Devitt, Brian H. Hurd, Bruce J. Lesikar, Virginia I. Lohr, Chris A. Martin, Garry V. McDonald, Robert L. Morris, Dennis R. Pittenger, David A. Shaw, and David F. Zoldoske, "Efficient Water Use in Residential Urban Landscapes," *HortScience* 43, no. 7 (December 1, 2008): 2081–92, https://doi.org/10.21273/hortsci.43.7.2081.

[103] Samuel J. Smidt, Diego Aviles, E. Fay Belshe, and Alexander J. Reisinger, "Impacts of Residential Fertilizer Ordinances on Florida Lacustrine Water Quality," *Limnology and Oceanography Letters* 7, no. 6 (August 31, 2022): 475–82, https://doi.org/10.1002/lol2.10279.

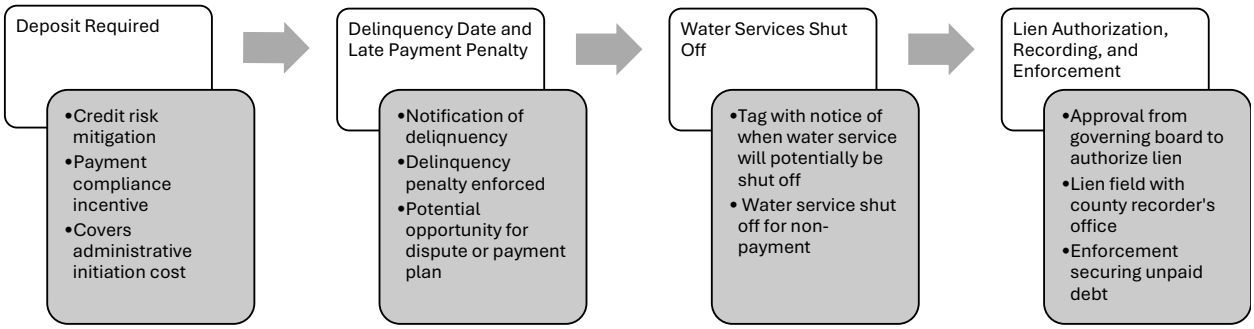
[104] This figure illustrates the spatial distribution of ordinances collected for 365 municipal water providers. These municipalities were chosen to be representative of the 859 municipal water providers in NCSI.

[105] Office of Community Assistance, Illinois Department of Commerce and Economic Opportunity, "Utility Bill Assistance," Illinois Department of Commerce and Economic Opportunity, accessed December 9, 2024, https://dceo.illinois.gov/communityservices/utilitybillassistance.html.

payment plans that make it easier for residents to manage their water expenses without compromising their access to essential services.

The number of municipalities stipulating a process to access payment assistance plans in their ordinances is relatively low (26, representing 7.16% of the ordinances sampled). In the event of overdue or unpaid water bills, there are steps that municipal water providers typically take to recoup the lost revenue. Figure 5.3 provides an overview of the typical process of establishing water service and the process for recouping late or delinquent water bills.

Figure 5.3. Typical Procedures for Non-Payment of Residential Water Bills

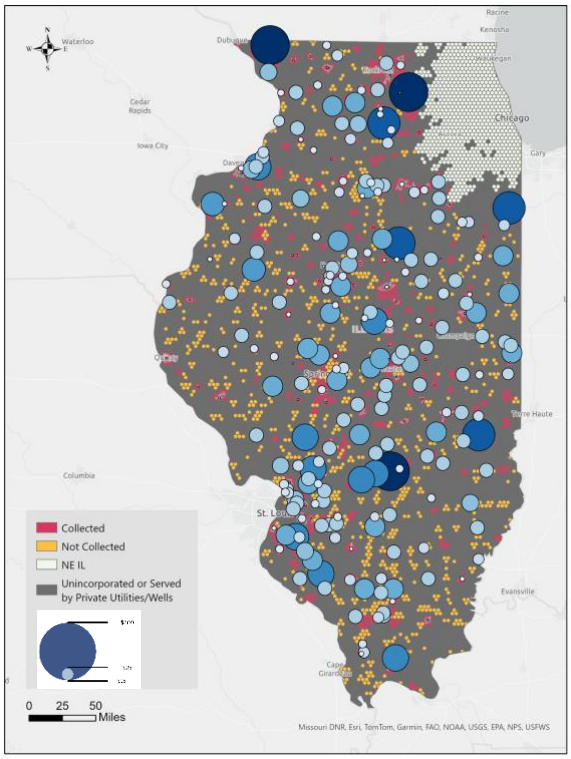
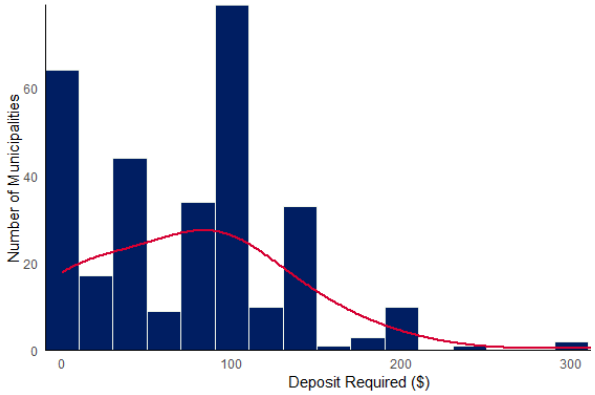


To hedge against the risk of water bill non-payment, water providers often require deposits before service is initiated for new customers. The values of deposits vary across NCSI as these policies are determined at the municipal level. In the LMSA, research found communities with higher percentages of Black or Latino residents had higher deposit requirements for initiating water services and higher reconnection fees after water shut-offs for non-payment.[106]

As deposits are the first charge that new customers face when initiating household water service, they play a crucial role in water access and affordability. They may be used as collateral for late and unpaid bills, reducing CWS' losses as well as acting as an incentive for timely payment by customers. Among the representative sample of NCSI ordinances collected, 308 (84%) mentioned a deposit requirement for initiating water services, with the majority (95%) of municipalities charging the same dollar amount to all customers. However, 15 municipalities (5%) have deposits that vary by specific types of customers, e.g., ones previously delinquent on bills. Required deposit amounts ranged from $15 to $350, with an average deposit value of $76.11 (see Figure 5.4).

[106] Deborah A. Carroll, Kate Albrecht, Laura Medwid, Christelle Khalaf, Jason Michnick, Dan Huang, Brooke Wetmore, and Jun Li, "Water rate setting in the Lake Michigan service area." (Chicago, IL: Government Finance Research Center, 2023.) https://gfrc.uic.edu/research/water-rate-setting-in-the-lake-michigan-service-area/.

Figure 5.4. Deposit Value to Initiate Water Service[107]

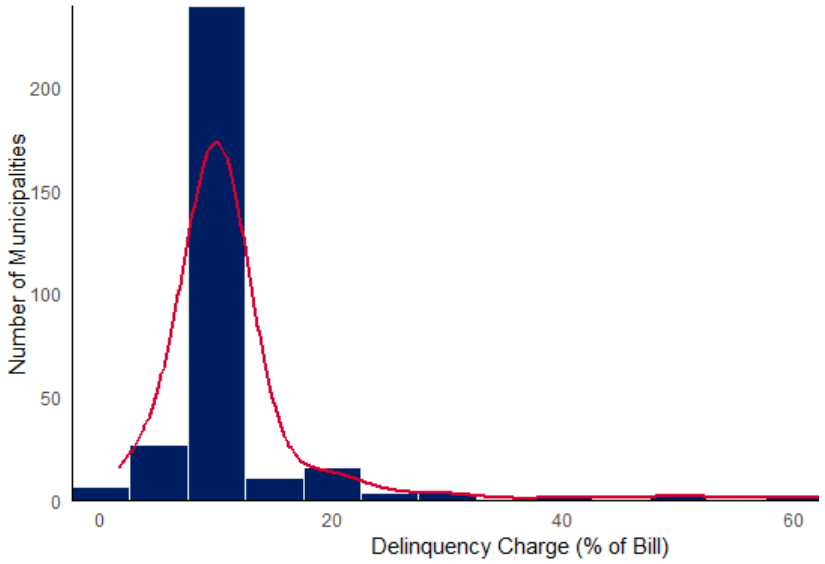
Panel A. Spatial Distribution	Panel B. Regional Aggregates
	

When a resident fails to pay their water bill on time, a municipal water provider typically follows a multi-step process to recoup the unpaid funds. The approach varies across municipalities, but the process often involves issuing a penalty charge once the bill is past due. Some municipalities send a notification of delinquency prior to issuing the penalty charge, which most often is calculated as a percentage of the outstanding bill.

The overwhelming majority of NCSI municipalities for which ordinances were collected (230, representing 79.31% of those with delinquency penalties charged as a percentage of water bills) charge 10% of the outstanding amount (see Figure 5.5). However, in general, these delinquency penalties ranged from 5% to 175% (see Figure 5.5, although outliers above 60% are not shown). Among the 365 ordinances collected, 42 (or 11.5%) listed a dollar-value delinquency penalty rather than a percent of outstanding charges.

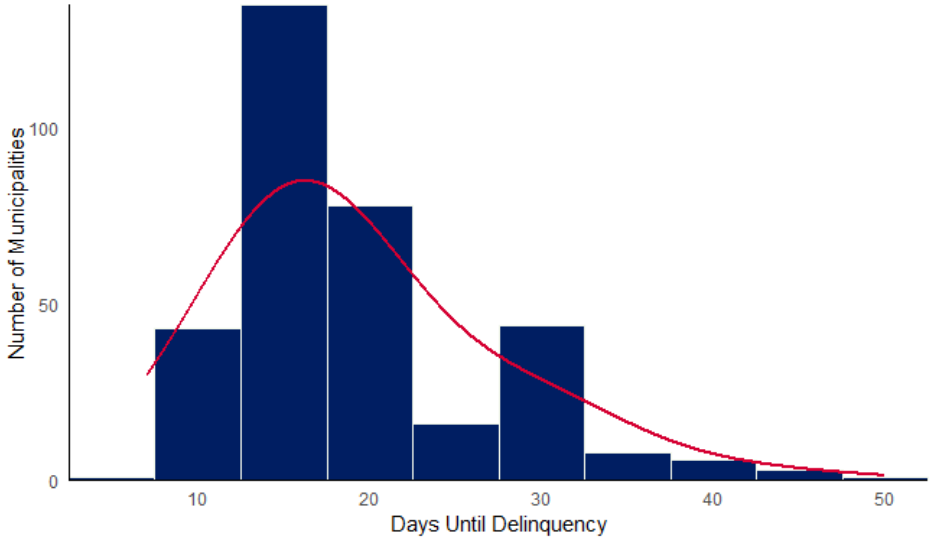
[107] This figure illustrates deposit values for 257 municipalities that include this information in their ordinances. Among the sample of 365 ordinances collected, which are representative of the 859 municipal water providers in NCSI, 108 did not include information about deposit values.

Figure 5.5. Delinquency Penalty as Percentage of Bill[108]



The time frame before residential water bills are due also varies by municipality (see Figure 5.6). Generally, a shorter time to pay bills is considered a stricter policy than ones with a longer payment duration. On average, NCSI customers have approximately 19 days until a penalty is applied to their account. However, this ranges from 7 to 50 days to pay their bills before they are considered delinquent. A deadline for bill payment was not stipulated for 30 municipalities, representing 8% of ordinances analyzed.

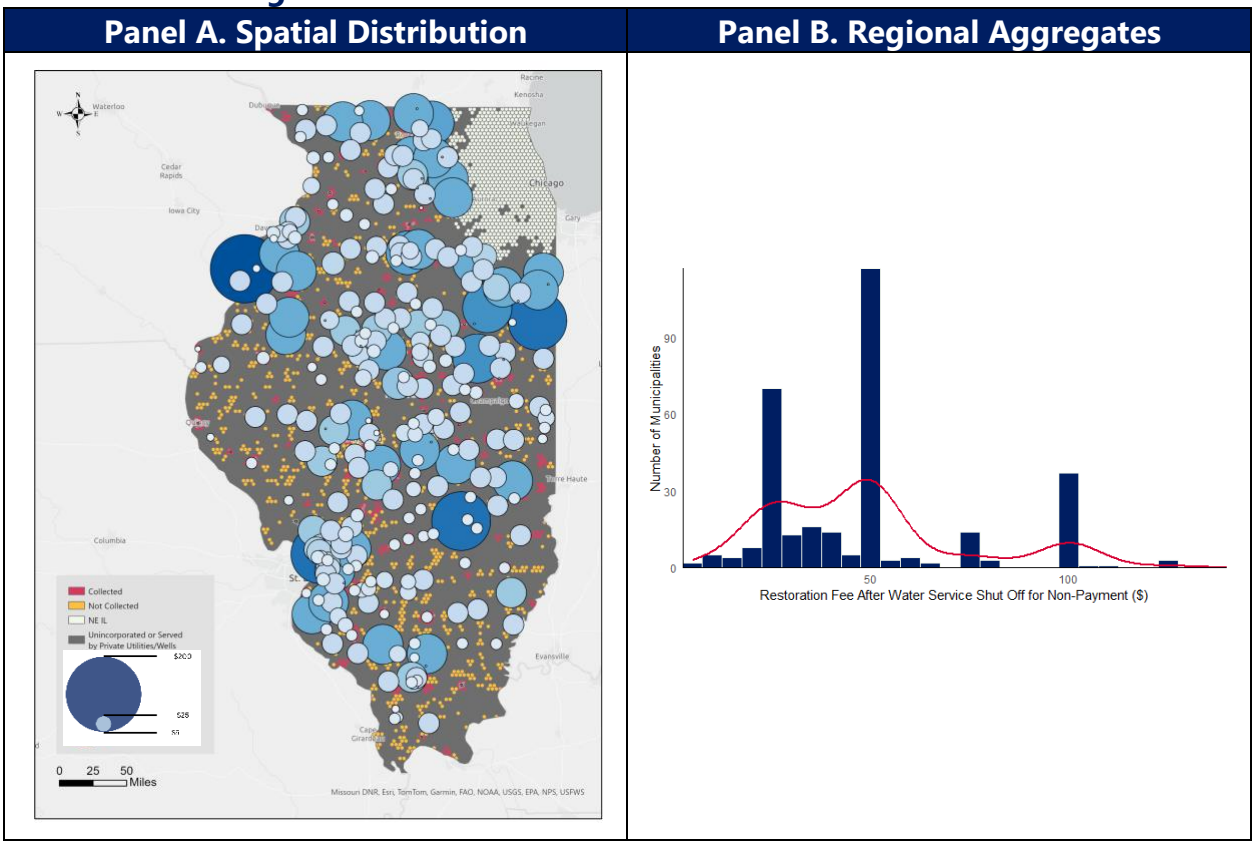
Figure 5.6. Days Until Customer is Considered Delinquent[109]



[108] This figure illustrates the delinquency penalty as a percentage of the standardized water bill for the sample of 365 ordinances collected, which were chosen to be representative of the 859 municipal water providers in NCSI.
[109] This figure illustrates the distribution of billing frequency across 595 municipal water providers in NCSI, using information from the original dataset produced as part of this Water Rate Setting Study.

If a property owner fails to pay their water bills after the final delinquency notice, several CWS across the region offer the opportunity to resolve this debt in the form of a repayment plan. Notably, some municipalities offer informal repayment plans on a case-by-case basis for delinquent customers. Among the 365 ordinances collected, 325 (89.04%) listed a fee for restoration of services after shutoff. These ranged from $10 to $90 (see Figure 5.7).

Figure 5.7. Restoration of Services Fee After Shutoff[110]



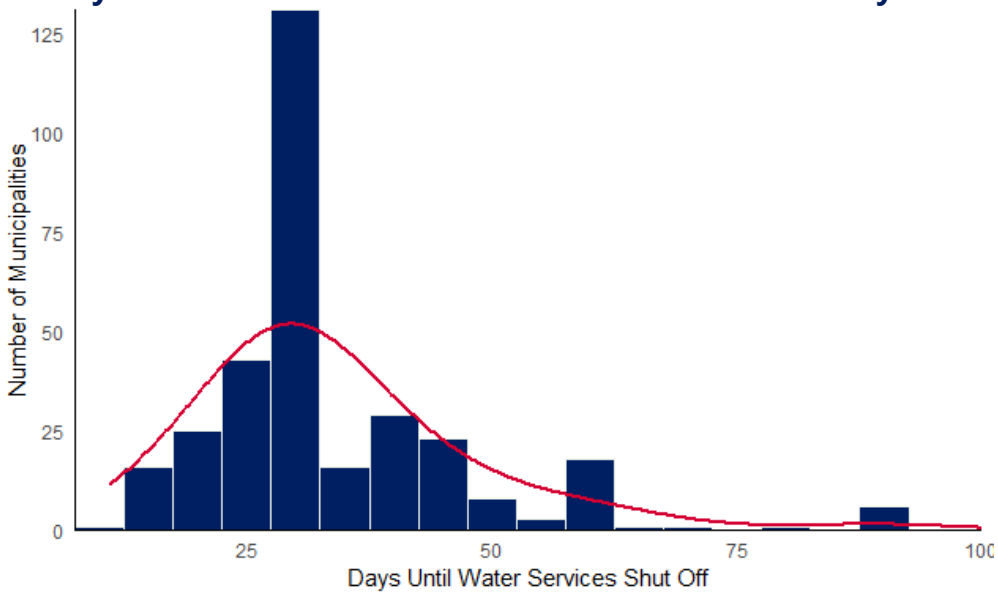
The charges associated with disconnecting or reconnecting water services can exacerbate the financial strain on households already struggling to pay for water bills. Reconnection fees add a layer of penalty that can deter timely payment, creating a cycle of debt and service disruption. Reducing or regulating these fees could play a role in improving water affordability and ensuring that households are not kept from accessing water due to transient financial difficulties.

[110] This figure illustrates the geographic distribution and regional aggregates of restoration of service fees after shutoff for 326 municipalities that include this information in their ordinances. Among the 365 ordinances collected, 39 did not include information about deposit value.

In the absence of a payment plan or payment of charges in full, a municipality may subsequently be authorized to disconnect (shut off) water services until all outstanding fees, and often a reconnection fee, are paid. A total of 34 US states imposed moratoria on water shut-offs between March and May 2020, which significantly lowered the daily COVID-19 infection and death rates.[111] In Illinois, the State has mandates for private utilities related to shut-offs and procedural transparency, but does not impose a uniform rule for municipally owned utilities.

In fact, private utilities regulated by the Illinois Commerce Commission (ICC) must provide a separate written notice to customers before discontinuing water service for nonpayment. This notice cannot be included with a bill and must be delivered at least 5 days before service discontinuation or mailed at least 8 days in advance.[112] However, municipal utilities set their own individual policies. As such, shut-off procedures were a common item included in municipal ordinances, with 320 (87.67%) municipalities stipulating the number of days after a bill is issued that water services may legally be suspended. These numbers ranged from 11 to 105 days (see Figure 5.8).

Figure 5.8. Days After Bill Issued Services Are Shut-Off for Non-Payment[113]

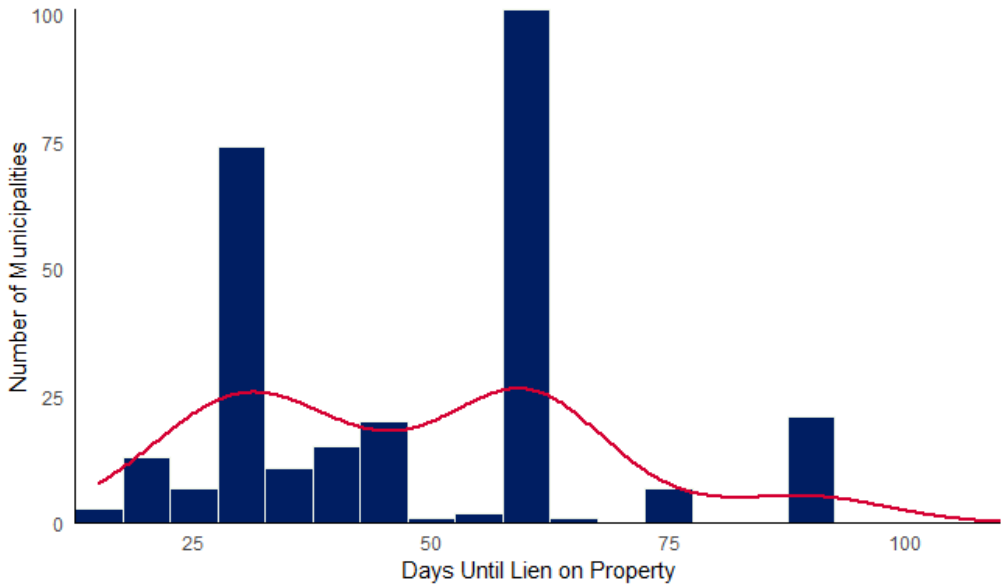


Most municipalities (279 or 76.44%) include language about issuing a lien on real estate for homeowners with outstanding water bill balances (see Figure 5.9). In issuing a lien, a municipality may claim the property and block the owner from selling or refinancing it

[111] National Library of Medicine, "PMC COVID-19 Collection," accessed September 17, 2024, https://pmc.ncbi.nlm.nih.gov/about/covid-19/.
[112] Illinois Public Utilities Act, 220 ILCS 5/8-306.
[113] This figure illustrates the frequency distribution of the number of days after a bill is issued when services may be shut off for non-payment for 320 municipalities that include this information in their ordinances.

without first resolving the debt. This lien typically has priority over other debts, meaning that a water lien must be paid before other debts. Some municipalities allow for the disconnection of water services and a property lien to be issued at the same time.

Figure 5.9. Days After Bill Issued That Liens are Established on Property[114]



5.1.3. Compounding Effects of Barriers to Affordable Water

Regression analysis using data from the sample of municipal ordinances collected revealed that the poverty rate is positively and significantly associated with deposit value (see Table 5.2). For each percentage point increase in the share of municipal residents in poverty, the average deposit amount increases by approximately $1.27 ($p<0.10$). This finding suggests that utilities hedge against the risk of non-payment for water bills higher through higher deposit requirements.

Table 5.2 indicates that higher water and sewer bills are associated with a shorter duration to pay before the initiation of property lien procedures. For every $10 water and sewer bill increase, customers have approximately one less day to pay before lien procedures may be initiated. Taken together, these trends represent a compounding effect: higher poverty rates are coupled with higher deposits and higher bills with stricter payment schedules. This observed dynamic increases the barrier to clean and affordable tap water for residents.

[114] This figure illustrates the frequency distribution of the number of days after a bill is issued that liens may be placed on the delinquent homeowner's property for 279 municipalities that include this information in their ordinances.

