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Northwest Water Planning Alliance

Water Supply Sustainability Plan

Chicago Metropolitan Agency for Planning

Sea Grant ILLINOIS–INDIANA

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NORTHWEST WATER PLANNING ALLIANCE

Acknowledgments

The Northwest Water Planning Alliance (NWPA) Water Supply Sustainability Plan project team is thankful for the leadership and participation of the NWPA Executive Committee through the plan's development:

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Executive summary

The Northwest Water Planning Alliance (NWPA) originally formed to provide a space for elected officials, utility and resources managers, water supply experts, and others to collaboratively plan for and advance solutions for water supply challenges across northeastern Illinois, including:

- **Excessive drawdown:** Overreliance on deep sandstone aquifers has led to water withdrawals exceeding natural recharge rates.
- **Degraded water quality:** Contaminants such as road salts threaten shallow aquifers and the Fox River — key water sources for some communities.
- **Regulatory and financial constraints:** Permits and infrastructure costs limit access to alternative water supplies, including Lake Michigan.

Communities throughout the NWPA region continue to face these water supply challenges, while also anticipating continued population growth. To address these challenges and keep in line with its mission "to ensure a sustainable water supply for the people, economy, environment, and future generations," the NWPA worked with the Chicago Metropolitan Agency for Planning (CMAP) and Illinois-Indiana Sea Grant (IISG) to develop a water supply sustainability plan.

The NWPA Water Supply Sustainability Plan serves as a roadmap for communities to take voluntary steps toward ensuring the long-term sustainability of drinking water sources across the five-county region in northeastern Illinois. The plan offers:

- **Critical insights** into the region's water supply and current and future demand.
- **Actionable water conservation and efficiency strategies** to help reduce demand.
- **Guidance to take local action**, encouraging communities to evaluate their own water demand supply and identify the most effective water conservation and efficiency strategies to address their specific needs.

Ensuring the long-term viability of the region's water resources is both a shared challenge and a collective responsibility. Together, this information can empower NWPA communities to do their part to extend the life of their water resources and provide sustainable water supplies for future generations.

Water supply and demand across the NWPA region

Understanding both the available supply of water and current and future demand is critical to making informed water management decisions. Recent Illinois Department of Natural Resources investments in groundwater science and water demand forecasting provide the critical information needed to develop a sustainability plan. This gives the NWPA information about the extent of current water withdrawals relative to the amount of water that can be sustainably withdrawn over the long-term without putting communities at risk of running out of water.

Water demand

According to the *Regional Water Demand Forecast for Northeastern Illinois, 2020-2050*, the NWPA region is expected to use 156.1 million of gallons of water per day by 2050. This is a 2.2 percent decrease from 2018 levels, due to continued water conservation and efficiency despite projected population and employment growth. Most declines in demand are projected for Lake County and, to a lesser extent, McHenry County. DeKalb, Kane, and Kendall counties are projected to see demand *increase* by 2050.

The water demand forecast also evaluates demand by source. Withdrawals from deep groundwater sources are projected to see the greatest decline, 8.5 million gallons per day (MGD) or 19.1 percent, by 2050. This is likely due in part to the planned transitions from this source to Lake Michigan, which is projected to experience increased demand. Shallow groundwater demand is anticipated to grow, while demands on river water will decline.

Water supply

The Illinois State Water Survey (ISWS) developed county-level sustainable water supply estimates, which identify the volume of water that can be withdrawn from each source without impacting the long-term viability of that source to provide water for future generations. These estimates (referred to as Tier 1 estimates) use statewide sustainable supply definitions based on a range of simplified assumptions and annual water withdrawal reporting from the ISWS' Illinois Water Inventory Program.

Within the NWPA's five-county region, the sustainable supply across its groundwater, Fox River, and Lake Michigan water sources is estimated at 203.8 MGD. The sustainable supply estimates provide valuable insights but do not capture all factors influencing water availability. Future refinements at the county or local level could provide details on water quality, seasonality, or drought conditions, which can influence water availability.

Comparing supply and demand in the NWPA region

The regional water demand forecast identifies counties in the NWPA region where groundwater demand is expected to exceed sustainable supply. In 2018, Kane County's total groundwater demand of 34.0 MGD exceeded its sustainable supply estimate of 22.6 MGD. By 2050, this imbalance is projected to worsen for both shallow and deep sandstone groundwater sources as total groundwater water demand increases to 35.3 MGD — or approximately 3.8 percent. In total, the NWPA region will need to reduce its groundwater demand by 12.2 MGD to align with groundwater sustainable supply estimates.

Demand reduction needed to align with shallow and sandstone sustainable supply estimates in the NWPA region, 2050

County	Reduction needed (MGD)
DeKalb	- *
Kane	12.2
Kendall	- *
Lake	- *
McHenry	- *
NWPA region	**12.2**

Source: CMAP and IISG, 2024.

Note: *Reductions will be needed in local areas facing risks of water stress due to concentrated demand or unique geological features.

Reductions needed across the NWPA region may even be greater than what these estimates convey. In counties where overall demand remains within the sustainable supply estimates, localized challenges can exist since local conditions — such as water quality and drought — are not yet taken into consideration. Wells in these counties may still be productive, while others may face risks such as reduced yields, drying up, or water quality challenges associated with the dewatering of an aquifer. For example, in McHenry County, there are known localized risks associated with the use of the Ironton-Galesville sandstone aquifer as well as ongoing water quality threats to its shallow groundwater aquifers supplies. Despite these known limitations, comparing water supply and demand gives the NWPA region insights into the scale of action needed to maintain a long-term supply.

In counties where overall demand remains within the sustainable supply estimates, localized challenges may arise given that local conditions — such as water quality and drought — are not yet taken into consideration.

Plan vision and goals

The NWPA Water Supply Sustainability Plan envisions a future where communities have affordable, safe, and sufficient water supplies while supporting healthy aquatic ecosystems. Together, the NWPA identified goals for each water resource: shallow and sandstone aquifers, the Fox River, and Lake Michigan.

These goals identify multiple dimensions of sustainable water supply — water affordability, reliability, quality, and availability (i.e., water quantity). While each of these dimensions is related and equally important to address, the plan focuses on water availability and direct water savings that can be achieved through active water conservation and efficiency strategies.

To meet the region's goals, the plan prioritizes five key water conservation strategies that municipalities and local water utilities can implement:

- **Residential retrofits** focused on the adoption of water-efficient appliances and fixtures
- **Outdoor landscape efficiency**
- **Water efficiency in new development** focused on WaterSense Homes certifications
- **Water loss control** within public water utilities
- **Commercial, institutional, and industrial** (CII) water conservation programming

Municipalities and local water utilities are the key implementers of the plan given that most water used in the NWPA region — 81 percent or 131.5 MGD — is provided by public water systems, either managed by a municipality or a private company. There is significant opportunity for communities to be the region's leaders in water conservation and sustainable water management, and effectively reduce demand to ensure a sustainable supply for existing and future residents and businesses.

Impact of water conservation and efficiency strategies

If fully implemented by NWPA communities with public water systems, these strategies could reduce regional water demand by up to 38.4 MGD, significantly alleviating stress on existing water sources, narrowing the gap between demand and sustainable supply, and reducing infrastructure and operational costs. Water use reductions of this magnitude will be critical in many NWPA communities across the region that are projected to see continued growth in jobs and population by 2050.

Water savings achieved from prioritized water conservation and efficiency strategies by NWPA county and water source, in MGD

County	Groundwater savings estimates	Fox River savings estimates	Lake Michigan savings estimates	Total
DeKalb	2.1	0.0	0.0	2.1
Kane	9.4	3.3	0.0	12.7
Kendall	3.0	0.1	0.1	3.2
Lake	2.1	0.0	11.7	13.8
McHenry	6.7	0.0	0.0	6.7
NWPA region	**23.2**	**3.5**	**11.8**	**38.4**

Source: CMAP and IISG, 2024.