Table 5.2. Model Estimates of Barriers to Affordable Water[115]

Variables	Deposit Value	Days to Delinquency	Days to Shut Off	Days to Lien
% Poverty	1.268* (0.675)			
Water + Sewer Bill ($/Month)	0.171 (0.116)	-0.009 (0.015)	-0.029 (0.029)	-0.082** (0.042)
Deposit Value ($)		-0.015** (0.007)		0.028 (0.019)
Dispute Procedures			-3.834** (1.662)	-1.195 (2.491)
Restoration of Service Fee ($)		0.01 (0.014)		-0.104*** (0.039)
Bimonthly Billing		-0.032 (1.625)	1.952 (3.142)	-3.661 (4.577)
Quarterly/Annual Billing		3.826* (2.091)	0.309 (4.123)	2.247 (6.494)

Note: *** p<0.01; ** p<0.05; * p<0.10; Coefficients are reported with standard errors in parentheses.

A similar compounding trend exists for residents who are required to pay a higher deposit value while also having fewer days to pay their water bills before delinquency, as Table 5.2 shows the deposit value is negatively correlated with the number of days until delinquency ($p<0.05$). This indicates that municipalities mitigating financial risk may use multiple approaches to recoup billing revenue efficiently.

Similarly, municipalities that include procedures to dispute or correct water bills provide a shorter window for payment before shut-offs may occur, by approximately 4 days ($p<0.05$). This finding is consistent with those for the LMSA region and confirms that a greater degree of procedural transparency is often paired with more stringent penalty procedures.

Compared to monthly billing, quarterly/annual billing schedules were weakly positively correlated with a longer period before delinquency ($p<0.1$) of approximately 4 days. As quarterly bills are larger payments, customers might be granted a higher number of days allotted to pay. Furthermore, municipalities using quarterly billing save on administrative costs related to bill issuance and collection, potentially allowing for greater flexibility in revenue collection timelines.

[115] The full regression results are provided in the Appendix.

5.2 Qualitative Results: Affordability Definitions

The concept of affordability in the context of water services varies significantly across municipalities in Illinois. In general, municipal representatives across NCSI noted that system operations had to be considered alongside consumers' ability to pay:

> *"But the long and the short of it is that we think affordability means that I can take care of business while maintaining rates that are highly competitive or cheaper than the communities around us and deliver a better service without fear of having rate jumps as a result."*

Another interviewee added:

> *"We set them as low as possible and still keep the system maintained. It does not run at a profit a lot of years. The rates are as affordable as we can make them."*

While there is no universally accepted definition of water affordability, many municipalities emphasize benchmarking against other communities' rates as a guiding principle. Representatives shared how benchmarking was a key aspect of rate setting:

> *"I basically brought in every surrounding towns' rates for both water and sewer, what we know about what they also pay for water and sewer and also their ordinances surrounding what they charge…I get once a year or once every other year, a report from an engineering firm. So, I go through that, and I look at what are the other towns using for their water rates and what does that include? And then I'm a member of the [local] County Mayor's Association. And we share information on salaries and water rates and anything and everything so that we're all sort of comparing with each other how do we compare with another town."*

Another municipal representative added:

> *"The municipality regularly reviews other communities' water rates (per unit), to gauge range, however the community's rate is consistently lower than the surrounding areas."*

Although many municipalities do not have a clear definition of water affordability, most pointed out that they try to minimize the burden for customers regarding water bills. Often, municipalities choose to slowly raise rates if an increase is needed:

> *"We have high property taxes here, so we're always conscious of not trying to cost our residents out of being able to live. So, we'll do everything we can to not raise your water and sewer and garbage rates, basically."*

6. ECONOMICALLY DISADVANTAGED COMMUNITIES

Disadvantaged communities across the United States face greater insecurity in access to safe and affordable drinking water, specifically low-income, Black, and Indigenous populations, as they experience higher rates of water shut-offs, among other disparities. Table 6.1 lists some of the common definitions of disadvantaged communities that are relevant to household water insecurity. One of these definitions is a designation by the Department of Housing and Urban Development (HUD) as a qualified census tract (QCT). QCTs are areas where at least 50% of households have incomes below 60% of the Area Median Gross Income (AMGI) or have a poverty rate of 25% or higher.[116]

EPA and IEPA leverage these definitions of disadvantaged communities to efficiently target aid related to public water provision. In 2022, the EPA released a reference guide with metrics to assist states in establishing their own definitions of disadvantaged community (DAC), largely focusing on Median Household Income (MHI).[117] To illustrate, in some states, MHI is used as a threshold percentage relative to the overall state's MHI, such that communities with an MHI of 80% or below the statewide MHI are considered a DAC. According to IEPA, a DAC is defined as, "A public water supply owned by a local government unit or not-for-profit water corporation that qualifies for either the Small Community Rate or Hardship Rate."[118] Though this is the current general use definition in Illinois, the definitions of DACs are fluid as they are often tailored to various funding program goals.

Disadvantaged community definitions determining access to loans and grants are critical to addressing the challenges that municipal water systems face. Illinois has the greatest number of local governments among all US states, which exacerbates challenges for disadvantaged communities that must independently generate sufficient revenue to fund water operations. In fact, while public utilities operate on a not-for-profit basis, setting water rates sufficiently high is a critical aspect of water system governance.[119] This is driven by the need to ensure that the system's operations and maintenance (O&M), capital needs, and environmental costs are fully covered.

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[116] US Department of Housing and Urban Development's Office of Policy Development and Research (PD&R), "Qualified Census Tracts and Difficult Development Areas," HUD User, accessed December 9, 2024, https://www.huduser.gov/portal/datasets/qct.html.

[117] US Department of Housing and Urban Development's Office of Policy Development and Research (PD&R), "Qualified Census Tracts and Difficult Development Areas," HUD User, accessed December 9, 2024, https://www.huduser.gov/portal/datasets/qct.html.

[118] Illinois Environmental Protection Agency, Bureau of Water, and Infrastructure Financial Assistance, "Public Water Supply Loan Program 2023 Intended Use Plan," July 6, 2022, https://epa.illinois.gov/content/dam/soi/en/web/epa/topics/grants-loans/state-revolving-fund/documents/final-illinois-pwslp-fy2023-iup.pdf.

[119] Antonio Massarutto, "Water Pricing and Full Cost Recovery of Water Services: Economic Incentive or Instrument of Public Finance?," *Water Policy* 9, no. 6 (September 27, 2007): 591–613, https://doi.org/10.2166/wp.2007.024.

Table 6.1. Common Disadvantaged Community Definitions

Agency	Definition/Guidance	Description of Financial Aid (if applicable)
US Housing and Urban Development	**Qualified Census Tracts** are defined as areas where at least 50% of households have incomes below 60% of the Area Median Gross Income (AMGI) or have a poverty rate of 25% or higher.	Used to target federal resources for use in housing and community development programs such as tax credits and grants.
US Department of Agriculture	**The Social Vulnerability Index (SVI)**, originally produced by the Centers for Disease Control and Prevention (CDC), it identifies vulnerable counties based on factors such as poverty, unemployment, housing burden, and minority status, helping direct resources to communities most in need.[120]	Used by the United States Department of Agriculture (USDA) to target Rural Development loans.
US EPA	The service area of a public water system that meets affordability criteria established after public review and comment by the State in which the public water system is located.	Included in the Intended Use Plan, required for states to receive federal funding for low-interest state revolving funds.
Illinois EPA	The **Small Community Rate** definition applies to system service area population<25,000 AND one of the following: • Median income of service area less than state average • Unemployment rate higher than state average • Annual user charge, based on average monthly bill, greater than 1% of MHI of service area The **Hardship Rate** definition applies to population<10,000 AND one of the following: • Median income below 70% of statewide MHI • Unemployment at least 3% higher than state • Annual user charge, based on average monthly bill, greater than 1.5% of MHI	Both definitions qualify a water system for either principal forgiveness on a loan, or a subsidized interest rate.

Ongoing debate questions whether system costs should be funded through water bills amid decreasing water demand and increasing infrastructure replacement needs.[121,122]

[120] US Department of Agriculture, "Rural Investments in Socially Vulnerable Communities," USDA – Rural Development, December 8, 2024, https://www.rd.usda.gov/rural-data-gateway/rural-investments/social-vulnerable-communities.

[121] Robert Enouy, Rashid Rehan, Neil Brisley, and Andre Unger, "An Implicit Model for Water Rate Setting Within Municipal Utilities," *American Water Works Association* 107, no. 9 (May 14, 2015), https://doi.org/10.5942/jawwa.2015.107.0122.

[122] Bernard Barraqué, "Full Cost Recovery of Water Services and the 3 T's of OECD," *Utilities Policy* 62 (November 13, 2019): 100981, https://doi.org/10.1016/j.jup.2019.100981.

The full cost recovery mandate disproportionately poses challenges for smaller systems and disadvantaged communities.[123] Smaller, rural communities, which are overrepresented in NCSI, face a range of challenges, including longer-deferred investment in infrastructure, lack of economies of scale in service provision, urbanization leading to shrinking customer bases, and customers with lower incomes.[124]

Notably, a shortage of research on infrastructure quality across small, disadvantaged communities limits understanding of infrastructure needs and how it impacts water rate setting.[125] Further, national standards and recommendations for water provision mostly focus on large, urban municipalities. Nonetheless, there are indications that rural systems struggle disproportionately to keep up with infrastructure maintenance and replacement costs. For example, water systems that provide household water services to rural, low-income communities have consistently higher health-based violations than larger, more professionalized systems.[126] Disadvantaged communities tend to also face barriers in acquiring water-saving technologies, such as lacking access to water conservation equipment, which is estimated to roughly double customers' water bills.[127]

6.1. Quantitative Results

6.1.1. Water Rates and State Revolving Funds

Given that public water systems must account for variations in income levels among their customer bases, Figure 6.1 illustrates the fitted regression lines for the relationship between MHI and standardized monthly water bills in NCSI. Among the 595 municipalities for which the GFRC researchers were able to collect water rates, there is no statistically significant association between MHI and monthly bills, even when examining DAC and non-DAC municipalities separately. These findings are similar to those for the LMSA.[128]

Figure 6.2 illustrates the relationship between base charges and the volume of water included within this base charge, suggesting that as the water amount included in the

[123] Antonio Massarutto, "Water Pricing and Full Cost Recovery of Water Services: Economic Incentive or Instrument of Public Finance?," Water Policy 9, no. 6 (September 27, 2007): 591–613, https://doi.org/10.2166/wp.2007.024.
[124] Katie Meehan et al., "Exposing the Myths of Household Water Insecurity in the Global North: A Critical Review," *Wiley Interdisciplinary Reviews Water* 7, no. 6 (October 4, 2020), https://doi.org/10.1002/wat2.1486.
[125] Kiely McFarlane, and Leila M. Harris, "Small Systems, Big Challenges: Review of Small Drinking Water System Governance," *Environmental Reviews* 26, no. 4 (October 9, 2018): 378–95, https://doi.org/10.1139/er-2018-0033.
[126] Senne Michielssen, Matthew C. Vedrin, and Seth D. Guikema, "Trends in Microbiological Drinking Water Quality Violations Across the United States," *Environmental Science Water Research & Technology* 6, no. 11 (January 1, 2020): 3091–3105, https://doi.org/10.1039/d0ew00710b.
[127] Bernard Barraqué, "Full Cost Recovery of Water Services and the 3 T's of OECD," *Utilities Policy* 62 (November 13, 2019): 100981, https://doi.org/10.1016/j.jup.2019.100981.
[128] Deborah A. Carroll, Kate Albrecht, Laura Medwid, Christelle Khalaf, Jason Michnick, Dan Huang, Brooke Wetmore, and Jun Li, "Water rate setting in the Lake Michigan service area." (Chicago, IL: Government Finance Research Center, 2023.) https://gfrc.uic.edu/research/water-rate-setting-in-the-lake-michigan-service-area/.

base charge increases, so does the base charge. This pattern applies to municipalities containing QCTs (designated as DACs) and those without QCTs, with no significant distinction between the two. In general, examining standardized water bills and their components disguises the fiscal disparities of DACs, as the median standardized bill for non-DAC communities is $46 compared to $41 for DAC communities.

Figure 6.1. Fitted Regression for Median Household Income & Water Bill[129]

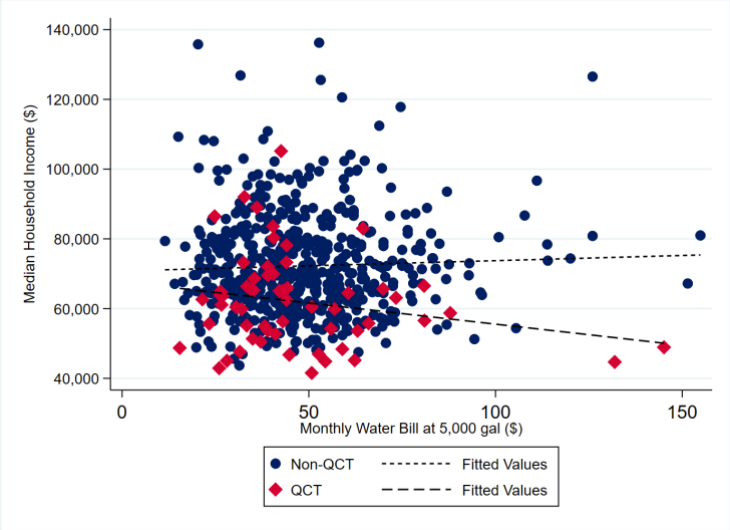
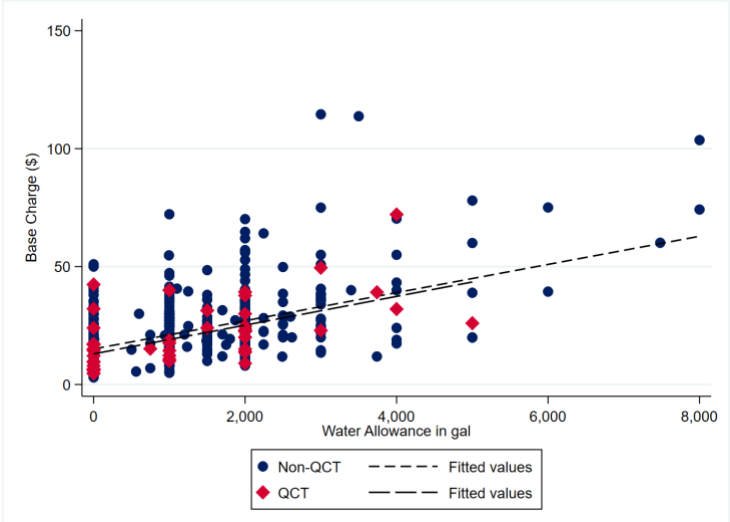


Figure 6.2. Fitted Regression for Base Charge and Water Allowance[130]



[129] This figure illustrates the relationship between MHI and standardized water bills for 60 municipalities with QCTs and 535 without. The figure uses information collected for 595 NCSI municipalities included in the original dataset produced for this Water Rate Setting Study.

[130] This figure illustrates the relationship between base charge and related water allowance for 51 municipalities with QCTs and 503 without. These 554 municipalities use a two-part rate structure. The figure uses information collected for 595 NCSI municipalities in the original dataset produced as part of this Water Rate Setting Study.

The US Department of Agriculture (USDA)'s Water & Waste Disposal Loan & Grant Program in Illinois offers a grant and revolving fund program. The grant program funds improvements to drinking water, sewage, solid waste, and stormwater systems in eligible rural areas, including for local governments with populations of 10,000 or less. The low-interest loans administered through the revolving fund program may be used for construction, infrastructure outlays, land acquisition, and legal or engineering fees.[131,132]

Similar to the USDA's Loan and Grant programs, the IEPA also offers low-interest loans for water infrastructure projects across Illinois. Funded projects include new infrastructure construction, infrastructure upgrades, stormwater management, and initiatives dedicated to water conservation.[133] Figure 6.3 illustrates the differences in communities that receive funds through these two programs.

Figure 6.3. IEPA SRF Funds & USDA Rural Development Grants & Loans 2012-2022

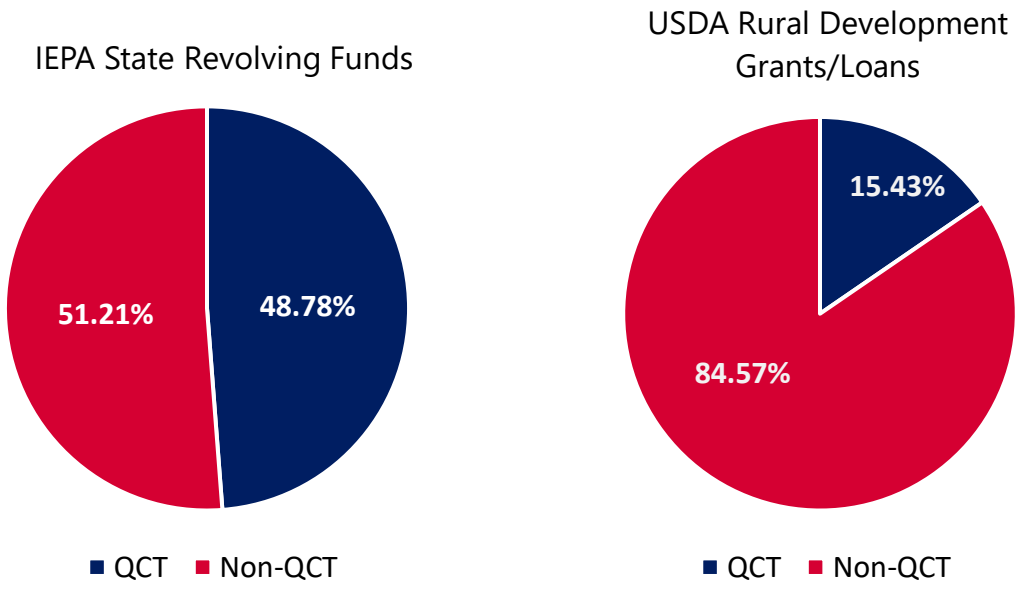


Figure 6.3 shows that, in the NCSI regions, almost half of the IEPA's SRF funding distributed from 2012 to 2022 was received by DAC communities, defined as containing

[131] US Department of Agriculture. "Rural Decentralized Water Systems Grant Program." Rural Development. Accessed December 9, 2024. https://www.rd.usda.gov/programs-services/water-environmental-programs/rural-decentralized-water-systems-grant-program.
[132] US Department of Agriculture. "Revolving Funds for Financing Water and Wastewater Projects." Rural Development. Accessed December 9, 2024. https://www.rd.usda.gov/programs-services/water-environmental-programs/revolving-funds-financing-water-and-wastewater-projects.
[133] Illinois Environmental Protection Agency. "State Revolving Fund." Accessed December 9, 2024. https://epa.illinois.gov/topics/grants-loans/state-revolving-fund.html.

one or more QCTs. This distribution is likely due to the IEPA's emphasis on providing loans, principal forgiveness, and subsidized interest rates to municipalities based on them meeting criteria related to hardship or small communities. By contrast, the USDA rural development grants and loans are less targeted towards DAC communities, with only 15.43% of funds distributed to NCSI municipalities containing QCTs.

Despite nearly half of all IEPA SRF funds being distributed to municipalities containing QCTs, Figure 6.4 shows that those receiving funds during this time period are relatively similar to those that did not. The percentages of residents in poverty, Black or Latino, college-educated, and elderly are similar across the two groups of municipalities.

Figure 6.4. Demographics Across Municipalities by IEPA SRF Recipient Status

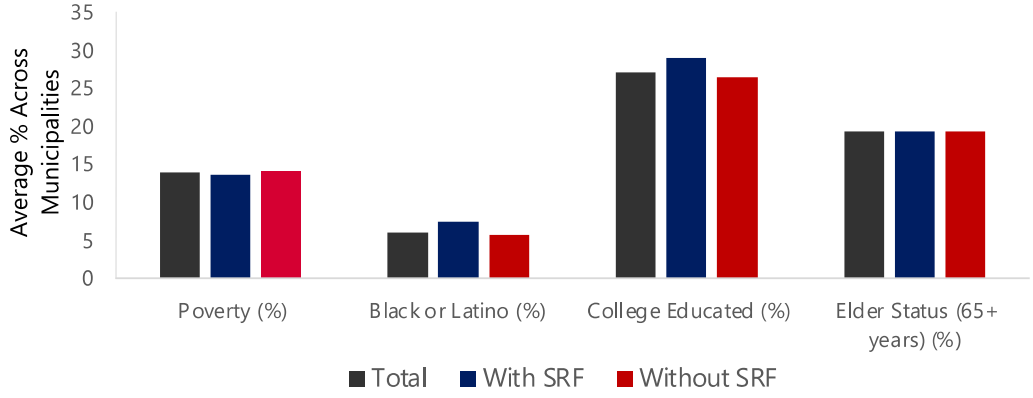
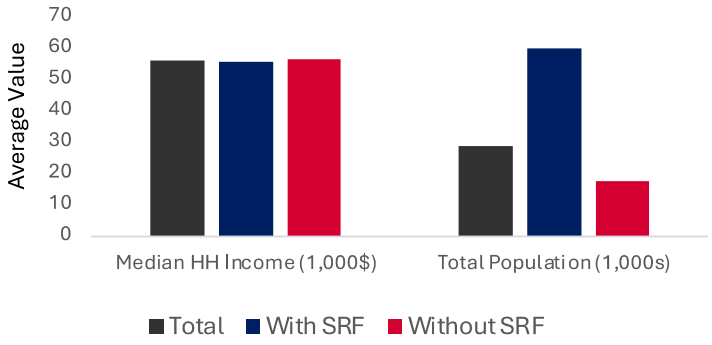


Figure 6.5 illustrates the differences in median household income and population size between municipalities with and without SRF funding from IEPA between 2012 and 2022. Though income is relatively similar across the two groups, it is evident that larger municipalities are more likely to receive IEPA SRF funding, likely due to greater capacity to overcome the administrative burden of SRF loan applications.

Figure 6.5. Population and Income Characteristics Across Municipalities by IEPA SRF Recipient Status



6.1.2. Association with Other Barriers to Water Affordability

Beyond MHI and access to funds, shut-off rates have been highlighted in news articles, academic literature, and government reports as a proxy for the inability to pay for household water services and subsequently identifying disadvantaged communities.[134] Though smaller water systems are often overlooked in research, one recent study evaluated water penalty policy in central Illinois during the peak of the Covid-19 pandemic.[135] The authors used municipal ordinances and survey data to understand how the severity of penalties due to nonpayment, as well as water affordability programs, are distributed across racial and otherwise vulnerable communities. The study found that populations with higher proportions of racial and ethnic minorities are served by municipalities with more lenient penalty policies, however the authors concluded that this finding likely reflects differences in racial and ethnic diversity, with urban areas served by private utilities (e.g., Champaign-Urbana, Peoria) being more diverse than the predominantly white rural areas of central Illinois.

Table 6.2. Regression Estimates of Community Characteristics[136]

	Standardized Water Bill	Deposit Value	Days to Delinquency	Days to Shut Off	Days to Lien
% Poverty		1.268* (0.675)			
MHI ($10,000)	-0.190 (0.531)	0.868 (3.481)	-0.024 (0.352)	0.546 (0.68)	0.129 (0.983)
% Black or Latino	-0.216** (0.084)	-0.712 (0.458)	0.056 (0.058)	0.237* (0.109)	0.053 (0.16)
% College Educated		-0.545 (0.413)	0.059 (0.051)	0.161 (0.098)	0.103 (0.145)
% Elderly Status (65+ years)		0.047 (0.75)	-0.215** (0.088)	0.100 (0.176)	0.491* (0.253)

Note: *** p<0.01; ** p<0.05; * p<0.10; Coefficients are reported with standard errors in parentheses.

Building on this prior research, Table 6.2 presents the results of several regression analyses of the association between several community characteristics and water policies using the data operationalized from ordinances collected for this study. The results indicate some population characteristics are associated with water payment and penalty policies. Specifically, the percentage of households in poverty has a significant positive correlation with deposit value, with a one percentage point increase in poverty

[134] Mildred E. Warner, Marcela González Rivas, Mary Grant, and Xue Zhang, "Water Shutoff Moratoria in the United States: The Role of Cities and States," in *Public Water and Covid-19: Dark Clouds and Silver Linings*, Chapter 5 (ISBN/ISSN, 2021), https://www.tni.org/files/public-water-covid-19_chapter_5.pdf.

[135] Melissa Heil, Rebekah Bollin, and Luke Gallagher, "Water Disconnection and Billing Policy in Central Illinois," *Faculty Publications--Geography, Geology, and the Environment*, no. 54 (2022), https://ir.library.illinoisstate.edu/fpgeo/54.

[136] The full regression results are provided in the Appendix.

associated with a $1.27 higher deposit amount required to initiate service ($p<0.10$). This result suggests that utilities in areas with higher poverty may require larger deposits, potentially as a precaution against non-payment. However, MHI was not statistically related to deposit values, suggesting deposit requirement amounts may be established based on the risk of non-payment by the lowest income-earning households rather than the overall wealth of the community served.

In Table 6.2, elderly status is negatively correlated with days until delinquency. A ten-percentage point increase in residents with elderly status is associated with a shorter payment window by 2 days. This finding is consistent with the central Illinois study, where customers with elderly status were slightly more likely to face stricter water policy penalties during the peak of the Covid-19 pandemic.[137] Notably, the shortened timeframe for paying bills may put elderly Illinois residents at additional risk of facing late payment penalties since elderly residents are disproportionately on fixed income and at risk of incurring debt for basic necessities.[138]

In evaluating water policy, it is important to note that the autonomy afforded to local water providers suggests that decisions regarding rates, penalties, and assistance programs can vary widely, affecting the uniformity and fairness of enforcing policies and procedures outlined in ordinances. In fact, evidence shows low-income households are as much as five times as likely as non-low-income households to experience disconnection of utility services for non-payment.[139] These patterns are likely to exist in water access and affordability as well.

6.2 Qualitative Results: Structural Constraints

Across the NCSI regions, small and rural communities can encounter significant challenges in setting affordable water rates that would also bring in revenue sufficient to support operations and maintenance of their systems. These challenges stem from specific community characteristics and socioeconomic patterns, lack of administrative and technical capacity, lower economies of scale in service provision, and fewer opportunities for intergovernmental cooperation, as one interviewee explained:

> *"Our village has a population of [about 100]. We have 85 water accounts, residential and business combined. Every $425 spent each month costs each of our customers $5 a month. It is for this reason we have had to raise our*

[137] Melissa Heil, Rebekah Bollin, and Luke Gallagher, "Water Disconnection and Billing Policy in Central Illinois," *Faculty Publications--Geography, Geology, and the Environment*, no. 54 (2022), https://ir.library.illinoisstate.edu/fpgeo/54.
[138] Deanne Loonin, and Elizabeth Renuart, "The Life and Debt Cycle: The Growing Debt Burdens of Older Consumers and Related Policy Recommendations," *Harvard Journal on Legislation* 44, no. 1 (December 2007): 167–203.
[139] Gary Wolff, "Water Rates: Water Affordability and the California Water Crisis," *Pacific Institute*, January 2013, https://pacinst.org/wp-content/uploads/2013/01/water-rates-affordability.pdf.

rates by 275%...I do not believe the State of Illinois and specifically, the EPA, understands the challenges we face in a small community."

Another interviewee added:

"Our community is very small with a lot of retired residents. The majority has to drive at least thirty miles for gainful employment. Our average income is [at] poverty [level] and below. Right now these challenges are not being handled well."

Disadvantaged communities face numerous challenges in the rate-setting process that go beyond simply having a small population. One significant challenge is the lack of administrative and technical capacity within smaller, rural water systems, which are prevalent across NCSI. One interviewee stated that complying with the rules and inspections is a burden to their small system, sharing that:

"We, like all water systems, are now wading through the lead supply line action that the state is mandating. Our system is new enough that we have never had any lead lines in town, but just complying with the rules and inspections is a burden on our small system, as we don't have a full-time employee, and must rely on a third party to handle the paperwork and interaction with the state."

Some communities discussed specific limitations, like geography or tax base, which limit their options to engage with other communities in ways that could benefit from economies of scale. When asked if their community might benefit from connecting or working with others, some municipal representatives shared:

"In terms of the production and distribution, I think each community is just so unique and so remote from each other that there's just never been any discussion of sharing or working together."

Another interviewee added:

"If we were to grow to a place where we needed to change things up, maybe we could cooperate with the larger community, but just like every other community, we'd have trouble buying land…no farmer is going to sell us land near their house in order to establish a new treatment plant."
"We're in the country…But our closest town near is probably five miles away…It's very, very small. And then the next bigger one that I think does have metered water is like 12, 14 miles away. So, that would probably be so expensive to go back and forth with that."

For some communities, the landscape can also be a limitation to expansion and the ability to add customers to support costs, as expressed here:

> *"We're surrounded by water on three sides, our community is. There's a swamp on the south side, a swamp or swampy bottom land on the west side and then there's a creek and water runoff on the north side. So, we really don't have the ability to expand much farther than beyond our borders unless we jump those creeks."*

7. THE ROLE OF FEDERAL, STATE, & LOCAL POLICIES

Municipal water providers exercise significant autonomy in setting water rates and tailoring their policies to meet the financial needs and priorities of their system. However, federal and state policies play a crucial role in shaping water provision and pricing, exerting both direct and indirect influence. Federal policies related to water provision are largely geared towards ensuring quality standards for drinking water, such as the Clean Water Act (CWA) of 1972 and the Safe Drinking Water Act (SDWA) of 1974. The federal government also allocates funding for low-cost State Revolving Funds (SRFs) to aid in financing infrastructure improvement and replacement initiatives. Federal funding was temporarily available for the Low-Income Household Affordability Program (LIHWAP), a residential water affordability program in response to the Covid-19 pandemic.

Federal Policies

The CWA was established to restore and maintain the integrity of US waters and allocated $65 billion in federal grants between 1972 and 2016.[140] It regulates pollutant discharges, supports wastewater treatment facilities, and manages stormwater. A subsequent piece of legislation, the SDWA, protects public water supplies by setting drinking water quality standards, establishing treatment requirements, and funding infrastructure projects. Since the 1980s, however, federal funding for water infrastructure has stagnated, largely due to a 1987 amendment to the CWA that shifted infrastructure financing from federal grants to the State Revolving Fund (SRF) program. The CWA and SDWA remain the cornerstone pieces of federal legislation governing water quality, with new and emerging contaminants frequently added to regulatory standards. For example, national drinking water standards for per-and polyfluoroalkyl substances (PFAS) were recently established as these chemicals are associated with a range of negative health and developmental effects.[141] This regulation requires water systems to adopt advanced technologies and processes to comply with stricter standards, likely impacting rate structures to cover these new compliance costs.[142] Lead service lines (LSLs) are also emerging as a significant concern nationally, especially in Illinois with the second-highest number of LSLs in the nation at an estimated 1,043,294.[143]

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[140] Claudia Copeland, "Water Quality: Implementing the Clean Water Act," University of Nebraska-Lincoln, 2006, https://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1035&context=crsdocs.

[141] US Environmental Protection Agency, "Key EPA Actions to Address PFAS," accessed November 17, 2024, https://www.epa.gov/pfas/key-epa-actions-address-pfas.

[142] Sudesh Yadav, Ibrar Ibrar, Raed A. Al-Juboori, Lovdeep Singh, Namuun Ganbat, Tayma Kazwini, Elika Karbassiyazdi, Akshaya K. Samal, Senthilmurugan Subbiah, and Ali Altaee "Updated Review on Emerging Technologies for PFAS Contaminated Water Treatment," *Process Safety and Environmental Protection* 182 (April 12, 2022): 667–700, https://doi.org/10.1016/j.cherd.2022.04.009.

[143] US Environmental Protection Agency, "Drinking Water Infrastructure Needs Survey and Assessment," report, *EPA's Drinking Water Infrastructure Needs Survey and Assessment (DWINSA)*, 2023, https://www.epa.gov/system/files/documents/2023-04/Final_DWINSA%20Public%20Factsheet%204.4.23.pdf.

To help manage the costs of infrastructure improvement related to EPA water standards, programs such as the Water Infrastructure Finance and Innovation Act (WIFIA) and the SRF provide financial assistance to local utilities. SRF consists of two primary loan programs offering low-interest rates to local governments and other public and private entities for infrastructure projects. The Water Pollution Control Loan Program (WPCLP) aims to finance projects addressing wastewater and stormwater, while the Drinking Water State Revolving Fund (DWSRF) is designed to fund initiatives related to drinking water.[144]

The DWSRF directly influences how local utilities structure their rates, often requiring that utilities demonstrate sound fiscal health, such as ensuring rates are sufficient to cover the cost of sustaining water operations. Consequently, utilities seeking these funds may be required to adjust their rate structures, potentially leading to higher costs for consumers.

The federal government also allocated $15 billion to replace lead service lines across the United States, with the EPA managing and distributing these funds to states through the Public Water System Loan Program (PWSLP).[145] To apply for an IEPA SRF loan, municipalities must submit a comprehensive list of documents that often require technical expertise in engineering, finance, and law. If water utility staff lack the capacity to meet these requirements, municipalities need to hire third-party contractors to demonstrate need and project readiness, which often acts as a large up-front expense and barrier to accessing the funds.[146]

State and Local Policies

The state of Illinois works in close partnership with federal agencies to enforce compliance with federal standards and regulations such as the CWA and SDWA. Specifically, IEPA manages and administers federal programs like SRF and distributes federal funds, such as the ones from the lead service replacement program. For example, the IEPA directed a $4 million loan to the city of Rockford in which 960 lead water pipes were identified for replacement.[147]

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[144] Illinois Environmental Protection Agency, "State Revolving Fund," accessed November 17, 2024. https://epa.illinois.gov/topics/grants-loans/state-revolving-fund.html.

[145] US Environmental Protection Agency, "Biden-Harris Administration Announces $3 Billion for Lead Pipe Replacement to Advance Safe Drinking Water as Part of Investing in America Agenda," May 2, 2024, https://www.epa.gov/newsreleases/biden-harris-administration-announces-3-billion-lead-pipe-replacement-advance-safe.

[146] Deborah A. Carroll, Kate Albrecht, Laura Medwid, Christelle Khalaf, Jason Michnick, Dan Huang, Brooke Wetmore, and Jun Li, "Water rate setting in the Lake Michigan service area." (Chicago, IL: Government Finance Research Center, 2023.) https://gfrc.uic.edu/research/water-rate-setting-in-the-lake-michigan-service-area/.

[147] John Clark, "Rockford to replace lead service pipes to homes, at no cost," MyStateline.com, August 19, 2024, https://www.mystateline.com/news/local-news/rockford-to-replace-lead-service-pipes-to-homes-at-no-cost/.

When water infrastructure failures occur, boil orders are required to notify at-risk residents in accordance with IEPA regulations.[148] Typically, these events are the result of water main breaks and other system malfunctions.[149] As such, researchers have incorporated boil order notices as indicators of water infrastructure performance.[150] Data on boil orders can provide valuable insights into the condition of water infrastructure over time and across regions. However, there is no statewide publicly accessible boil order dataset in Illinois, limiting the feasibility of such analyses. Though the State plays a crucial role in funding, compliance enforcement, and program administration, municipalities retain significant autonomy in notifying customers of system failures and potential health hazards.

Municipal utilities often maintain reserve funds and manage their own debt levels. While some utilities adopt a pay-as-you-go approach, which avoids debt by funding operations through rates or other current revenues, others incur debt by borrowing or issuing bonds that will be repaid over time. The choice between these financing strategies can impact water rates significantly. Utilities with high levels of debt might need to increase rates to ensure adequate service coverage ratios, which are often required by bond covenants.[151]

Managing water losses due to leaks, theft, or metering inaccuracies further complicates the rate-setting process. Municipalities that do not source water from Lake Michigan—like those in NCSI—are not required to track or limit non-revenue water losses. Similarly, there are no statewide policies governing water shut-offs by municipal providers. Instead, these policies are determined at the municipal level but may be guided by state recommendations and general consumer protection standards. In comparison, investor-owned utilities (IOUs), privately owned companies that provide water services in Illinois (e.g., Illinois American Water or Aqua Illinois), are regulated by the Illinois Commerce Commission (ICC). The ICC maintains oversight and regulatory authority over IOU's water rate increases, service quality, and other operational factors.[152]

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[148] Illinois Environmental Protection Agency, *Sample Collector's Handbook –Boil Orders*, Chapter 15, 2012, https://epa.illinois.gov/content/dam/soi/en/web/epa/documents/compliance-enforcement/drinking-water/sample-collectors-handbook/ch-15-boil-orders.pdf.

[149] Sara Moghaddam-Ghadimi, Audrey Tam, Usman T. Khan, and Stephanie L. Gora, "How Might Climate Change Impact Water Safety and Boil Water Advisories in Canada?," *FACETS* 8 (January 1, 2023): 1–21, https://doi.org/10.1139/facets-2022-0223.

[150] Mike Benson, Katy Haralampides, and Anna Robak, "Investigating Disparities in Public Infrastructure Performance: A Case Study of Drinking Water Sites in New Brunswick," in *Lecture Notes in Civil Engineering* (2024), 75–88, https://doi.org/10.1007/978-3-031-61515-3_7.

[151] Robert A. Greer, "A Review of Public Water Infrastructure Financing in the United States," *Wiley Interdisciplinary Reviews Water* 7, no. 5 (August 28, 2020), https://doi.org/10.1002/wat2.1472.

[152] Illinois Commerce Commission, "Citizens' Guide to the Illinois Commerce Commission," *Illinois Commerce Commission* (2022), https://icc.illinois.gov/api/web-management/documents/downloads/public/Citizens%20Guide%20to%20ICC.pdf.

7.1 Quantitative Results

7.1.1. Boil Orders

Using the boil order notices dataset discussed in Section 2.2, over a 15-month period, municipal water operators in NCSI reported a total of 943 boil orders to the IEPA or IEMA, averaging 62.87 orders per month. Table 7.1 presents a summary of boil order counts for issuing municipalities categorized by their population size served.

Table 7.1. Boil Orders Reported to IEPA/IEMA[153]

Population	Number of Municipalities With at Least One Boil Order	Total Boil Orders Reported	Average Orders per Municipality
<= 500	32	57	2
<= 1,000	42	70	2
<= 3,300	61	147	2
<= 10,000	36	180	5
> 10,000	22	489	22
	193	**943**	**4.891**

Compared to the number of boil order notices reported to IEPA and IEMA, identifying boil orders issued through the public data scraping process revealed a substantial level of reporting non-compliance, indicating that reported notices offer only a partial view of the actual frequency of boil orders in the region. Of the 250 municipalities sampled, 38% had at least one boil order posted online, despite none of the municipalities reporting orders to the IEPA/IEMA during the time period. In total, 446 boil orders were identified across 96 municipalities through the data scraping process. Table 7.2 summarizes these additional orders for municipalities categorized by their population size served.

Table 7.2. Boil Orders Publicly Scraped[154]

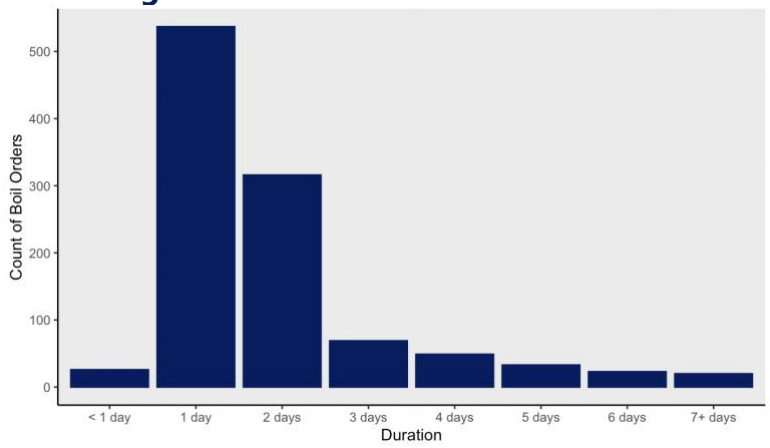
Population	Number of Municipalities With at Least One Boil Order	Total Boil Orders Reported	Average Orders per Municipality
<= 500	14	31	2.214
<= 1,000	21	50	2.381
<= 3,300	32	64	2.000
<= 10,000	18	65	3.611
> 10,000	11	236	21.455
	96	**446**	**4.646**

[153] The population groupings are based on the POP_CAT_11_CODE variable in the SDWA dataset from the US Environmental Protection Agency (2024). SDWA Data Download Summary and Data Element Dictionary. https://echo.epa.gov/tools/data-downloads/sdwa-download-summary.

[154] The population groupings are based on the POP_CAT_11_CODE variable in the SDWA dataset from the US Environmental Protection Agency (2024). SDWA Data Download Summary and Data Element Dictionary. https://echo.epa.gov/tools/data-downloads/sdwa-download-summary.

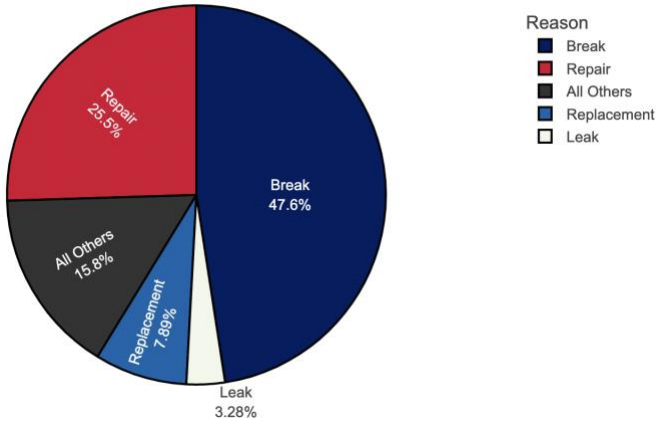
Analysis of boil orders focused on understanding both the reasons underlying the orders and their duration. As illustrated in Figure 7.1, most boil orders were relatively short, lasting primarily 1 or 2 days, with an average of 2 days. However, there were notable exceptions to this trend: 20 boil orders extended beyond a week, indicating more prolonged or complex issues in those cases. These extended durations may reflect situations where underlying causes required more substantial investigation or repair, such as contamination or infrastructure challenges, necessitating extended precautions.

Figure 7.1. Duration of Boil Orders[155]



For boil orders specifying an underlying reason, a "break" in the water distribution system is the leading cause (47.6%), followed by repair (25.5%), as shown in Figure 7.2. Most breaks, 89.5%, are water main breaks.

Figure 7.2. Reasons for Boil Orders[156]



[155] This figure illustrates the frequency distribution of boil order notices in NCSI from April 1, 2023, to July 1, 2024, by their duration measured in the number of days.

[156] This figure illustrates the proportions of boil order notices in NCSI from April 1, 2023, to July 1, 2024, by their underlying causes when available. A significant proportion of the boil orders recorded (37.5%) do not contain accompanying information on reasons triggering the orders.

Table 7.3 presents the sample distribution of the public scraping process, broken down by population served, along with the numbers and percentages of municipalities in each category where at least one boil order was identified. At least one boil order was identified for 20% of municipal utilities serving populations of 500 or fewer. The percentages of municipal utilities with at least one boil order notice increase consistently as the size of the population served increases, culminating in 52.3% of utilities serving populations over 10,000 having at least one system malfunction requiring a boil order.

This trend may reflect differences in communication practices and infrastructure capacities for sharing notices online, or it may simply indicate a greater frequency of boil orders in larger utilities. As discussed in Section 4, smaller municipalities are less likely to maintain active websites and social media, suggesting that these differences are likely influenced by communication limitations rather than actual boil order frequency.

Table 7.3. Municipalities Included in Scraping for Publicly Posted Boil Orders[157]

Population	Number of Municipalities Sampled	Number With At Least One Boil Order	Percentage With At Least One Boil Order
<= 500	70	14	20.0%
<= 1,000	57	21	36.8%
<= 3,300	67	32	47.8%
<= 10,000	35	18	51.4%
> 10,000	21	11	52.3%
	300	**96**	**38.4%**

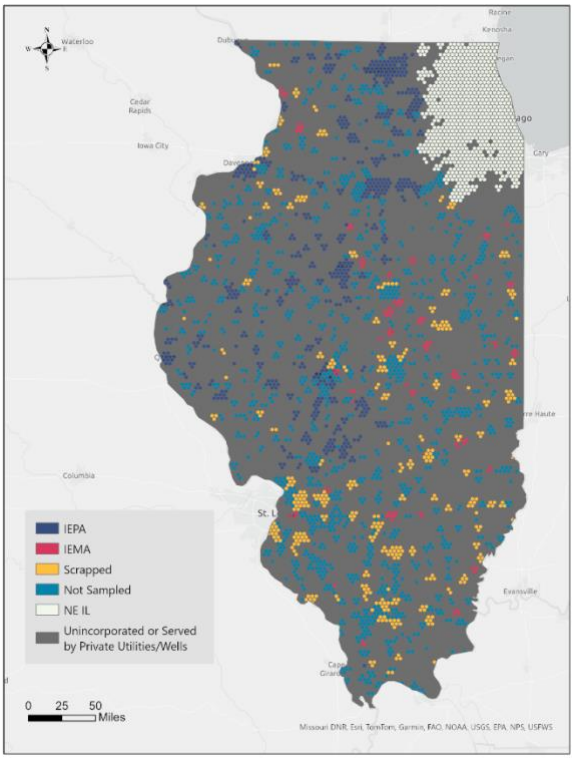
Figure 7.3 illustrates the geographic distribution of municipalities in the dataset. Municipalities that reported orders to the IEPA/IEMA are clustered in the northwestern and central parts of the NCSI region. However, the web scraping process revealed boil orders issued in all parts of NCSI, indicating that the clustering of IEPA/IEMA reporting is likely a reflection of reporting practices and municipalities' relationships with these agencies rather than a reflection of the actual incidence of boil orders.

Analyzing differences across municipalities can provide insight into why municipalities in certain areas consistently report to state agencies while others do not, potentially helping to improve public safety and reporting transparency. Other factors, such as resource availability or administrative practices, may also influence compliance levels

[157] The population groupings are based on the POP_CAT_11_CODE variable in the SDWA dataset from the US Environmental Protection Agency (2024). SDWA Data Download Summary and Data Element Dictionary. https://echo.epa.gov/tools/data-downloads/sdwa-download-summary.

and should be examined further for the purpose of addressing compliance disparities and aiding water suppliers to build capacity for adhering to reporting requirements.

Figure 7.3. Geographic Distribution of Boil Order Notices by Data Source[158]



7.1.2. Lead Service Line Replacement

Drinking water systems across the country are required to identify and replace lead service lines within 10 years.[159] While there are federal and state funding sources earmarked to facilitate this transition, many communities fear that this funding is not sufficient for them to undertake the necessary steps to replace service lines.

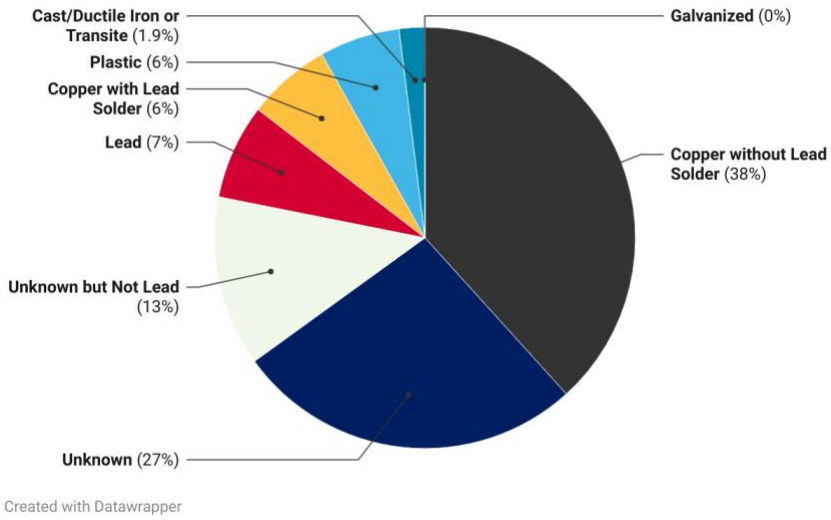
According to the 2022 IEPA Service Line Material Inventory Reports, 128 municipalities in NCSI reported lead service lines. For these communities, the proportion of their total service lines needing replacement due to lead averages about 8%. However, for some communities, the lead service line replacement burden reaches about 90% (Mill Shoals Village). Notably, less than 10% of Illinois' lead service lines are located in NCSI (see Figure 7.4), with the bulk of the replacement burden in the Northeastern region.

[158] This figure illustrates boil order counts across 313 municipalities in NCSI.

[159] US Environmental Protection Agency, *Biden-Harris Administration Issues Final Rule Requiring Replacement of Lead Pipes Within 10 Years, Announces Funding to Provide Clean Water to Schools and Homes*, https://www.epa.gov/newsreleases/biden-harris-administration-issues-final-rule-requiring-replacement-lead-pipes-within.

However, disparities in identifying and reporting lead service lines exist for DACs that face challenges of incomplete records and limited capacity, which could impact reporting in NCSI.

Figure 7.4. NCSI Reported Service Lines by Material[160]



7.2 Qualitative Results

During interviews with municipal representatives across the NCSI regions, local officials discussed several ways that federal and state policies impacted their process and decision-making in rate setting. Overall, the interviewees discussed the challenges of keeping pace with water quality regulations, the administrative burden of preparing compliance reports, and the complexity of applying for state funding that likely will require a rate increase, specifically as eligibility for an SRF loan often includes a requirement to raise water rates.

7.2.1. Lead Service Line Replacement

In some communities, local officials are actively considering the future impact of mandates and regulations, even if that means ongoing rate increases for consumers, as expressed here:

> *"One of the things that kind of drives rates, or some of our current rate increase, is of those 52,000 meter connections, about 20% of them, or about 10,000 or 11,000 of them, are constructed of lead materials. So, we fall into that category where we've got to do an extensive lead service line replacement program here in Illinois starting in 2027."*

[160] This figure illustrates the share of reported service lines by material in NCSI.

Another interviewee added:

> *"Currently implementing PFAS and lead legislation are of the biggest concern, as those are both pretty heavy lifts. While these contaminants must be addressed and I support doing so, it is also of concern that water utilities are not creating or generating PFAS or lead contamination, so why are utilities bearing the financial and resource burdens to address these contaminants when utilities already don't have enough money to keep facilities going and maintain them properly?"*

For some communities, aging infrastructure, coupled with ongoing updates to water quality regulations and mandates, creates the need for constant review and updating of rates. With shifting regulatory frameworks, municipalities can face increased risks in long-term financial planning for water infrastructure. Interviewees shared:

> *"We're coming up on our 200-year anniversary in two years. We have a lot of old infrastructure. We've really focused a lot on improving our infrastructure over the last 30 years. So you know, we're in a pretty good place, but of course, there's never ending need. So, a lot of our focus is on what we have today, but we are aware of potential for PFAS and we're engaged in lead service line replacement now…it all gets considered (in rate setting)."*

Lead service line inventories and replacement costs can be a challenge for setting water rates, especially when the scope of these projects is still being investigated, as expressed here:

> *"Lead service line replacements are a major issue…Currently, we have 14,085 confirmed lead service lines, 452 galvanized lines (which will be treated as lead and require replacement), and 29,304 lines that are unknown or suspected to be lead. This brings the total number of services needing replacement to 43,841. At the current average replacement cost of $14,000 per service, the total estimated expense for replacing these lines from the water main to the meter is approximately $615,000,000. Under the existing IEPA regulations, the City has about 30 years to complete these replacements. However, with the proposed EPA Lead and Copper Rule Improvements (LCRI), this timeframe would be shortened to 10 years. Without state or federal funding or loan forgiveness, the financial burden of these timelines would significantly impact the City's rates."*

Even some systems with newer infrastructure struggle to find the capacity to comply with mandates, like those issued for communities to document the prevalence of lead

service lines. For some communities, the administrative burden to understand regulations and comply with them was described:

> *"So, it's been tough. But I can't imagine how tough it'll be on the next person, because like you said, it is changing. Things are changing. Numbers, and the requirements are changing."*

Another interviewee added:

> *"The quality of our water is regulated by the Illinois EPA and monitored by our part time certified water operator. Any and all EPA requirements definitely affect our water rates. The most recent was the EPA required Source Water Protection Plan which cost our little village $7,000. "*

7.2.2. Privatization

Another relevant aspect of state policies that may affect water rates is the possibility of privatization of water services that would then be regulated by the Illinois Commerce Commission. The interviews were conducted largely with municipal representatives of systems that are not privatized, but many shared insights about neighboring communities or their own communities' decisions when approached by private providers.

Privatization can come with some advantages, including infrastructure improvements and municipal debt relief. One interviewee shared:

> *"In some municipalities, municipalities opted for privatization due to financial constraints. Private companies were able to make needed infrastructure improvements, such as upgrading water towers or installing transponders, which the municipalities could not afford."*

Another municipal representative added:

> *"The (private) corporation has deep pockets. They were able to come in and upgrade the system as far as new meter read-outs and stuff. They got transponders so they don't have to have employees go around and read each meter every month…They put $100,000 into the water tower because the water tower needed to be updated and painted and cleaned. So, basically it was all money. Money and manpower."*

In addition, an interviewee confirmed:

> **"***The big selling point to me (for privatization) was they're taking away our debt. We know the water quality. They've got to turn their samples into the state. So, we would know if they got fined or if something happened. They can't hide that."*

On the other hand, one of the most pressing concerns regarding privatization is the potential for increased costs for consumers. Many municipalities reported that privatizing water services often results in significantly higher water rates. For instance, in nearby localities, water prices have risen dramatically post-privatization, as stated:

> *"There are localities close to us that have done that. And I'm not so sure that's been a good deal for them. They may think so, but they're paying really high prices for their water. And I guess it's like anything else, if you can't get people to take care of your own water, and deal with it, then you might get to that point where you're forced to do that, but it's gonna cost you. It's gonna cost the customers to go that route."*

Another interviewee added:

> *"Yeah. So, within a three-year period, our cost from Illinois American is going to go up 43%, assuming the Illinois Commerce Commission approves it, which I'm guessing they will. But what we feel like is Illinois American is, basically, kind of a monopoly. We don't have many other options."*

Another municipal representative confirmed:

> *"We do have a community close to us right now that is run by a private company called American Water. But what we found with that is the affordability isn't there for the consumer. Okay. Their water rates are astronomical."*

Interviewees also shared their concerns that privatization of their systems would result in less local control over system decisions and water rate setting, as described by one:

> *"The differences between going to a private company or having outside influences—you lose control over setting the rate structure…The actual board that runs the community kind of gets squeezed out of it."*

Another interviewee added:

> *"Well, the only thing we could do is sell out to another company, and have them come in. And we don't want to lose control of our water. We wouldn't have water for the price we've got it now if we did that".*

Finally, another municipal representative explained:

> *"(Our city) doesn't have to make profits to pay shareholders or owners. We have to make money in order to reinvest in our system and make sure you're getting quality water. You sell off a municipal utility and then you have absolutely no control over A.) the quality or B.) the rates people are going to pay."*

8. REASONS FOR WATER RATE INCREASES

Water bills are becoming more expensive across the United States, with combined water and sewer bills having increased approximately 50% over the last decade.[161] This represents an increase in water bills that is three times the rate of inflation and faster than other essential utility costs. This trend stems from a confluence of factors, including deferred infrastructure investment, as local governments fund 95-98% of water and sewer infrastructure, which is threatening access to clean and affordable water in some communities.[162,163]

Shifting from financing water infrastructure and operations through large national subsidies and general tax revenues to the current system of user charges has increased concerns about affordability for residential water customers.[164] As a result, community water systems increasingly struggle to establish a water rate that customers can afford while also generating adequate revenue to support sustainable water provision.[165] In light of challenges associated with drinking water quality, water infrastructure, and groundwater drawdown, municipalities are at a crossroads in determining how to finance needed water infrastructure to address these problems in the long term. Several communities continue to defer necessary water infrastructure improvements until they are unavoidable and then implement reactive, large increases in water rates.

A significant portion of aging infrastructure across Illinois, much of which has exceeded its intended lifespan, continues to challenge public water systems in delivering safe, reliable, and affordable water to residents.[166] In 2022, the quality of critical infrastructure for drinking water received a grade of D+ from the Illinois Section of the American Society of Civil Engineers (ASCE). In 2019, a total of 444 community water systems were in violation of one or more of the US EPA drinking water compliance programs.[167]

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[161]Bluefield Research, "Cost of Water," October 17, 2024, https://www.bluefieldresearch.com/our-coverage/macro-trends/cost-of-water/.

[162] Diego S. Cardoso, and Casey J. Wichman, "Water Affordability in the United States," *Water Resources Research* 58, no. 12 (November 29, 2022), https://doi.org/10.1029/2022wr032206.

[163] Elevate, "Water Affordability: A Growing Challenge," January 18, 2022, https://www.elevatenp.org/water/water-affordability-a-growing-challenge/#:~:text=Water%20affordability%20is%20a%20growing,growth%20in%2078%25%20of%20communities.

[164] Joel Arthur Tarr, *Technology and the Rise of the Networked City in Europe and America*, 1988. *Martin V. Melosi, The Sanitary City: Urban Infrastructure in America from Colonial Times to the Present, 2000.*

[165] Donald A. Forrer, Jacob Boudreau, Elizabeth Boudreau, Sheronia Garcia, Christopher Nugent, Dean Allen, and Alexis C. Lubin, "The Effects of Water Utility Pricing on Low Income Consumers," *Journal of International Energy Policy (JIEP)* 5, no. 1 (November 28, 2016): 9–18, https://doi.org/10.19030/jiep.v5i1.9839.

[166] Illinois Section of the American Society of Civil Engineers (ILASCE)., "2022 Report Card for Illinois' Infrastructure," ASCE's 2021 Infrastructure Report Card, April 22, 2024, https://infrastructurereportcard.org/state-item/Illinois/.

[167] Kate Albrecht, Deborah A. Carroll, Amanda Kass, Jason Michnick, and Brooke Wetmore "Fiscal Institutions and Racial Equity: Determining the Price of Water," *Public Budgeting &Amp Finance* 44, no. 2 (April 21, 2024): 45–68, https://doi.org/10.1111/pbaf.12361.

Although there is significant federal funding available for water-related infrastructure projects, as well as addressing emerging contaminants and replacing lead service lines, it is insufficient to address the needs. As recently as September 2023, the EPA estimated that water utilities nationwide will need to spend $625 billion over the next 20 years to fix, maintain, and improve the country's water infrastructure, $50-80 billion to replace all lead service lines, and another $448 billion to $944 billion needed through 2050 to adapt drinking water and wastewater systems for the consequences of climate change.[168] Infrastructure needs present significant challenges for water affordability because these costs will be almost entirely borne at the local level.[169]

Smaller communities in Illinois face significant but unique challenges, including the depletion of groundwater resources that could be unusable within 15 years, with even more at risk of depletion by 2050.[170] Groundwater depletion also poses a significant threat across the United States.[171] These challenges are particularly evident in NCSI as these communities lack access to Lake Michigan, which is subject to more stringent water use regulations aimed at conservation. So, it is important to protect groundwater since the source of water significantly impacts water treatment costs and, in turn, water rates. Groundwater is generally considered cleaner than surface water due to natural purification processes during percolation through soil. As a result, treating groundwater is typically less expensive than treating surface water.[172,173]

Drinking water provision in Illinois is undergoing a transformative shift towards privatization.[174] However, there is little transparency in these decisions or research on how privately-provided water quality and pricing compare to community water systems

[168] US Environmental Protection Agency, "Drinking Water Infrastructure Needs Survey and Assessment," report, EPA's Drinking Water Infrastructure Needs Survey and Assessment (DWINSA), 2023, https://www.epa.gov/system/files/documents/2023-04/Final_DWINSA%20Public%20Factsheet%204.4.23.pdf.
[169] Katy Hansen, and Megan Mullin. "Barriers to Water Infrastructure Investment: Findings From a Survey of US Local Elected Officials." *PLOS Water* 1, no. 8 (2022): e0000039.
[170] American Society of Civil Engineers, "Illinois Earns C- on Its 2022 Infrastructure Report Card While Making Strides on Roads and Transit," April 28, 2022, https://www.asce.org/publications-and-news/civil-engineering-source/society-news/article/2022/04/28/illinois-earns-c--on-its-2022-infrastructure-report-card-while-making-strides-on-roads-and-transit.
[171] Brett Walton, "US Groundwater Wells Race Towards Bottom," Circle of Blue, November 20, 2019, https://www.circleofblue.org/2019/world/u-s-groundwater-wells-race-towards-bottom/#:~:text=Well%20depths%20are%20increasing%20across%20the%20country%2C%20study%20finds.&text=To%20locate%20sufficient%20supplies%20of,well%20records%20since%20the%201950s.
[172] Anand K. Plappally, and John H. Lienhard, "Costs for Water Supply, Treatment, End-use and Reclamation," *Desalination and Water Treatment* 51, no. 1–3 (October 16, 2012): 200–232, https://doi.org/10.1080/19443994.2012.708996.
[173] Rahman Zeynali, Kamran Ghasemzadeh, Elham Jalilnejad, and A. Basile, "Chapter 10 - Economic Evaluation of Wastewater and Water Treatment Technologies," in *Current Trends and Future Developments on (Bio-) Membranes*, 2020, 263–79, https://doi.org/10.1016/B978-0-12-817378-7.00010-0.
[174] Citizens Utility Board, "Big Profits, Big Bills: Tracking Illinois' Water Privatization," accessed December 9, 2024, https://www.citizensutilityboard.org/water-privatization-in-illinois/.

across the state.[175] While the allure of short-term financial solvency leads many municipalities to privatize, evidence shows that the promise of long-term infrastructure improvement and increased affordability may fall short.[176] Over the long term, though private water utilities are more likely to modernize their system infrastructure, residential water prices are often set higher to achieve this goal.[177] Further, a national survey of 1,897 municipalities in 2015 found that privately owned water utilities are less likely to have policies dedicated to protecting low-income residents from disconnection.[178]

In Illinois, private water providers operate under strict regulations, including requirements to submit financial reports, income statements, balance sheets, and cash statements, as well as to receive approval for proposed rates, tariffs, and fee structures. Requests for rate increases by private utilities are only approved after a review of cost studies, revenue projections, and justification for rate adjustments. Though many community water systems allow their customers to participate in the water rate-setting process through their elected officials and municipal water boards, they are exempt from these reporting and approval requirements imposed on private water utilities.

Water loss can impose significant financial burdens on households when system leaks go undetected over extended periods. To address this issue, advancements leading to smart water metering (SWM) technology have been made, which offer several opportunities for cost-savings and promoting water affordability despite steep adoption costs.[179] Benefits include more accurate billing based on real-time data, leak detection by accessing abnormal water usage patterns live, and reduced operational costs associated with manual meter readings, among others. However, the adoption of SWM technologies is slow due to barriers disproportionately felt by low-resourced communities, including a lack of regulatory requirements for adoption, a lack of customer awareness or support, and insufficient cost-benefit analysis.

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[175] "Utility watchdog urges legislation to give Illinois residents a say in water privatization," Chicago Tribune, March 23, 2021, https://www.chicagotribune.com/2021/03/22/utility-watchdog-urges-legislation-to-give-illinois-residents-a-say-in-water-privatization/.

[176] Frank L. K. Ohemeng, and John K. Grant, "Has The Bubble Finally Burst? A Comparative Examination of the Failure of Privatization of Water Services Delivery in Atlanta (USA) and Hamilton (Canada)," *Journal of Comparative Policy Analysis Research and Practice* 13, no. 3 (June 1, 2011): 287–306, https://doi.org/10.1080/13876988.2011.565915.

[177] Francisco González-Gómez, and Miguel A. García-Rubio, "Prices and Ownership in the Water Urban Supply: A Critical Review," *Urban Water Journal* 15, no. 3 (February 19, 2018): 259–68, https://doi.org/10.1080/1573062x.2018.1436187.

[178] George C. Homsy, and Mildred E. Warner, "Does Public Ownership of Utilities Matter for Local Government Water Policies?," *Utilities Policy* 64 (April 29, 2020): 101057, https://doi.org/10.1016/j.jup.2020.101057.

[179] Ryan Quigley, "Enhancing Water Management for Cities and Towns with Smart Water Meters and Advanced Metering Infrastructure," Performance Services, March 6, 2024, https://www.performanceservices.com/resources/smart-water-meters-smarter-water-management-for-cities-and-towns/.

Advances in water-efficient technologies, such as low-flow fixtures and high-efficiency appliances, have also significantly reduced water demand. This trend represents the successful achievement of conservation goals but introduces uncertainty and upward pressure on water rates. For instance, between 1999 and 2016, water use declined by 39% for dishwashers, 26% for clothes washers, and 29% for toilets, leading to per capita residential consumption dropping by 18.2% in some municipalities.[180] Below-average water consumption often requires higher per-unit rates to cover fixed costs, a challenge exacerbated in municipalities facing population decline.

Water systems in Illinois and across the US face multifaceted challenges, including outdated infrastructure, groundwater depletion, privatization, and uncertainties associated with technological upgrades. Rising water rates are outpacing inflation and income growth, exacerbating residential water access and affordability.

8.1 Quantitative Results

8.1.1. Water Quality and Compliance

Analysis of the drivers of water rates reveals that water source and quality, factors related to municipal governance, and geographic characteristics of the service area are associated with variations in water rates across the NCSI regions. It is least costly for municipalities to source from groundwater and self-produce rather than purchase wholesale. Since groundwater is generally less costly to sanitize than surface water, these municipalities have average standardized monthly bills of approximately $6.42 lower. Municipalities purchasing surface water tend to charge an average of $3.92 more per month.

Water contamination violations were not statistically significantly related to water rates, even for high-cost contaminant violations (see Table 8.1). At the same time, there is a negative correlation between water rates and consumer confidence. This result may indicate that customers who perceive lower-quality water may be only willing to pay lower water prices.

Table 8.1. Hierarchical Linear Model Estimates of Water Bill[181]

System Characteristics	Coefficients	Standard Errors
Contaminant Violation: Low-Cost	-3.053	(2.946)
Contaminant Violation: Moderate-Cost	-0.734	(2.203)
Contaminant Violation: High-Cost	-2.865	(1.908)
Consumer Confidence	3.500*	(2.095)

Note: *** p<0.01; ** p<0.05; * p<0.10

[180] William Deoreo, and Maureen Hodgins, "Residential End Uses of Water, Version 2," The Water Research Foundation, 2016, https://www.waterrf.org/research/projects/residential-end-uses-water-version-2.

[181] The complete regression results are provided in the Appendix.

Examining the association between water quality and compliance and policies related to affordability suggests that municipalities with volatile organic compounds (VOCs) in their water supply are associated with an average of 6.32 more days until bills are due before they are considered delinquent ($p<0.05$) as shown in Table 8.2. Another statistically significant factor is source water protection, an indication of a potential threat to water quality.[182] Source water protection is negatively associated with days until lien ($p<0.05$), providing customers an average of 5.5 fewer days to pay bills before a lien may be imposed.

In Table 8.2, the number of formal facility actions taken by the water utility to address violations has a positive and significant association with days until delinquency, with each additional action associated with an average 3.49-day increase in the payment window ($p<0.05$). Each formal facility action is also associated with an extended timeline of approximately 9 days until water may legally be disconnected due to nonpayment ($p<0.01$). These results suggest that municipalities with a higher number of formal EPA actions may face challenges in implementing policies needed to efficiently recover funds, potentially limiting their ability to invest in initiatives that improve compliance.

Table 8.2. Model Estimates of System Characteristics[183]

System Characteristics	Days to Delinquency	Days to Shut Off	Days to Lien
Formal Facility Action Count	3.49** (1.397)	9.428*** (2.665)	7.513* (3.824)
Source Water Protected	1.352 (0.872)	0.958 (1.656)	-5.515** (2.424)
VOCs	6.32** (3.099)		

Note: *** p<0.01; ** p<0.05; * p<0.10; Coefficients are reported with standard errors in parentheses.

8.1.2. Clean Water State Revolving Funds (CWSRF) and USDA Water and Environmental Programs

Two common sources of low-cost financing for infrastructure improvement and replacement for municipal water systems in Illinois are funded through the US EPA via the Clean Water State Revolving Funds (CWSRFs) and USDA's Rural Development Programs. Though the emphasis on the distribution of funds differs, both programs are critical for municipalities to improve and maintain water infrastructure in NCSI. The USDA's focus is rural water providers as they select qualified nonprofits to distribute revolving funds to water systems for financing water and wastewater projects in low

[182] Illinois Environmental Protection Agency, "Source Water Assessment Program," accessed December 9, 2024, https://epa.illinois.gov/topics/water-quality/swap.html.
[183] The complete regression results are provided in the Appendix.

population density regions across the state. The CWSRFs target municipalities that meet criteria associated with disadvantaged community (DAC) status (see Section 6). While both the IEPA and USDA rely on revolving funds, both offer increased financial relief for qualifying recipients. The USDA offers grants to municipal water systems, technical assistance programs, and household water affordability programs. The IEPA's CWSRFs may forgive a portion of the distributed funds for qualifying municipalities.

Figure 8.1 shows the disbursement of these funds to municipal water systems in NCSI from 2012 to 2022. A total of 238 grants of approximately $150 million and 229 loans of approximately $397 million were awarded. The highest cumulative investment of these funds spanned 72 counties, including Montgomery ($36 million), Fayette ($32 million), Clay ($30 million), Macoupin ($26 million), and Piatt ($24 million).

Figure 8.1. USDA Rural Development Funding for Water and Wastewater[184]

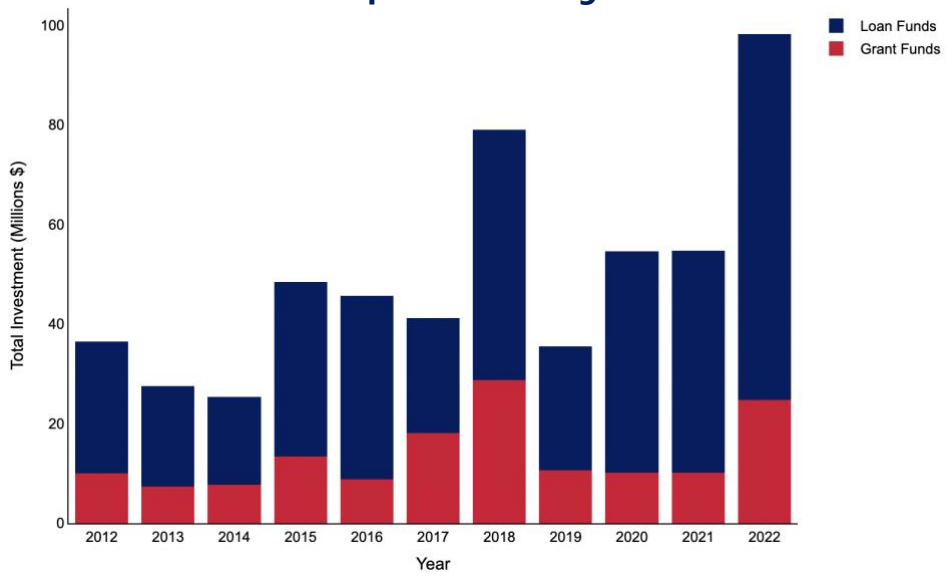


Figure 8.2 compares the magnitude of revolving loan funds issued to municipal water providers by the IEPA and USDA across the NCSI regions from 2012 to 2022. The amounts dispersed from both programs have fluctuated, with the lowest value in 2014 of only 9 SRFs from IEPA dispensed totaling approximately $7 million disbursed throughout the NCSI regions. Since that time, and particularly since 2019, there has been a generally upward trend in both IEPA and USDA funds distributed, though IEPA SRFs reached their peak at approximately $77 million disbursed across 12 separate loans in 2017.

[184] This figure illustrates total investment amounts distributed in NCSI as grants and loans from the USDA Rural Development Program between 2012 and 2022 in inflation-adjusted dollars.

Figure 8.2. Rural Development Loans and State Revolving Funds[185]

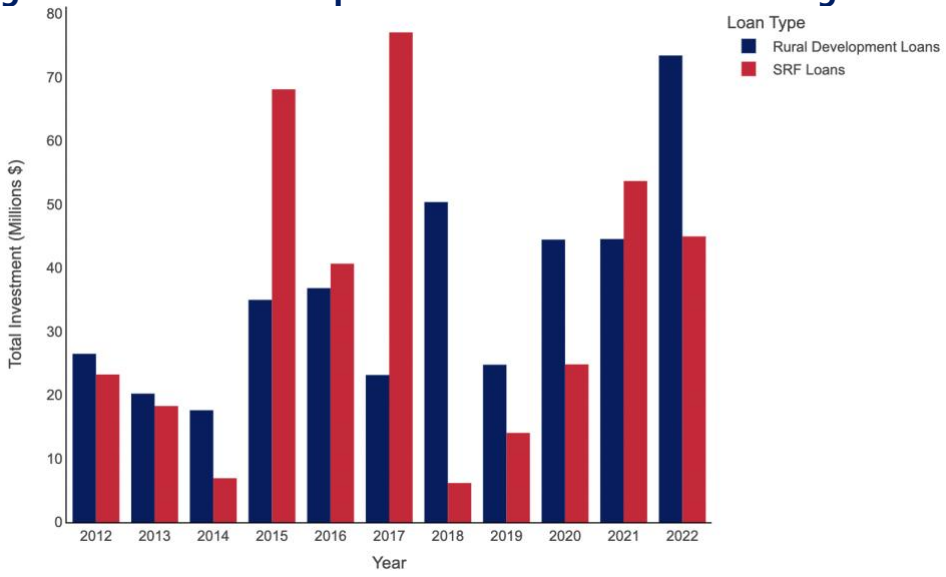
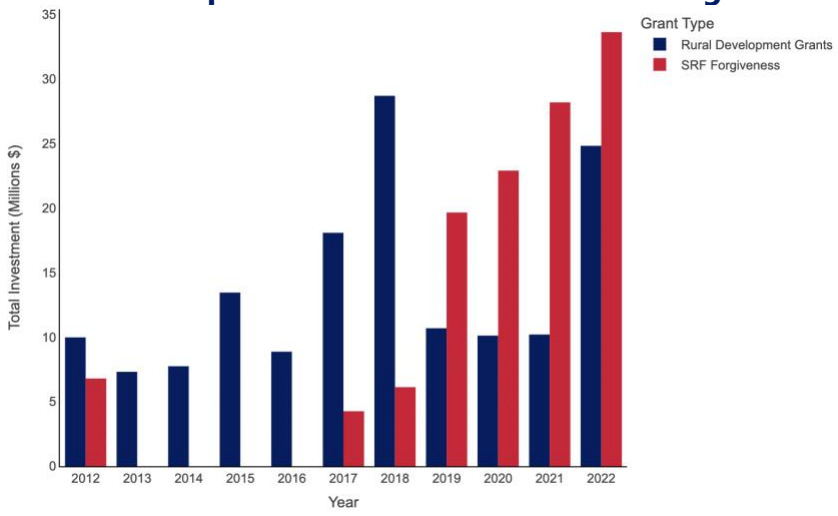


Figure 8.3 presents the dollar amount forgiven from IEPA SRFs compared to the value of USDA Rural Development Program grants (which also do not require repayment) for NCSI municipal water systems from 2012 to 2022. While IEPA's SRF forgiveness mirrors the upward trend of loans depicted in Figure 8.2, rural development grants remain relatively constant between 2018 and 2021. Both grant and loan forgiveness values peak in 2022, with USDA grants totaling just under $25 million and IEPA SRF values totaling approximately $33.6 million.

Figure 8.3. Rural Development Grants and State Revolving Funds Forgiven[186]



[185] This figure illustrates total loan amounts distributed in NSCI from IEPA's State Revolving Fund and the USDA Rural Development Program between 2012 and 2022 in inflation-adjusted dollars.

[186] This figure illustrates total funding distributed in NSCI as forgivable loans from IEPA's State Revolving Fund and as grants from the USDA Rural Development Program between 2012 and 2022 in inflation-adjusted dollars.

Taken together, Figures 8.3 and 8.4 demonstrate that although the IEPA's SRF program and USDA's Rural Development Programs prioritize funding for different types of water providers, they provide comparable levels of assistance. As such, these programs play a crucial role in addressing gaps in infrastructure financing for communities in need.

Regression analysis of the relationship between DRF funding and water rates and affordability policies revealed a positive association between the amount charged for water bills and SRF funding. On average, municipalities that applied for and received SRF funding are associated with charging approximately $0.34 more per month on water bills for each million dollars received (see Table 8.3). In addition, the value of SRFs received by each municipality is negatively related to the deposit value required for initiating water services. For every million dollars of SRF funding received, municipalities require $1.56 lower deposits on average ($p<0.05$). This suggests that utilities receiving more external funding may be able to lower deposit requirements, perhaps because these funds help stabilize utility finances.

Table 8.3. Model Estimates of SRFs[187]

Variables	Standardized Water Bill	Deposit Value	Days to Shut Off
State Revolving Funds ($ Million since 2008)	0.336*	-1.564*	0.086
	(0.184)	(0.611)	(0.15)

Note: *** p<0.01; ** p<0.05; * p<0.10; Coefficients are reported with standard errors in parentheses.

These municipalities also likely face greater infrastructure funding requirements, as indicated by their reliance on SRF support. The Illinois EPA often mandates that municipalities increase water rates to ensure they can effectively meet loan repayment obligations. Aside from the receipt of funds, no correlation is observed between water rates and the amount of loan forgiveness, even though the forgiven amount is determined at the time the loan is issued.

8.2 Qualitative Results

8.2.1. Inflation & Infrastructure Costs

During interviews with municipal representatives, a variety of factors emerged as drivers of increases in consumer water rates. These factors include pre-established, incremental increases to reflect rising costs that relate to the Consumer Price Index, costs associated with maintaining and upgrading infrastructure, and compliance with federal or state water quality regulations. For communities that purchase water from wholesalers, water rate increases are often motivated by wholesale price increases as well.

[187] The complete regression results are provided in the Appendix.

Many municipalities implement automatic water rate increases as a means of managing large system expenses and ensuring the financial viability of their water systems. These automatic increases are often tied to inflation or established in local ordinances to ensure that rates keep pace with rising operational costs. Often, municipalities use established indexes such as the Consumer Price Index (CPI) to guide pricing strategies. This helps ensure that water rates keep pace with inflation and reflect the costs of service delivery. One interviewee explained:

> "*Water rates increase every year based on the CPI. This has been in practice since an ordinance was passed in 2015 by the City Council.*"

Another interviewee added:

> *"There's been a lot of inflation in some of the products that we need to use, so that's gotten more expensive. And, as you go for these state and federal grants, the state in particular, they want you to have water rates that can pay for your system."*

A significant driver of water rate increases is the cost of maintaining and upgrading aging infrastructure. As water systems continue to deteriorate, the cost of maintaining and upgrading these systems becomes increasingly burdensome. For municipalities with older systems, maintaining and upgrading infrastructure that was built decades ago is both costly and challenging, as this municipal representative explained:

> *"Rates are reviewed annually and have increased between 3% and 9.5% over the past decade. Rate increases have been driven by aging infrastructure needs like water main replacement, water treatment plant maintenance such as filter rehabilitations, water service replacements, and so forth, regulatory requirements like adding treatment at various well sites, and overall increases in labor, chemicals, materials, and so forth."*

Another interviewee added:

> *"Our treatment plant is 70 years old. The majority of our pipes are 50-100 years old. Several of our towers are 60-75 years old. We will need to build a new treatment plant and towers in the next 15-30 years...major projects like that don't get funded overnight. We therefore will have to either increase rates further to accommodate building new [facilities] in addition to the increasing cost to maintain and operate current facilities, or bond it and pay more in interest, costing rate payers more in the long run as well. There are no good answers to these challenges. Customers can only bear increases of so much, particularly considering the overall increase in cost of living."*

Another aspect of rising rates is the need to comply with federal and state regulations in general. Ensuring high water quality is a primary concern for municipalities, but maintaining this quality often comes at a financial cost, leading to increases in water rates. Emerging contaminants like PFAS (per- and polyfluoroalkyl substances) present new challenges for water systems. These contaminants require additional treatment and monitoring, which may significantly increase operational expenses, as explained here:

> *"The PFAS…that's a new emerging contaminant to our water systems across the United States…we're still searching to find out how to treat them and how much it's going to cost us to do it. Because this is a brand-new thing, we have yet to get to that point where we can do the research possible to show how that is going to affect our rates."*

In some cases, the need for water quality improvements, such as removing sediment from reservoirs, requires significant infrastructure investments, which can increase water rates. One municipal representative shared:

> *"One of the problems that they had to solve was the sediment building up in the lake, and so there was a $90 million dredging project which was funded by bonds, but they had to raise the rates for that."*

Many municipalities purchase water from wholesalers, who periodically raise their rates. When wholesalers increase their rates, municipalities often need to pass these increases on to residents. Some municipalities have experienced frequent rate increases from their wholesale suppliers, making it challenging to maintain affordable rates for residents. In other cases, the cost of purchasing water from wholesalers is substantially higher than producing it locally, but municipalities opt for wholesale water due to quality considerations or to avoid the costs associated with operating their own treatment facilities. A representative from a municipality that purchases wholesale shared:

> *"The water is excellent in quality and taste and would alleviate our needing a new well and allow us to obsolete our current water treatment equipment, as the purchased water was already potable and ready to go to our tower. The downside is the cost of the water was four to five times that of what we could provide via our own wells. The quality was so much better that we had almost no complaints. The problem is now that the supplier seems to be raising their prices almost yearly, which we must pass along. Luckily, we aren't receiving complaints yet, but it makes it hard for us to make additional money to maintain our tower and system without jacking the price even more."*

8.2.2. State Revolving Funds

State revolving funds (SRF) can help support community water system infrastructure and capital projects, monitor water quality, and manage water systems. These loans often require complex applications and "shovel ready" engineering plans. To apply for an IEPA SRF loan, municipalities must submit a comprehensive list of documents requiring technical expertise across engineering, financial, and legal domains. One community that works with a consultant for preparing grant and loan applications shared:

> *"We must rely on a third party to handle the paperwork and interaction with the state. Those costs are partly offset by grants, but we will still be out quite a bit of money, which may force a rate increase after the cost totals are finally visible.*"

Finally, municipalities that complete their own applications for SRF loans often discuss that they anticipate or have been required to raise consumer water rates to be able to take advantage of the additional funding for system upgrades and necessary infrastructure repairs. Interviewees shared that:

> *"We had a large kind of system improvement project on the east side of our community and had the SRF loans bond dollars involved in that. They require a rate study. So, we undertook that and did implement a very small rate increase, just to be compliant with their requirements."*

Another municipal representative added:

> *"There was a time after we built our treatment plan…we had to build a well and water tower, so both those projects really spiked our rates."*

In addition, an interviewee confirmed:

> *"What we are going to tell the IEPA on our SRF loan [is] that, Yes, we anticipate the need for rate increases."*

9. INTERGOVERNMENTAL COORDINATION

Regional challenges and opportunities that are cross-jurisdictional in nature require a higher degree of collaboration in the absence of a central governing authority, especially across NCSI, which has a variety of community sizes and sources of drinking water production and provision.[188,189,190] To overcome the hurdles created by this functional fragmentation and lack of central decision-making for public service delivery, governments regularly engage in intentional coordination through various arrangements.[191] These can range from informal and temporary *ad hoc* groups to more formal and legally binding contractual arrangements or the creation of entirely new organizations like water commissions.[192] Depending on the regulatory environment, there is flexibility within certain types of collaboration arrangements that will be discussed in this section.

The mechanism of collaboration is often determined by the types of organizations that are involved, the nature of the problem or opportunity, and any potential risks associated with collaboration.[193] More complex issues may require that municipalities cooperate through multiple types of arrangements.[194] While fragmentation is often thought of as the geographic division of local governments, the US structure of government also separates functions vertically. As a result, there are unique relationships and types of cooperation that occur between different levels of government (i.e., local governments and states, states and the Federal government). The provision of drinking water is an example of a public good where there are multiple arrangement types for intergovernmental coordination.[195]

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[188] Iris Hui, Nicola Ulibarri, and Bruce Cain, "Patterns of Participation and Representation in a Regional Water Collaboration," *Policy Studies Journal* 48, no. 3 (November 4, 2018): 754–81, https://doi.org/10.1111/psj.12266.

[189] Serena Y. Kim, William L. Swann, Christopher M. Weible, Thomas Bolognesi, Rachel M. Krause, Angela YS Park, Tian Tang, Kiernan Maletsky, and Richard C. Feiock, "Updating the Institutional Collective Action Framework," *Policy Studies Journal* 50, no. 1 (May 16, 2020): 9–34, https://doi.org/10.1111/psj.12392.

[190] Jay Rickabaugh, "Regional Public Sector Organizations: A Broader Taxonomic Classification to Cross-pollinate Empirical Research," *Public Administration* 101, no. 1 (August 6, 2021): 271–83, https://doi.org/10.1111/padm.12779.

[191] Guy B. Peters, "The Challenge of Policy Coordination," *Policy Design and Practice* 1, no. 1 (January 2, 2018): 1–11, https://doi.org/10.1080/25741292.2018.1437946.

[192] Ricardo S. Morse, and Charles R. Abernathy, "Mapping the Shared Services Landscape," in *Municipal Shared Services and Consolidation*, ed. Andrew Henderson (New York: Routledge, 2015), 143–160.

[193] Serena Y. Kim, William L. Swann, Christopher M. Weible, Thomas Bolognesi, Rachel M. Krause, Angela YS Park, Tian Tang, Kiernan Maletsky, and Richard C. Feiock, "Updating the Institutional Collective Action Framework," *Policy Studies Journal* 50, no. 1 (May 16, 2020): 9–34, https://doi.org/10.1111/psj.12392.

[194] Mark Lubell, "Governing Institutional Complexity: The Ecology of Games Framework," *Policy Studies Journal* 41, no. 3 (August 1, 2013): 537–59, https://doi.org/10.1111/psj.12028.

[195] Katy Hansen, and Megan Mullin, "Barriers to Water Infrastructure Investment: Findings From a Survey of US Local Elected Officials," *PLOS Water* 1, no. 8 (August 16, 2022): e0000039, https://doi.org/10.1371/journal.pwat.0000039.

The conversation around intergovernmental coordination and cooperation has largely focused on highly formal arrangements that actively seek to consolidate or regionalize water systems in a variety of ways, including through water commissions, joint action water agencies, water districts, and even privatization through businesses and 501(c)12 nonprofit utilities.

Public water districts were established through state legislation in 1945, and they are given the ability to serve both urban and rural areas.[196] In addition, public water districts are created through voter referendum, governed by elected trustees, have eminent domain powers, and can levy taxes and issue revenue bonds. Rural water districts were established in 1953, but they are limited to only serving rural areas and communities under 500 people.[197] Rural water districts are only created after landowners petition the county board, and they have much more limited powers of eminent domain. These entities can only charge user fees and issue revenue bonds, but rural water districts are often eligible for USDA Rural Development funding programs.

An alternative formal intergovernmental coordination takes place when communities choose to form a water commission. The Illinois Constitution gives municipalities the right to contract between municipalities or to combine and transfer any power or function to obtain and share services.[198] The right to combine and transfer power or function can then be traced to alternative pieces of enacting legislation that provide the rights to alternative institutional forms of Regional Public Service Organizations (RPSOs).[199] Across the NCSI regions, water commissions serve communities alongside public and rural water districts and private providers.

This report does not focus on private provision, but it is important to note that private companies can be for-profit or nonprofit. The ICC oversees private for-profit providers, but across NCSI there are also nonprofit providers (cooperatives) who are registered 501(c)12 public utilities that have a board of directors overseeing operations and rate setting. A 501(c)(12) is a tax-exempt organization for mutual or cooperative utility companies that provide utilities like power, water, and telecommunications.[200] These types of water cooperatives must adhere to having at least 85% of their income from members for providing water services, and any excess revenue is returned to members as capital credits or is reinvested in operations. These organizations differ from standard

[196] Illinois General Assembly. "Public Water District Act," 70 ILCS 3705 (1945).
[197] Illinois General Assembly. "Rural Water District Law," 70 ILCS 3710 (1953).
[198] Constitution of the State of Illinois. "Local Government." Article VII. Accessed June 7, 2023. https://www.ilga.gov/commission/lrb/con7.htm.
[199] Rickabaugh, Jay. 2023. "Regional Public Sector Organizations: A Broader Taxonomic Classification to Cross-Pollinate Empirical Research." *Public Administration* 101 (1): 271–83.
[200] Internal Revenue Service Code. § 501(c)(12).

public utilities in that they are member-owned rather than investor-owned, and their primary goal is service to members rather than profit.

The motivation for regionalizing water systems is tied to the well-known issues of fragmentation and specific challenges associated with managing small water systems. Consolidation of systems can occur through the functional consolidation of multiple systems into one or through administrative consolidation, where the management of fragmented systems is shared. Functional consolidation is thought to create economies of scale potentially, but it largely depends on the scale and design of a water system.[201] Although consolidating systems has benefits, local officials may be averse to losing the autonomy of their systems.[202] As a result, alternatives to full consolidation are sought to create some of the known benefits of consolidation without surrendering control.

Rather than consolidation, municipal water utilities may enter into wholesale purchasing agreements. Approximately a quarter of community water systems in the US rely on purchasing water wholesale to provide to their customers.[203] Treatment plants are expensive, and engineering studies have found that economies of scale are nearly inexhaustible on the treatment side; however, economies of scale in water distribution are not guaranteed.[204] Wholesale purchasing agreements allow municipalities without the fiscal capacity to construct and maintain a treatment facility or without access to a viable source of water to maintain a degree of control over their system and the rate-setting process. Although a large portion of community water systems in the country rely on wholesale purchasing, little is known about the wholesale water market between municipal water utilities, and there are mixed research findings on the effect that purchasing water has on residential water rates.[205]

Another formal aspect of intergovernmental cooperation and coordination is the prevalence of community water systems sharing certified water operators. An aging drinking water operator workforce has been a challenge exacerbated by difficulties in

[201] Marcelo Torres, and Catherine J. Morrison Paul, "Driving Forces for Consolidation or Fragmentation of the US Water Utility Industry: A Cost Function Approach With Endogenous Output," *Journal of Urban Economics* 59, no. 1 (November 8, 2005): 104–20, https://doi.org/10.1016/j.jue.2005.09.003.
[202] Katy Hansen, Megan Mullin, and Erin K Riggs, "Collaboration Risk and the Choice to Consolidate Local Government Services," *Perspectives on Public Management and Governance* 3, no. 3 (August 23, 2019): 223–38, https://doi.org/10.1093/ppmgov/gvz017.
[203] Janice A. Beecher, and Jason A. Kalmbach. "Structure, Regulation, and Pricing of Water in the United States: A Study of the Great Lakes Region." *Utilities Policy* 24 (2013): 32-47.
[204] H. Youn Kim, and Robert M. Clark. "Economies of Scale and Scope in Water Supply." *Regional Science and Urban Economics* 18, no. 4 (1988): 479-502.
[205] Janice A. Beecher, and Jason A. Kalmbach. "Structure, Regulation, and Pricing of Water in the United States: A Study of the Great Lakes Region." *Utilities Policy* 24 (2013): 32-47.

recruiting the next generation of water operators.[206,207,208] Small utilities, like many of those in NCSI, are having the most difficulty in hiring certified operators and instead tend to hire and train entry-level employees.[209] In addition, the skills needed by water operators are changing and now include higher digital proficiency and knowledge of innovative treatment technologies, among others.[210,211] Notably, while the water operator occupation is not expected to grow significantly over the next decade, "about 10,500 openings for water and wastewater treatment plant and system operators are projected each year," primarily to replace those that retire.[212] Regional collaboration among water systems has been examined in the literature, but shared operators have often not been central to the investigation aside from being mentioned as a characteristic or benefit of cooperation.[213]

In addition to these formal contractual arrangements in the production and provision of drinking water, there are meaningful informal means of collaboration. A common means of informal cooperation is the information sharing and knowledge transfer that occurs through professional associations.[214] Through these networks, elected officials or public managers may seek policy-oriented information to determine what is successful in implementation or politically popular.[215,216] There is also evidence that benchmarking or reviewing neighboring communities' rates influences the rate-setting process.[217] If benchmarking is done in an effort to remain competitive, it can result in a "race to the

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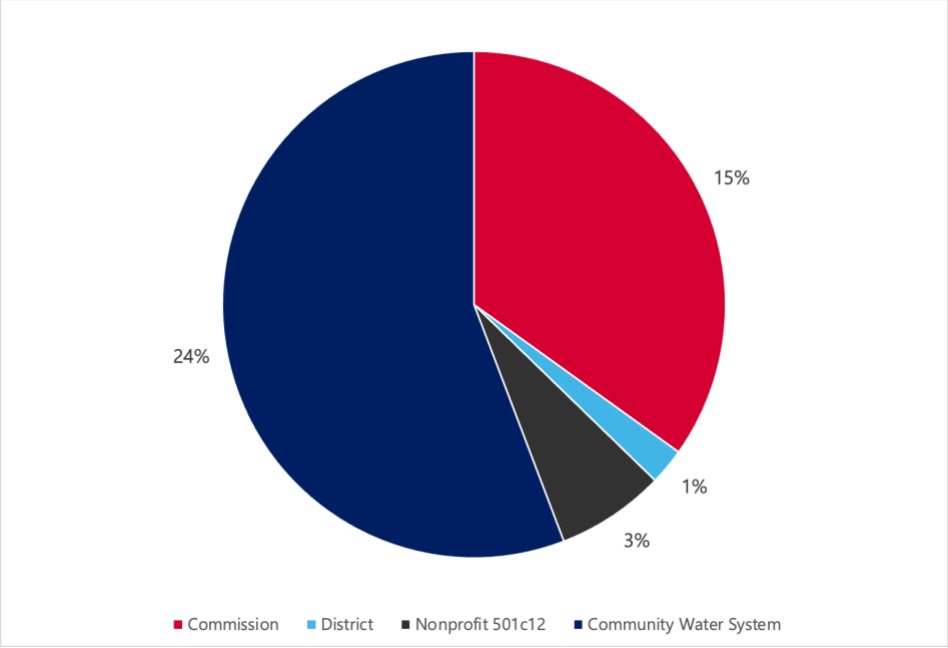
[206] Sherri Thompson Dickerson, and Andrada Butler, "Resolve Workforce Challenges to Ensure Future Success at Water and Wastewater Utilities," *Opflow* 44, no. 9 (August 31, 2018): 8–9, https://doi.org/10.1002/opfl.1063.
[207] Joseph W. Kane, and Adie Tomer, *Renewing the Water Workforce* (Washington, DC: Brookings Institution, 2018).
[208] Andrew Wheeler, US EPA, and David Ross, "America's Water Sector Workforce Initiative: A Call to Action," October 2020, https://www.epa.gov/sites/default/files/2020-11/documents/americas_water_sector_workforce_initative_final.pdf.
[209] US Government Accountability Office. (2018). Water and Wastewater Workforce: Recruiting Approaches Helped Industry Hire Operators, but Additional EPA Guidance Could Help Identify Future Needs. Retrieved from https://www.gao.gov/products/gao-18-102.
[210] Joseph W. Kane, and Adie Tomer, *Renewing the Water Workforce* (Washington, DC: Brookings Institution, 2018).
[211] United States Environmental Protection Agency. (2020). America's Water Sector Workforce Initiative: A Call to Action. Retrieved from https://www.epa.gov/sites/default/files/2020-11/documents/americas_water_sector_workforce_initative_final.pdf.
[212] US Bureau of Labor Statistics. (2024). Water and Wastewater Treatment Plant and System Operators. Retrieved from https://www.bls.gov/ooh/production/water-and-wastewater-treatment-plant-and-system-operators.htm.
[213] Angela R. Bielefeldt, Kurt Paterson, Chris Swan, John J. Duffy, Olga Pierrakos, and Nathan E. Canney "Engineering Faculty Engagement in Learning Through Service Summit: Best Practices and Affinity Mapping," *2012 ASEE Annual Conference & Exposition*, September 10, 2020, https://doi.org/10.18260/1-2--21304.
[214] Richard Rose, "What Is Lesson-Drawing?," *Journal of Public Policy* 11, no. 1 (January 1, 1991): 3–30, https://doi.org/10.1017/s0143814x00004918.
[215] Fabrizio Gilardi, "Who Learns From What in Policy Diffusion Processes?," *American Journal of Political Science* 54, no. 3 (June 21, 2010): 650–66, https://doi.org/10.1111/j.1540-5907.2010.00452.x.
[216] Covadonga Meseguer, "Rational Learning and Bounded Learning in the Diffusion of Policy Innovations," *Rationality and Society* 18, no. 1 (February 1, 2006): 35–66, https://doi.org/10.1177/1043463106060152.
[217] Richard E. Thorsten, Shadi Eskaf, and Jeffrey Hughes, "Cost Plus," *Public Works Management & Policy* 13, no. 3 (October 7, 2008): 224–38, https://doi.org/10.1177/1087724x08324302.

bottom" that can result in municipalities being reluctant to charge rates that appropriately account for all of the costs associated with service delivery.[218] However, information sharing and knowledge transfer around successful practices or policies can result in more homogeneity of service delivery among community water systems.[219] Promoting knowledge sharing within the right context and implementation may be a mechanism to advance more equitable rates across the region, though there are certainly differences between systems and communities that may make this challenging.

9.1 Quantitative Results

Focusing on the 859 municipalities in NCSI served by municipal water systems or water commissions and districts, about 59% (506) self-produce water and do not purchase from others. Over 7% (62) purchase exclusively from water districts, about 7% (59) purchase exclusively from private sources, and about 5% purchase exclusively from commissions (41). The remaining 22% (191) buy from a mix of sources. Of the wholesalers across NCSI, water commissions are the largest provider to community water systems that choose to purchase their water (see Figure 9.1), while water districts serve the largest number of people (see Table 9.1).

Figure 9.1. Share of Wholesalers by Type



[218] Craig Volden, "The Politics of Competitive Federalism: A Race to the Bottom in Welfare Benefits?," *American Journal of Political Science* 46, no. 2 (April 1, 2002): 352, https://doi.org/10.2307/3088381.

[219] David H. Bearce and Stacy Bondanella, "Intergovernmental Organizations, Socialization, and Member-State Interest Convergence," *International Organization* 61, no. 04 (October 1, 2007), https://doi.org/10.1017/s0020818307070245.

Table 9.1. Population Served by Wholesalers

Type	Population Served
Commission	25,523
District	256,140
Nonprofit 501c12	16,420

9.1.1. Wholesale Purchasers

A hierarchical linear model examining the association between wholesale purchasing and water rates and affordability policies revealed that municipalities purchasing water wholesale tend to have lower standardized water bills by $4.57 less on average ($p<0.10$), as seen in Table 9.2. In addition, wholesale purchasers have on average 5 fewer days until shut off ($p < 0.05$). This suggests that wholesale purchasers may be more risk-averse, possibly due to their obligation to repay their wholesale suppliers.

Table 9.2. Model Estimates of Community Characteristics[220]

	Standardized Water Bill	Deposit Value	Days until Delinquent	Days to Shut Off
Wholesaler	-4.572*	18.822**	-1.111	-4.484**
	(2.745)	(7.786)	(1.024)	(1.932)

Note: *** p<0.01; ** p<0.05; * p<0.10; Coefficients are reported with standard errors in parentheses.

9.1.2. Operator Sharing

Faced with difficulties in recruiting and retaining the next generation of water operators, water systems leverage partnerships to benefit from economies of scale and increased capacity, partly facilitated through sharing operators.[221,222] To examine this practice in Illinois, the GFRC researchers scraped data from the Operator Certification System maintained by IEPA. Then, they aggregated this operator-level information to merge it with EPA data on water system characteristics.

In NCSI, over 66% of municipalities or 531 (out of 798 for which data are available) share operators, i.e., have at least one operator working for another system. Table 9.3 lists descriptive statistics by four groupings of the system: systems with 85% or more of their operators employed full-time and that share operators (providers), systems with less than 85% of operators employed full-time and that share operators (recipients), systems that do not share operators, and systems that have no listed operators in the IEPA database.

[220] The complete regression results are provided in the Appendix.
[221] United States Environmental Protection Agency, 2020
[222] United States Environmental Protection Agency, 2024a

Table 9.3. Characteristics of Systems that Engage in Operator Sharing[223]

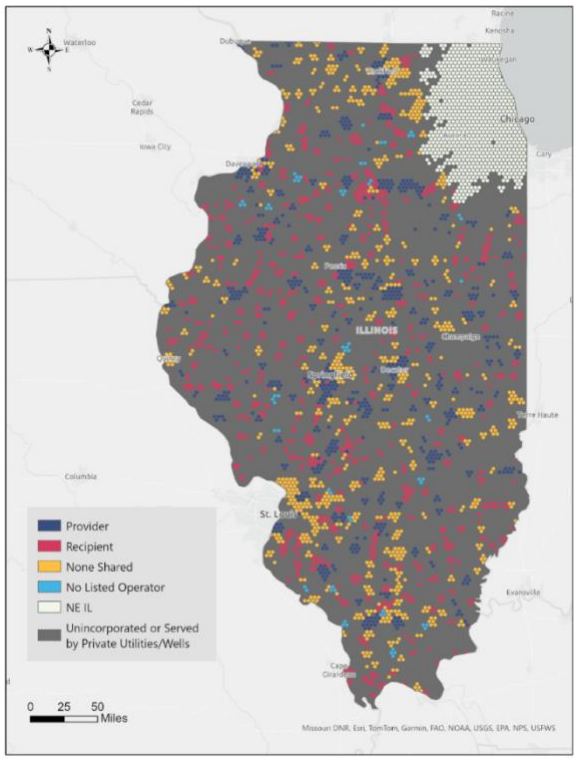
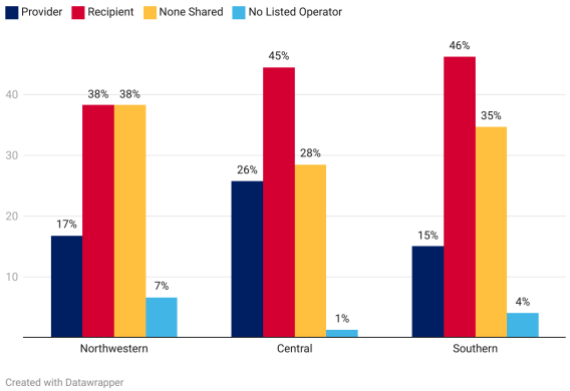
Variables	Full Sample	Operator Providers	Operator Recipients	No Operator Sharing	No Operator Listed
Operator Sharing Ratio	52.51%	65.94%	85.54%	0%	0%
Population Served					
<=100	0.63%	1.14%	0.85%	0%	0%
101-500	29.07%	23.30%	44.51%	10.29%	33.33%
501-1,000	23.31%	20.45%	26.20%	19.75%	37.50%
1,001-3,300	27.69%	23.30%	22.54%	38.27%	29.17%
3,301-10,000	12.91%	17.61%	4.79%	22.63%	0%
10,001-50,000	5.89%	11.93%	1.13%	9.05%	0%
50,001-100,000	0.25%	1.14%	0%	0%	0%
100,001-250,000	0.25%	1.14%	0%	0%	0%
Number of Operators	2	4	2	3	0
Certification					
Class A	13.18%	19.89%	7.61%	16.46%	0%
Class B	31.52%	34.66%	32.68%	27.57%	0%
Class C	27.52%	24.43%	27.89%	29.22%	0%
Class D	27.78%	21.02%	31.83%	26.75%	0%
Source					
Groundwater Produced	57.52%	59.09%	56.34%	57.61%	62.50%
Groundwater Purchased	13.53%	10.80%	18.87%	8.64%	4.17%
Surface Water Produced	6.02%	12.50%	1.69%	7.82%	4.17%
Surface Water Purchased	22.93%	17.61%	23.10%	25.93%	29.17%
Wholesaler	0.38%	0.57%	0%	0.82%	0%
Number of Observations	798	176	355	243	24

In Table 9.3, the operator sharing ratio emerges as substantially different across providers and recipients, at 65.94% and 85.54%, respectively. In addition, the size of the population served varies, with recipients constituting a larger share of systems serving 1,000 or fewer people. Further, the average total number of operators per system is two for recipients compared to four for providers. Class A certification, the one requiring the most hands-on and educational experience, is more prevalent among providers. Finally, purchased water is more represented as a source among recipients.

[223] This table provides descriptive statistics for municipal water systems using information from IEPA and EPA. In NCSI, there are 798 municipalities with their own water systems. Some of these (14) sell water to a neighboring municipality. The rest (47) procure water through water commissions or districts. The total number of municipalities obtaining water from municipal systems or water commissions and districts is 859.

Figure 9.2, Panel A, spatially illustrates the four groupings of operator sharing. Figure 9.2, Panel B, illustrates the variation in operator sharing across regions. In NCSI, operator sharing is most prevalent in Central Illinois, where over 70% of municipalities share at least one operator. Southern Illinois follows at over 60%.

Figure 9.2. Prevalence of Operator Sharing[224]

Panel A. Spatial Distribution	Panel B. Regional Aggregates
	

9.2 Qualitative Results

9.2.1. Purchasing Agreements

Across the NCSI regions, individual purchasing agreements between communities and wholesalers are available to small community water systems or those that have specific needs, e.g., dealing with water quality issues. Municipal representatives from systems that wholesale to others shared:

> *"Currently, the City provides water to several small community water systems that previously faced challenges with contaminants such as PFAS and radium in their existing wells. These communities opted to receive water from the City due to the high costs associated with owning, operating, and maintaining their own water treatment plants."*

[224] This figure illustrates the geographical distribution and regional aggregates of water operator sharing for the 798 community water systems for which data were available.

Another interviewee added:

> *"We don't make a profit off of (customer). We just pass on the rates and they pay us. We just bill them for their portion of the bill and we tell them what percentage and what gallon usage they've used and they just pay us at their monthly meeting. So, we're just passing the water on to them. The terms between the two communities are very friendly and very, very cooperative."*

Wholesalers also note that sometimes their own systems benefit from selling water to neighboring communities as it helps raise revenues. Wholesalers also recognize the benefits of economies of scale and using the existing capacity of their treatment plants or distribution systems. Representatives from wholesalers also noted that larger systems have more administrative and technical capacity:

> *"We've chosen to collaborate by wholesaling to neighboring communities to generate revenue and use more of our treatment capacity."*

Another interviewee added:

> *"Certainly, wholesale customers are good for holding prices stable inside the city. I mean, we deliver the water at a master meter, and that's the end of our responsibility. And you're charging as much or more than actually having to set a meter and maintain that distribution infrastructure…I think they're good to spread costs. I think they're good for everybody to be able to take advantage of those economies of scale and keep prices down for both the city customers as well as the wholesale customers."*

Further, a municipal representative explained:

> *"The pros to having the larger water provider expand is that we're obviously able to utilize the economies of scales, and we think we'll be able to do things at a higher level in terms of employing more technical professionals and implementing more consistent treatment practices than you'd be able to do at a reduced scale or a smaller community. So, we think the product that we have to offer is a superior product, and we're able to do it more consistently."*

9.2.2. Districts, Commissions, & Cooperatives

Across NCSI, communities also engage in formal arrangements with water districts, commissions, and cooperatives that are private 501(c)12 utilities. For some communities, these arrangements are beneficial because rates can be negotiated to be consistent over time, even if they may change later. One municipal representative whose community purchases from a cooperative said:

"Financially, it was cheaper for us to go with the water corporation because they locked us in for 10 years at a three percent rate increase every year. So, I said we can't beat that. Now, at the end of the 10 years are they going to woo-hoo (raise prices)? I don't know it might be but…our minimum water and sewage bill would've had to have been at least $80.00 a month in order to catch up to how far behind we were."

Another community was faced with the cost of building a new well to deal with water quality issues when they had the opportunity to connect to a rural water district. While the water is high quality, that connection has come with higher consumer costs and concerns about how to set affordable rates and raise revenue for system maintenance.

9.2.3. Operator Sharing

Municipal representatives also discussed ways in which communities share water operators and have other types of intergovernmental arrangements that benefit their communities by sharing resources:

"We have 5 or 6 other municipalities that came together and built a water treatment plant. Ours and theirs were so outdated the villages were unable to maintain the cost of repairs. Our Water Supervisor also helps other communities in need of an operator with a license. He can prepare the water samples that are required by law."

Another interviewee added:

"Our Certified Water Operator works full time for (City 1), part-time for (City 2) and part-time for (City 3). He is very good at what he does and has been a true blessing to our community. With that said, quality work comes at a cost!"

In addition, a municipal representative said:

"*We have IGAs for emergency interconnection purposes. We have chosen to collaborate on interconnections to ensure water sustainability in emergencies."*

9.2.3. Informal Collaboration

One type of informal intergovernmental coordination is benchmarking, or comparing proposed rate increases to neighboring communities. Part of this informal collaboration also involves engagement and connections between regional leaders. Interviewees discussed engagement in professional associations to connect and share information. For example, one representative discussed the benefits of being part of a County Managers Association:

"The Mayor's Association that I mentioned, that's the group where in (local) County we share all of our rates. We share lots of information, from water rates to what equipment we have that another town–we do a lot of sharing of equipment between towns. So, you don't have to buy every piece of equipment. We'll buy this one, you buy that one. And then if we need the other one, we can sort of share through intergovernmental agreements. But that's the way we share water rates with the other mayors and other villages and cities in (our) County."

10. SUMMARY & RECOMMENDATIONS

10.1. SUMMARY

This report examined the rate-setting process across Northwestern, Central, and Southern Illinois (NCSI), made possible through immense primary data collection efforts. The GFRC researchers constructed an original dataset of water rates directly collected from communities between July 2023 and March 2024, as well as data operationalized by coding municipal ordinances and official websites and communicating with municipal clerks, treasurers, public work directors, and mayors. Through this effort of contacting 859 municipalities where residents receive water from municipal systems or water commissions and districts, the GFRC researchers were able to collect water rates from 595 (70%) communities. This water rate collection initiative is the largest in Illinois and only the third effort among researchers nationwide to collect water rate data spanning an entire US state.[225,226] Figure 10.1 illustrates the general water rate-setting process in both NCSI and the Lake Michigan Service Area (LMSA) of Northeastern Illinois.

A municipality's water source plays a critical role in rate setting. Across NCSI, over 56% of municipalities (571) rely on self-produced groundwater, while about 21% of municipalities (210) purchase surface water. Over 12% of municipalities (122) purchase groundwater and about 11% of municipalities self-produce surface water. In NCSI, groundwater and purchased surface water are most prevalent in the Northwestern (90%) and Southern (48%) regions.

Rate structures vary across NCSI, with over 93% using a two-part rate structure and only 4% using a flat rate structure, followed by less than 3% solely using a volumetric rate structure. Bills were standardized to a 5,000-gallon monthly consumption rate to compare water rates across the region. Scales Mound Village offers the lowest residential water rate in NCSI at $11, while Makanda Village offers the highest at $155. The average monthly water bill is about $48. Purchased water is more expensive than self-produced water, with the average bill from a groundwater producer equal to about $45 compared to $55 from a municipality purchasing groundwater. Similarly, the average bill from a surface water producer equals $50 compared to over $53 from a municipality purchasing surface water. Variation in rate structures across municipalities is reflected in NCSI residents' bills.

[225] Ahmed Rachid El-Khattabi, Kyra Gmoser-Daskalakis, and Gregory Pierce, "Keep Your Head Above Water: Explaining Disparities in Local Drinking Water Bills," *PLOS Water* 2, no. 12 (December 21, 2023): e0000190, https://doi.org/10.1371/journal.pwat.0000190.

[226] Richard E. Thorsten, Shadi Eskaf, and Jeffrey Hughes, "Cost Plus," *Public Works Management & Policy* 13, no. 3 (October 7, 2008): 224–38, https://doi.org/10.1177/1087724x08324302.

Figure 10.1 General Water Rate Setting Process across NCSI and LMSA

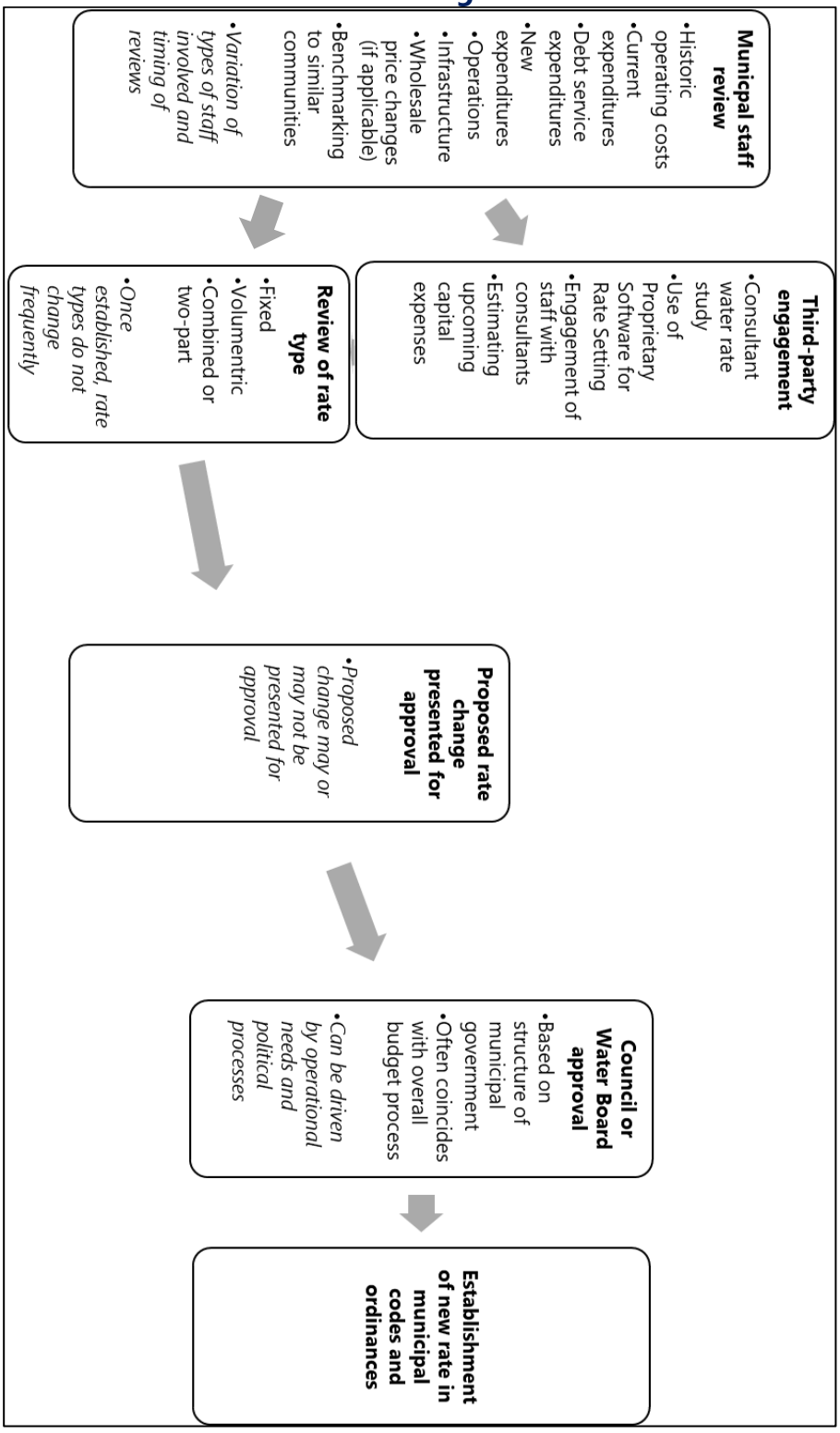


Figure 10.1 was developed based on findings from municipal documents, ordinances, and semi-structured interviews. The rate-setting process shown is a general overview of

the steps a municipality may take to review and adjust water rates. Water rate increases are needed to maintain systems properly, but the process is also political. Sometimes, inaction or delays to avoid election losses leave systems dealing with higher inefficiencies and, consequently, higher costs to address problems. Also, government leaders in disadvantaged communities can exhibit strong resistance to water rate increases to maintain affordability for their residents, which further impedes the ability of systems to maintain operations and infrastructure. This reluctance was communicated by community water system managers and examined in statistical models presented in this report. However, in NCSI, there is no statistically significant association between median household income (MHI) and monthly bills. The lack of a statistically significant relationship is still present when examining disadvantaged communities (DAC, defined as containing a qualified census tract) and non-DAC municipalities separately.

Results from interviews with municipal representatives indicated that variations in rate-setting practices and personnel involved are driven by the frequency and time frame of rate increases, as well as the use of benchmarking and the reliance on third-party consultants. Across NCSI, some communities will proactively adjust rates to meet operational needs, while some utility managers meet political opposition to incremental increases that later result in large reactive rate changes. In addition, when some communities pursue funding for system or infrastructure improvements through state revolving fund (SRF) loans, they are often required to raise their rates to be eligible.

Throughout this research, a few contingencies were mentioned that could complicate the rate-setting process, including:

- Although third-party consultants may be involved, the municipal board may or may not consider these studies when rate changes need approval.
- Tensions can arise in this process when the proposed rates are brought to the board for approval and ultimately are not approved. Municipal staff then may decide to present a smaller rate increase or manage their system with the current rate, even if it does not cover operational costs.
- Rate increases must be established in new codes and ordinances, and the process from approval to codification can be slowed down or stalled entirely.

Municipalities across NCSI do not have a single working definition of affordability. Rather, they often rely on benchmarking or comparing the amount they charge their customers to what other communities are charging. EPA and the literature on affordability offer measures such as the share of income spent on a standardized water bill in relation to median income household for the area or for those below the 20th percentile income level. While these provide a snapshot of the water burden across NCSI, municipalities often lack the capacity to undertake these analyses.

Regional challenges and opportunities that are cross-jurisdictional in nature require a higher degree of collaboration in the absence of a central governing authority, especially across NCSI, which has a variety of community sizes and sources of production and provision. Several intergovernmental coordination mechanisms emerge as opportunities to establish rate-setting processes. Informal coordination facilitates information sharing and provides a unified approach to dealing with challenges. The benefits of formal collaboration through water commissions and districts are even greater, as these entities can play an important role in co-financing costly infrastructure projects. Especially beneficial for communities in NCSI is the opportunity to share water system operators, most prevalent in central Illinois, where over 70% of municipalities share at least one operator, and southern Illinois, where 60% share at least one operator.

This report discussed findings across several key themes: the rate-setting process, challenges in rate-setting among disadvantaged communities, reasons for rate increases, the role of federal and state policy in rate-setting, water bill components, intergovernmental coordination as a means of increasing equitable rate-setting, and the definition of affordability across NCSI. These themes are heavily interconnected. For example, it is impossible to discuss rate-setting without examining infrastructure financing, which directly relates to water rate increases and state policies. In turn, examining financing leads to investigating access to funds by disadvantaged communities.

Community water systems have the complex challenge of balancing the costs of maintaining their systems and charging an affordable rate for safe drinking water. As such, the recommendations presented in this section do not address one report theme at a time but rather recognize the interconnectedness of affordability, sustainable operations and maintenance, and applications of policy and regulation.

10.2. POLICY AND PROGRAM RECOMMENDATIONS

10.2.1. Ensuring Communication Standards for Water Bills

Households receive water bills on a regular basis, and this represents the primary interaction that households have with their water providers. However, water bills could convey billing information more clearly and comprehensively to the public. Using water bills as a public outreach and communication tool may improve trust between the public and water providers, as well as allow customers to budget for and consume water more efficiently. To achieve these goals, it is recommended to:

1. **Establish regional or state-level support for comprehensive water bills to be provided in all communities.** Some communities may need technical and financial assistance to implement best practices for water billing to increase billing frequencies, promote the adoption of automatic billing systems and meter

reading technologies, and include standards for transparent billing that clearly shows water usage.

2. **Use clear and accessible language in billing**. Replacing technical terms with plain language and thorough descriptions of charges and graphics could be used and standardized across the state to help customers better interpret their usage.
3. **Include and itemize all charges that contribute to the total amount owed for water services on consumer water bills.** Comprehensive information is important for transparency and may increase trust in municipal water systems. Conveying information about the levels of fixed and variable charges may help customers better understand how their household's water consumption will impact future bills.
4. **Clearly separate charges unrelated to water or wastewater services as additional line items from the total water bill, if they must be included.** Detailed listing of charges can allow for clearer household water service price signals.
5. **Provide comparisons of water use between individual household bills** and average usage in the households' neighborhood to motivate conservation behaviors in heavy water users. Bills can include figures and descriptions of household water use levels over time so households can better understand how variations in their own consumption directly translate into water bill charges. Visualizations of the billing unit of water charges relative to commonly understood water units can help households better understand their water consumption charges.

10.2.2. Increasing Municipal Capacity, Expertise, & Knowledge

Many municipalities shared their challenges when lacking the basic capacity to address their community's and water system's needs. Municipalities expressed the need for opportunities to build their capacity for proper cost-of-service model implementation, daily system operations, administrative support for billing, and infrastructure needs. The US EPA offers capacity-building resources for "small drinking water systems," and these could be utilized more broadly.[227] As such, it is recommended to:

1. **Provide templates, web hosting services, and technical assistance for communities to establish municipal websites.** Smaller, rural communities in NCSI often have limited or no Internet presence. Currently, Illinois lacks a comprehensive statewide program dedicated to supporting or funding municipal websites. Developing such websites would provide municipalities with a cost-effective and efficient way to deliver clear and comprehensive information to the public, including sharing up-to-date ordinances on water rates, system details,

[227] US Environmental Protection Agency, "Learn About Capacity Development," September 25, 2024, https://www.epa.gov/dwcapacity/learn-about-capacity-development.

billing practices, and water quality while also serving as a reliable resource for community water rate benchmarking and delivering emergency notifications.

2. **Support municipalities to build capacity to understand community concerns about water affordability and water quality**. Providing resources for municipalities to gather data and conduct analyses may be a first step to helping communities better understand how citizens fit water bills into their household budgets, to what degree households could absorb water rate increases in the future, and/or whether residents are willing to pay more for improved water quality or customer service.
3. **Establish guidelines for municipalities to track information related to residential customers' difficulties with paying their water bills**. These metrics could include water disconnects, liens placed on real estate, and late payment penalties.
4. **Host regional and state-wide convenings of water operators, municipal leaders, elected officials, and citizens to discuss definitions and challenges with setting affordable water rates.** In Illinois, there are several organizations that convene community water system professionals, but the emphasis is often on the technical aspects of providing high-quality drinking water. More opportunities exist for wider engagement in state-wide and nationwide agenda-setting for water affordability policies.

Many municipalities reported lacking capacity for financial management and capital planning. This study's findings suggest a wide variety of practices that municipalities use for managing their water funds and planning for infrastructure improvements. Given a lack of consistency, it is recommended to:

5. **Develop recommendations for "rainy day" funds for water systems.** Establishing a sustainable water fund balance can be an important financial management tool for municipalities to prevent sudden rate increases resulting from emergency repairs or seasonal changes in demand. State-level guidance might broadly improve the financial health of municipal water systems by encouraging municipalities to build sufficient reserves for infrastructure improvements while protecting consumers from sudden, significant rate hikes.
6. **Provide additional support for financial planning by disadvantaged communities when creating system improvement plans**. Especially for municipalities with a high percentage of water system loss, these plans can help municipalities financially prepare for infrastructure improvements and better understand their financing options.

The findings from this study indicate that enhanced capacity is needed for rate setting that balances residents' ability to pay with capital improvement needs and system operations. It is recommended to:

7. **Provide state-level technical assistance to municipalities for establishing contingency plans to mitigate the impacts of unforeseen cost shocks**, such as natural disasters or sudden infrastructure failures. Although these types of plans are required by the EPA by 2025, there are opportunities for municipalities to receive more support in creating their plans. Provide additional technical and administrative support for small and rural communities that struggle with planning for infrastructure upgrades due to limited resources and capacity.
8. **Assist municipalities with investing in innovative and new technology through low-cost or no-cost financing to make water provision more efficient.** The technology could include smart meters and advanced system leak detection for many small or rural communities that have neither of these systems. These innovations could be supported through a technology levy on water rates, government grants, or public-private partnerships.

10.2.3. Establishing Strategic Investment & Support for Disadvantaged Communities

Given differences in water provision and delivery costs across municipalities, expecting all households to pay a similar water rate is not feasible. Lower-income individuals and households may not be able to afford a water rate that guarantees financial sustainability of the water system. Since water systems are generally funded by taxpayers and water ratepayers, the social and economic composition of municipalities heavily influences the level of resources available to municipal water operators. It is recommended to:

1. **Provide water affordability program information more broadly to engage households with the greatest need for water assistance.**
2. **Codify processes in municipal ordinances and communicate them to the public** where municipalities provide flexibility in repayment of past-due bills or penalties for nonpayment to ensure equal access where leniency is possible.
3. **Decrease the administrative burden of intergovernmental coordination to allow water systems in lower-resourced communities to benefit from various sources of state financing and intergovernmental coordination.** This could include additional support to initiate participation in relevant initiatives and strengthen financial programs such as state revolving funds or other types of low-interest programs.
4. **Increase low-cost loans or grants to communities for technical assistance.** This could include support for regular system audits and inspections, engaging third-party consultants, and preparing needed engineering plans to access

funding opportunities and ensure proactive improvements rather than reacting to catastrophic issues that require large water rate increases.

10.2.4. Enhancing State-Level Policies & Programs

Few water providers offer payment assistance programs for low-income or otherwise at-risk households. Due to the fragmented nature of the water systems in NCSI, there can be a significant burden for citizens to find information about and apply for these programs. At the municipal level, public outreach alone might not be effective in raising awareness about programs and eligibility for enrollment. To improve consumer affordability and enhance system sustainability, it is recommended to:

1. **Consider a state-level affordability program.** This type of program would be most successful if co-designed with municipal representatives from various communities across NCSI and the state. A streamlined program might increase equitable access, ensuring low-income households are eligible regardless of where they live. This would also benefit households moving between municipalities.
2. **Reduce barriers for application procedures for state and federal infrastructure support.** Reducing the upfront costs of engineering plans and other administrative burdens could increase financing access across NCSI, particularly for water systems servicing smaller and/or lower-income customer bases in rural areas. State revolving fund (SRF) loan programs could offer lower barriers to applications to help municipalities upgrade infrastructure, particularly with the growing costs of lead service line replacements and PFAS compliance.
3. **Consider coordinated and co-financed infrastructure programs**, especially for disadvantaged communities and others in geographically isolated areas that cannot benefit from economies of scale through collaboratively creating water commissions or districts. These programs would support consistent and targeted efforts to address aging infrastructure from a regional or statewide view.

10.2.5. Increasing Support for Intergovernmental Coordination

Intergovernmental coordination can take many forms, and it is important to understand these coordination options in the appropriate context as they relate to municipal drinking water systems, water system governance, and specific types of communities. Overall, there are opportunities to enhance existing coordination and cooperation and develop new forms of collaboration between government organizations that govern or support the provision of drinking water in NCSI and the state. It is recommended to:

1. **Continue to increase communication and coordination between wholesalers of all kinds and purchasers.** More coordination and engagement from wholesalers could increase accountability and transparency in setting wholesale rates. Specifically, the AWWA's cost-of-service water rate methodology could be

more readily utilized by wholesalers, water commissions, water districts, and 501c(12) utilities.

2. **Archive and make publicly available intergovernmental agreements between wholesalers and purchasers.** This type of information source would enable consistency and transparency, as well as offer a resource for municipalities who may be considering engaging in an agreement for water provision.
3. **Mitigate coordination risks with more readily available grants or low-interest loans** to support the initial costs of infrastructure and coordination to establish intergovernmental agreements, water commissions, or districts. While there are benefits to intergovernmental coordination, smaller and lower-resourced communities discussed significant concerns about the initial financial burdens.
4. **Establish a system for training a network of experienced water operators who can be shared.** Currently, there is little specific training for shared water operators despite the unique administrative and operational challenges of serving multiple municipalities.

10.2.6. Facilitating Consistent Data Collection

Water providers across NCSI draft and enforce water policy and carry out operations. While this autonomy allows municipal water utilities to tailor services and water rates to their communities, this level of fragmentation can also lead to drawbacks for water customers. Primarily, there is a lack of publicly available data on water rates, the rate-setting process, billing practices, and policies related to intergovernmental coordination, including information on wholesale agreements.

Reporting water rate data and other indicators associated with household water affordability are mandated at the state level in some states, including California and Illinois.[228] However, these requirements are limited to private water utilities only.[229] Recently, New Jersey passed legislation requiring the reporting of monthly data at the zip-code level for all public and private water systems.[230] Reporting requirements include monthly water rates, average and median customer bills, usage, and number of customers, as well as disconnects and tax liens due to non-payment of water bills.[231] In contrast, municipal water providers in Illinois are not required to report any of these types of data. It is recommended to:

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[228] Larry Levine, "Water Vs. Energy: Solving the COVID-19 Utility Crisis," Natural Resource Defense Council, March 6, 2024, https://www.nrdc.org/bio/larry-levine/water-vs-energy-solving-covid-19-utility-crisis.
[229] Ibid.
[230] Dana DiFilippo, "New Law Aims to Improve Water, Utility Affordability in Requiring Public Reporting," New Jersey Monitor, September 20, 2022, https://newjerseymonitor.com/2022/09/20/new-law-aims-to-improve-water-utility-affordability-in-requiring-public-reporting/.
[231] Ibid.

1. **Strategically use existing tools and software for data collection.** Currently, some municipalities that are allocated water from Lake Michigan through the Illinois Department of Natural Resources (IDNR) utilize the American Water Works Association (AWWA) Free Water Audit Software (FWAS), but more communities across the state, regardless of water source, could be trained to use this free tool.
2. **Support additional data collection processes and platforms designed with municipal input.** To facilitate many of the other recommendations in this report, accurate data needs to be collected; however, the process and platforms for this data collection effort could be co-created with a variety of municipal leaders to encourage usability. Data collection and processes currently used by the Illinois Commerce Commission (ICC) could provide a starting point for this recommendation.
3. **Develop data dashboards and educational tools for municipal leaders, policymakers, and consumers**. Online dashboards and educational tools can be created to enhance transparency and encourage regional and statewide usage of water-related data. These tools would enable municipal leaders to continue data-driven benchmarking, encourage lawmakers to use data to support adjustments to policies and programs, and educate consumers about the cost and complexity of drinking water provision.

10. 3 Implementation

Often, the most challenging step towards effecting positive change is the implementation of new approaches. This section provides suggestions for possible implementation steps. Table 10.1 offers suggested agencies or levels of government that could lead implementation, supporting partner organizations, timeframes for implementation to begin, and potential ways to finance the recommendations. This table of implementation recommendations was designed by the GFRC researchers, with consultation from the advisory committee members.

Organizations and agencies listed in Table 10.1 are suggestions only, and inclusion does not constitute an endorsement of the recommendations or suggested implementation approaches. As shown in Table 10.1, implementation recommendations are aligned with the overall recommendations based on the findings in this report. Implementation practices should include all relevant stakeholders, as determined by lead agencies and organizations.

Table 10.1. Suggested Recommendation Implementation Approaches

Recommendation	Lead Implementor	Supporting Agencies	Timeframe	Potential Financing
Ensuring Communication Standards				
Model Water Bill Language	Municipalities	IL AWWA, ILCMA, IML	As Soon As Possible	---
Include All Itemized Charges on Water Bill	Municipalities	IGFOA, ILARC, Mayor and Managers Associations	As Soon As Possible	---
Separate Other Charges from Water Charges	Municipalities	IGFOA, ILARC, Mayor and Managers Associations	As Soon As Possible	---
Compare Water Use on Water Bill	Municipalities	IEPA, ILARC, Mayor and Managers Associations	As Soon As Possible	---
Increasing Municipal Capacity				
Provide Templates and Web Hosting Support	Municipalities, IML	IML, ILCMA, Regional Economic Development Groups	As soon as Possible	---
Examine Community Concerns About Water Affordability and Quality	Municipalities, IEPA	Nonprofit Advocacy Organizations, ILARC, Mayor and Managers Association	3 Years	National And Community Foundations, US Water Alliance Partnerships
Develop Guidelines for Tracking Challenges with Paying Water Bills	Municipalities	IGFOA, ISWS	3 Years	---
Offer Regional And State-Wide Convenings to Understand Affordability	IEPA, IL AWWA	IRWA, US Water Alliance Water Equity Network	Ongoing	Municipal And Professional Associations
Provide Guidance For Rainy Day Fund Best Practices	IGFOA	ILCMA, IML	3 Years	---
Offer Additional Technical Assistance for Emergency Contingency Planning	IEMA, IEPA	ILARC, Mayor and Managers Association	3 Years	IEMA/FEMA Preparedness Grants

Recommendation	Lead Implementor	Supporting Agencies	Timeframe	Potential Financing
Support Innovation and Investment in Efficient Technology	DPI, Illinois Innovation Network	IEPA	5 to 10 Years	IL SRF PWSLP, National and Community Foundations, US EDA
Establishing Investment and Support for Disadvantaged Communities (DACs)				
Provide Affordability Program Information More Broadly	Municipalities	Nonprofit Advocacy Organizations	As Soon As Possible	---
Codify And Communicate Processes for Bill Repayment	Municipalities	ILCMA, IML	As Soon As Possible	---
Decrease Administrative Burden for Intergovernmental Aid Applications	IEPA, USDA RDWP	American Council of Engineering Companies, Regional Water Rate Study Consultant Firms	3 Years	IL SRF PWSLP, USDA RDWP
Offer Low-Cost Loans or Grants for Technical Assistance to DACs	IEPA, USDA RDWP	Illinois Finance Authority	3 Years	IL SRF PWSLP, USDA RDWP
Enhancing State-Level Policies and Programs				
Develop State-Level Affordability Program Pilot	IDHS	Nonprofit Advocacy and Planning Organizations	2 Years	More Ideation and Development of This Type of Program Is Needed
Reduce Engineering Plan Barriers for Grant and Loan Application Procedures	IEPA, USDA RDWP	American Council of Engineering Companies, Regional Water Rate Study Consultant Firms	As Soon As Possible	IL SRF PWSLP

Recommendation	Lead Implementor	Supporting Agencies	Timeframe	Potential Financing
Coordinate And Co-Finance Infrastructure Programs	Municipalities	Illinois Finance Authority	Ongoing	WIFIA, IL SRF PWSLP, ESG Bonds Through IFA
Increasing Support for Intergovernmental Coordination				
Continue Communication and Coordination of Wholesalers and Purchasers	NCSI Wholesaler CWS, Water Commissions	Mayor and Managers Associations, IL AWWA	Ongoing	---
Develop Archive of Intergovernmental Agreements	IL Secretary of State	ILARC, Mayor and Managers Associations	3 Years	State Appropriation
Coordinate And Co-Finance Infrastructure Programs	Municipalities	Illinois Finance Authority	Ongoing	WIFIA, IL SRF PWSLP, ESG Bonds Through IFA
Provide Low-Cost Loans or Grants to Support Initial Costs of Additional Infrastructure and Coordination to Water Commissions	IEPA	Illinois Finance Authority	Ongoing	WIFIA, IL SRF PWSLP
Establish Training and Network of Experienced Operators for Sharing	IL AWWA	IEPA	3 years	---
Facilitating Consistent Data Collection				
Use Existing Tools and Software and Training	IL AWWA	ILCMA, IGFOA	As Soon As Possible	Sponsorships
Design Data Collection Processes and Data Platform	IEPA, ISWS	IISG, PRI, UIC GFRC	As Soon As Possible	State Appropriation
Create Data Dashboard and Education Tools for Municipalities, Policymakers, And Residents	IEPA	IISG, PRI, UIC GFRC	2 To 3 Years	State Appropriation

10.4 CONCLUDING REMARKS

Any questions or comments related to this report should be directed to the Principal Investigator, Dr. Deborah A. Carroll. She can be reached at deborahc@uic.edu. The researchers at the University of Illinois Chicago's Government Finance Research Center (GFRC) are committed to providing innovative and unbiased public finance research that shapes and informs public policy and scholarly discourse. Thank you for working with us to make government agencies and nonprofit organizations work better to improve the fiscal health of our communities.

APPENDICES

Appendix A. Statistics and Regression Results for Water Rates Analysis

Table A.1. Summary Statistics

Variables	Mean	Std. Dev.	Min	Max	N	Count	%
Water Bill ($/5,000 Gallons)	48.07	20.08	11.50	154.88	595		
Social, Demographic, and Community Characteristics							
Median HH Income ($10,000)	6.19	1.64	2.74	14.54	592		
GINI	0.40	0.06	0.24	0.65	595		
Average Household Size (occupied)	2.43	0.31	1.63	4.73	595		
Black or Latino (%)	6.88	9.52	0	90.59	595		
Median Age	40.72	5.74	24.80	62.10	595		
Billing Policy							
Sewer Service (Y=1)			0	1	595	460	77.31
Sewer Bill ($/5,000 Gallons)	29.16	24.06	0	260.16	594		
Billing Frequency: Monthly (Y=1)			0	1	595	541	90.92
Billing Frequency: Bimonthly (Y=1)			0	1	595	33	5.55
Billing Frequency: Quarterly/Annual (Y=1)			0	1	595	21	3.53
Billing Structure: Uniform Volumetric			0	1	595	427	71.76
Billing Structure: Flat Rate			0	1	595	25	4.20
Billing Structure: Block Rate			0	1	595	143	24.03
Minimum Bill ($)	20.71	15.27	0	130	595		
Water Bill Lag	48.11	7.76	27.78	74.03	588		
Population, Municipal Finance, and Governance							
Population Density (100/sq. mile)	11.90	6.16	0.72	49.15	595		
Municipal Water Expenditures ($100k)	7.43	17.36	0.19	199.71	595		
SRF Loans Forgiven (%)	9.45	18.89	0	100	595		
Water System Characteristics							
Contaminant Violation: None			0	1	595	368	61.85
Contaminant Violation: Low-Cost			0	1	595	38	6.39
Contaminant Violation: Moderate-Cost			0	1	595	76	12.77
Contaminant Violation: High-Cost			0	1	595	113	18.99
Consumer Confidence			0	1	589	79	13.41
Treatment Plant (Y=1)			0	1	595	451	75.80
Wholesaler (Y=1)			0	1	595	52	8.74
Purchases Groundwater (Y=1)			0	1	595	53	9.01
Produces Groundwater (Y=1)			0	1	595	398	67.69
Purchases Surface Water (Y=1)			0	1	595	137	23.30
Produces Surface Water (Y=1)			0	1	595	53	9.01

Regression Results

Several tests were used to determine whether a HLM regression yields an improved fit. The HLM with restricted maximum likelihood estimation (REML) revealed significant variability in intercepts across the different categories of water source acquisition. The estimated variance of the random intercept for the purchase/source grouping variable yielded a value of 20.45 (95% CI: 3.15–132.78), indicating heterogeneity in baseline water rates between categories. This result suggests that water rates vary significantly across grouping categories beyond the effects of the exogenous variables in level 1 of the model.

The likelihood ratio (LR) test against the linear model provided further evidence for the superiority of the HLM approach with a $\chi 2$ value of 229.76 (p<0.0000) supporting the use of a hierarchical model. These findings suggest that while the level 1 predictors explain a significant portion of the variability in water rates, additional factors at the category level contribute to the observed differences in water rates. Table 3 presents the predicted random effects of level 2 in the model. Results confirm that the groundwater producer municipalities deviate negatively from the mean. On average, groundwater producers charge approximately $5.67 less per month than the average across all municipalities. Furthermore, municipalities that source from surface water charge more for water, with municipalities relying on purchased surface water, charging $3.92 more per month than the sample average.

Table A.2. Predicted Random Effects

Purchaser & Source Water Category	Predicted Random Effects	
Groundwater Producer	-5.67	
Groundwater Purchaser	0.09	
Surface Water or Mixed Producer	3.03	
Surface Water or Mixed Purchaser	2.73	
	Estimate	Standard Error
RE Variance (Constant)	20.45	19.52
RE Variance (Residual)	276.44	16.63
Observations	579	
Number of groups	4	

Table A.3. Multilevel Regression Model Coefficients

	Coefficients	Standard Errors
Social & Demographic Characteristics		
Median HH Income ($10,000)	-0.190	(0.531)
GINI	12.312	(14.437)
Average household size (occupied units)	5.756	(2.948)
Black or Latino (%)	-0.216**	(0.084)
Median Age	0.031	(0.153)
Water Billing Policy		
Sewer Service	-4.159*	(2.300)
Sewer Rates	0.092**	(0.039)
Billing Frequency: Bimonthly	-8.431***	(3.155)
Billing Frequency: Quarterly	-21.691***	(4.000)
Water Billing Structure: Flat Rate	-14.985***	(3.606)
Water Billing Structure: Block Rate	-2.792	(1.749)
Minimum Bill ($)	0.597***	(0.051)
Water Bill Lag	0.313***	(0.097)
Municipal Finance & Governance		
Population Density (100s)	0.0.391***	(0.127)
Water Utility Expenditures ($100k)	0.026	(0.057)
SRF Total Value (Millions USD)	0.366*	(0.180)
SRF Forgiven (%)	-0.007	(0.038)
Water System & Source Characteristics		
Contaminant Violation: Low-Cost	-3.053	(2.946)
Contaminant Violation: Moderate-Cost	-0.734	(2.203)
Contaminant Violation: High-Cost	-2.865	(1.908)
Consumer Confidence	3.500*	(2.095)
Treatment Plant (Y=1)	2.9167	(2.638)
Wholesaler (Y=1)	-4.572*	(2.745)
Constant	4.04	(14.69)
Observations	579	
Number of groups	4	

Note: The dependent variable is water bills ($) standardized to 5,000 gallons/month. Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1.

Appendix B. Statistics and Regression Results for Municipal Ordinance Analysis

Table B.1. Deposit Value Regression Results

Deposit Value	Coefficient
(Intercept)	72.317* (38.161)
MHI ($10,000s)	0.868 (3.481)
% Poverty	1.268* (0.675)
% Black or Latino	-0.712 (0.458)
% College Educated	-0.545 (0.413)
% Elder Status (65+ years)	0.047 (0.75)
Square Miles (10s)	13.595 (8.602)
Population Density (100/Sq. Mile)	0.135 (0.603)
Annual Facility Pumpage (100 Million Gallons)	0.007 (0.09)
State Revolving Funds ($ Million since 2008)	-1.593*** (0.61)
Formal Facility Action Count	3.864 (10.884)
Wholesale Purchaser	18.822** (7.786)
Water + Sewer Bill ($/Month)	0.171 (0.116)
Sewer Service Provided	-2.169 (10.007)
Dispute Procedures	-4.367 (6.886)
Water Included in Minimum Bill (Gallons/Month)	2.881 (3.836)
Days until Water Bill Due	-0.924** (0.451)
R-squared	0.109
Adjusted R-squared	0.063
Model p-value	0.005
N	306

Note: Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1.

Table B.2. Days until Water System Punitive Action Regression Results

	Days until Delinquent	Days to Shut Off	Days to Lien
(Intercept)	24.079*** (3.409)	27.714*** (6.561)	51.042*** (10.088)
MHI ($10,000)	-0.024 (0.352)	0.546 (0.68)	0.129 (0.983)
% Black or Latino	0.056 (0.058)	0.237* (0.109)	0.053 (0.16)
% Elder Status (65+ years)	-0.215** (0.088)	0.100 (0.176)	0.491* (0.253)
% College Educated	0.059 (0.051)	0.161 (0.098)	0.103 (0.145)
Square Miles (10s)	-0.551 (1.093)	-3.473. (2.043)	-4.464* (2.642)
Population Density (100/Sq. Mile)	-0.084 (0.072)	-0.013 (0.138)	-0.521** (0.208)
Wholesale Purchaser	-1.111 (1.024)	-4.484** (1.932)	
Annual Facility Pumpage (100M Gals)	-0.015 (0.011)	0.013 (0.021)	0.076** (0.033)
Formal Facility Action Count	3.49** (1.397)	9.428*** (2.665)	7.513* (3.824)
Source Water Protected	1.352 (0.872)	0.958 (1.656)	-5.515** (2.424)
VOCs	6.32** (3.099)		
State Revolving Funds ($Millions since 2008)		-0.04 (0.16)	
Water Included in Minimum Bill (Gals/Mo.)	1.063** (0.459)	1.679* (0.914)	-0.234 (1.35)
Water + Sewer Bill ($/Month)	-0.009 (0.015)	-0.029 (0.029)	-0.082** (0.042)
Sewer Service Provided	-1.611 (1.228)	-1.627 (2.429)	3.645 (3.556)
Deposit Value ($)	-0.015** (0.007)		0.028 (0.019)
Restoration of Service Fee ($)	0.01 (0.014)		-0.104*** (0.039)
Bimonthly Billing	-0.032 (1.625)	1.952 (3.142)	-3.661 (4.577)
Quarterly Billing	3.826* (2.091)	0.309 (4.123)	2.247 (6.494)
Dispute Procedures		-3.834** (1.662)	-1.195 (2.491)
Adjusted R-squared	0.097	0.083	0.085
Model p-value	0.000	0.000	0.002
N	332	320	275

Note: Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1.

Table B.3. Summary Statistics for Water Service Charges & Past Due Water Bills

Variable Description	Obs.	Mean	Std. Dev.	Min	Max
Deposit Amount Required ($)	308	76.11	59.78	0.0	350
Days After Customer Considered Delinquent	335	19.29	7.58	7	50
Delinquency Charge (% Bill)	290	9.99	3.18	1.5	21.0
Delinquency Value ($)	41	15.19	9.57	4	50.0
Days Until Lien Proceedings May Commence	280	49.00	22.00	0	180
Days After Bill Water Is Shut Off	323	34.63	14.37	11	105
Reconnection Fee After Shutoff	325	49.98	28.05	5	200

Table B.4. Procedural Transparency and Affordability in Municipal Ordinances

		Frequency	Percent
Payment Assistance	Detailed repayment plan schedule	14	3.86
	Repayment plan alluded to, but not detailed	7	1.93
	No mention of payment plan	342	94.21
Assistance Program in Ordinances	Yes	26	7.16
Process Outlined for Disputing Water Bills	Not mentioned	156	43.09
	Yes and well defined	142	39.23
	Mentioned but not detailed	64	17.68
Rates available	Clearly detailed	335	92.80
	Mentioned but not detailed	20	5.54
	Not mentioned	6	1.66
Annual review or audit required	Yes	272	75.56

Appendix C. Typology Creation Steps & Associated Sample Numbers

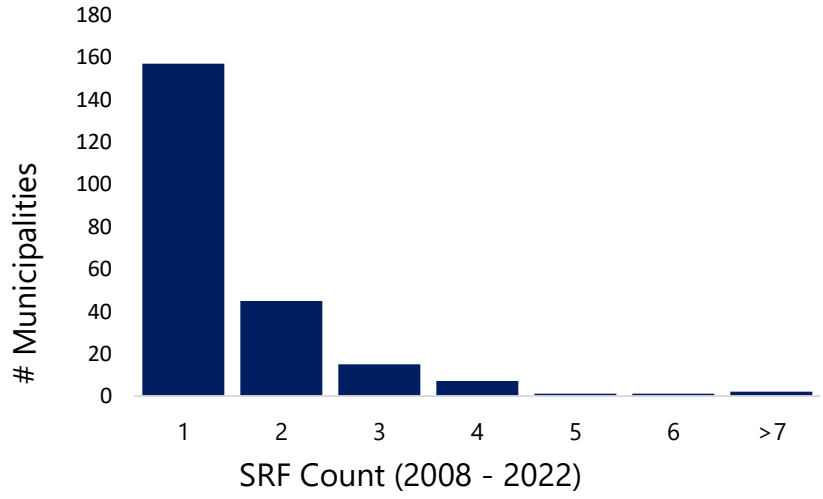
Step 1: The Government Finance Research Center (GFRC) researchers separated municipalities across the NCSI into categories defined first by the source of water for the CWS.

Table C.1. Water Sources

	Number of CWS
Surface	
River	49
Reservoir	134
Mixed source	28
Unspecified	15
Groundwater	
Deep	67
Shallow	417
Mixed source	85
Unspecified	20
Both Surface and Groundwater	
River and groundwater	10
Reservoir and groundwater	28
Mixed surface and groundwater	6
Total	**859**

Step 2: The GFRC researchers then identified which communities had received State Revolving Fund Loans and the number of loans received.

Figure C.1. Frequency Distribution of SRFs Received by Municipality (2008–2022)



Step 3: Next, communities were categorized by their approach to production or provision, and whether they sell water on the wholesale market. Table C.2 provides a breakdown of the number of municipalities in these four categories.

Step 4: Using the categories identified above, the GFRC researchers further divided municipalities based on whether they have 100% more of their population living within a Qualified Census Tract (QCT). Due to the importance of understanding water affordability and the challenges that under-resourced communities have with maintaining affordable water rates and maintaining capital-intensive water systems, the GFRC researchers prioritized the identification of municipalities meeting the100% QCT threshold in each category. The breakdown of this subdivision is found in table C.2.

Table C.2. Producers & Sellers

	100% QCT	< 100% QCT	Total
Produces and Wholesales	0	12	12
Purchases and Wholesales	2	10	12
Produces and Does Not Wholesale	7	529	536
Purchases and Does Not Wholesale	10	289	299
Total			**859**

Step 5: The GFRC researchers examined the distribution of standardized residential water bills to determine municipalities above or below the median water rates.

Table C.3. Water Provider Types & Standardized Bills ($/Month/5000 gallons)

	Min.	Med.	Max.
Produces and Wholesales*	46.00	50.91	55.81
Produces and Does Not Wholesale	11.50	43.01	145.12
Purchase and Wholesales	18.10	31.05	44.00
Purchase and Does Not Wholesale	16.65	50.10	154.88

* The GFRC only collected water rates for 2 municipalities in the NCSI regions that both produced and wholesale water.

Appendix D. List of NCSI Water Commissions, Districts, and Cooperatives

Table D.1. NCSI Water Commissions, Districts, and Cooperatives

Name	Type	Source
Adams County Water District No 1	District	Ground water purchased
Akin Water District	District	Surface water purchased
Alexander Water District	District	Surface water purchased
Alsey-Glasgow Water Commission	Commission	Ground water purchased
Alto Pass Water District	District	Ground water purchased
Anna-Jonesboro Water Commission	Commission	Ground water
Beason Chestnut PWD	District	Ground water
Birds Pinkstaff Water District	District	Ground water purchased
Bismarck Community Water District	District	Ground water
Blairsville PWD	District	Surface water purchased
Bloomington Township PWD West Phase	District	Surface water purchased
Bloomington Township PWD Crestwicke	District	Surface water purchased
Boody Community Water Company	Nonprofit 501c12	Ground water purchased
Broughton Water District	District	Ground water purchased
Brownsville Water Project, Inc	Nonprofit 501c12	Ground water purchased
Buncombe Water District	District	Surface water purchased
Burnside PWD	District	Surface water purchased
Calhoun County RWD	District	Ground water
Camden-Littleton Water Commission	Commission	Ground water purchased
Carlyle Southwest PWD	District	Surface water purchased
Cass Rural Water District	District	Ground water purchased
Caterpillar Trail PWD	District	Ground water
Central Alexander County PWD	District	Ground water purchased
Central Macoupin County RWD	District	Surface water purchased
Clark-Edgar RWD	District	Ground water
Clay County Water Inc.	Nonprofit 501c12	Surface water purchased
Clayton-Camp Point Water Commission	Commission	Ground water
Clinton County East PWD	District	Surface water purchased
Coal Valley PWD	District	Surface water purchased
Corinth PWD	District	Surface water purchased
Curran-Gardner Township PWD	District	Ground water
Dallas Rural Water District	District	Ground water
Devils Kitchen Water District	District	Surface water purchased
Dix-Kell Water Commission	Commission	Surface water purchased
Dunfermline-St David Water Commission	Commission	Surface water purchased
E J Water - Watson	Nonprofit 501c12	Surface water purchased
E J Water- Dewey	Nonprofit 501c12	Ground water
E J Water-Coalton	Nonprofit 501c12	Ground water purchased
E J Water-Montrose	Nonprofit 501c12	Ground water purchased
Eaton PWD	District	Ground water purchased

Name	Type	Source
Edgington Water District	District	Ground water
Elverado Water District	District	Surface water purchased
Ewing-Ina Water Commission	Commission	Surface water purchased
Ferges Water District	District	Surface water purchased
Fort Massac PWD	District	Ground water purchased
Fosterburg PWD	District	Surface water purchased
Fountain Water District	District	Ground water
FSH Water Commission	Commission	Surface water purchased
Gallatin-White Water District	District	Ground water purchased
Gateway Regional Water Company	Nonprofit 501c12	Surface water
Greene County Rwd	District	Ground water purchased
Greenwood-Creek Nation Water Company	Nonprofit 501c12	Surface water purchased
Groveland Township Water District	District	Ground water
Hamilton County Water District	District	Surface water purchased
Hardin County Water District No.1	District	Ground water purchased
Hardinville Water Company	Nonprofit 501c12	Ground water
Heartville Pwd	District	Surface water purchased
Henderson Pwd	District	Surface water purchased
Hennepin Pwd	District	Ground water
Hickory-Kerton Wtr Coop	Nonprofit 501c12	Ground water purchased
Highway 37 North Pwd	District	Surface water purchased
Hill City Water District	District	Surface water purchased
Hoffman Rural Water Company	Nonprofit 501c12	Surface water purchased
Jonesville Pwd	District	Ground water purchased
Kaho Public Water District	District	Surface water purchased
Kaskaskia Water District	District	Surface water
Kinkaid Area Water System	Nonprofit 501c12	Surface water
Lake Mattoon Pwd	District	Ground water purchased
Lake Of Egypt Pwd	District	Surface water
Lakeside Pwd	District	Surface water purchased
Langleyville Pwd	District	Surface water purchased
Liberty-Ledford Pwd	District	Ground water purchased
Lick Creek Pwd	District	Surface water purchased
Limestone-Walters Pwd	District	Ground water purchased
Lost Lake Utility District	District	Ground water
Low Point Water District	District	Ground water
Mcclure-East Cape Pwd	District	Ground water purchased
Meadowbrook Pwd	District	Ground water purchased
Mechanicsburg-Buffalo Water Commission	Commission	Ground water
Mill Creek Pwd	District	Ground water
Millstone Pwd	District	Ground water
Mitchell Pwd	District	Surface water purchased
Mitchellsville Pwd	District	Ground water purchased
Moro Pwd	District	Ground water purchased

Name	Type	Source
Moultrie County Rwd	District	Surface water purchased
Mound Pwd	District	Ground water
Mulkeytown Pwd	District	Surface water purchased
Murdale Pwd	District	Surface water purchased
Murrayville-Woodson Water Commission	Commission	Surface water purchased
New Hope Waterworks Corp	Nonprofit 501c12	Surface water purchased
New Memphis Pwd	District	Surface water purchased
New Salem Pwd	District	Ground water purchased
North East Central Pwd	District	Ground water purchased
North Morgan Water Coop	Nonprofit 501c12	Surface water purchased
North Park Pwd	District	Ground water
North Tazewell Pwd	District	Ground water
Oak Ridge Sanitary District	District	Ground water
Olivet Pwd	District	Ground water purchased
Oraville Water District	District	Surface water purchased
Otter Creek Lake Utilities District	District	Ground water
Otter Lake Water Commission	Commission	Surface water
Palmyra-Modesto Water Commission	Commission	Surface water
Penfield Pwd	District	Ground water
Petrolia Pwd	District	Ground water purchased
Pike County Pwd 1	District	Ground water
Pleasant Valley Pwd	District	Ground water
Plumfield Water District	District	Surface water purchased
Pontoon Beach Pwd	District	Surface water purchased
Prairie Dupont Pwd	District	Surface water purchased
Prospect Water District	District	Surface water purchased
Raleigh Water District	District	Ground water purchased
Robinson-Palestine Water Commission	Commission	Ground water
Rural Wabash County Water District	District	Ground water purchased
S L M Water Commission	Commission	Surface water
Saline Valley Conservancy District	District	Ground water
Sangamon Valley Pwd	District	Ground water
Seymour Water District	District	Ground water purchased
Shawnee Valley Pwd	District	Ground water purchased
South Fulton Water District	District	Ground water purchased
South Highway Pwd	District	Surface water purchased
South Palmyra Water Commission	Commission	Surface water purchased
South Sangamon Water Commission	Commission	Ground water
St Rose Pwd	District	Surface water purchased
Sugar Crk Pwd	District	Surface water purchased
Three County Pwd	District	Surface water purchased
T-L Rural Water District	District	Ground water purchased
Tritownship Water District	District	Surface water purchased
Union-York Water District	District	Ground water

Name	Type	Source
Wee-Ma-Tuk Water District	District	Surface water purchased
West Liberty-Dundas Water District	District	Surface water purchased
West Morgan Water Corporation	Nonprofit 501c12	Ground water purchased
West Prairie Water Company	Nonprofit 501c12	Ground water purchased
West Prairie Water Co-Op	Nonprofit 501c12	Ground water purchased
Western Wayne Water District	District	Surface water purchased