Note: These are the water savings that can be achieved under the high water conservation and efficiency scenario (100 percent program participation). See chapters 3 and 4 for more details. Savings estimates are rounded to the nearest tenth; therefore, totals may not equal the sum of individual values due to rounding.

Groundwater demand could be reduced by 23.2 MGD by implementing the priority strategies. For Kane County, this could substantially address the imbalance between demand and sustainable supply estimates, reducing the remaining reduction needed to just 2.8 MGD. The water conservation and efficiency strategies are also critical for communities within DeKalb, Kendall, and McHenry counties which face known localized challenges not yet captured in the ISWS's Tier 1 statewide sustainable supply estimates, which use a range of simplified assumptions to approximate sustainable supply at the county level.

Demand reduction remaining after savings achieved from prioritized water conservation and efficiency strategies, in MGD

County	Reduction needed to align with groundwater sustainable supply estimates	Groundwater savings estimates	Reduction remaining to align with groundwater sustainable supply estimates
DeKalb	- *	2.1	-
Kane	12.2	9.4	2.8
Kendall	- *	3.0	-
Lake	- *	2.1	-
McHenry	- *	6.7	-
NWPA region	**12.2**	**23.2**	**2.8**

Source: CMAP and IISG, 2024.

Note: These are the water savings that can be achieved under the high water conservation and efficiency scenario (100 percent program participation). Savings are rounded to the nearest tenth; therefore, totals may not equal the sum of individual values due to rounding. See chapters 3 and 4 for more details. Groundwater refers to both shallow and deep aquifer sources. *Reductions will be needed in local areas facing risks of water stress due to concentrated demand or unique geological features.

Water loss control measures, residential retrofits, and building water-efficient, single-family residential development throughout the NWPA region can achieve the greatest savings. However, those savings vary by county based on water use, housing stock, and projected development. For example, in Kane and Lake counties, water loss control techniques are estimated to provide the greatest savings. In Kendall and McHenry counties — which anticipate a sizeable increase in population — constructing water-efficient, single-family residential development would provide the greatest savings.

Water savings by NWPA county and prioritized water conservation and efficiency strategies, in MGD

County	Potential saving estimates, MGD					Total
	Residential retrofits	Outdoor landscape efficiency	New residential development	Water loss	CII conservation programming	
DeKalb	0.6	0.1	0.4	0.7	0.3	2.1
Kane	3.2	0.3	2.9	4.3	2.1	12.7
Kendall	0.6	0.1	1.3	0.8	0.4	3.2
Lake	3.9	0.4	1.4	5.5	2.6	13.8
McHenry	1.8	0.2	2.0	1.9	0.9	6.7
NWPA region	**10.1**	**1.1**	**7.9**	**13.1**	**6.2**	**38.4**

Source: CMAP and IISG, 2024.

Note: These are the water savings that can be achieved under the high water conservation and efficiency scenario (100 percent program participation). Savings estimates are rounded to the nearest tenth; therefore, totals may not equal the sum of individual values due to rounding. See chapters 3 and 4 for more details. CII building data was not available for DeKalb County. Estimates are based on DeKalb's non-residential base water use and CII building share equivalent to Kendall County.

Benefits of water conservation and efficiency strategies

In addition to reducing water use, water conservation strategies can deliver multiple co-benefits to communities and the region, including:

- Lowering peak demand — particularly in the summer months when demand is typically at its highest — for communities that rely on water sources influenced by seasonal flows.
- Freeing up existing infrastructure capacity to provide service to new customers, which can benefit communities that anticipate an increase in population and employment.
- Delaying the need to switch water sources by extending the life of current sources, allowing more time to secure alternative supplies if and when necessary.
- Saving money by delaying expensive infrastructure capacity expansion projects or reducing the size of the expansion when it becomes necessary.
- Reducing the energy needed for water treatment and distribution as well as household and business use, thereby cutting greenhouse gas emissions and operational costs.
- Increasing a community's resilience to droughts and climate variability, ensuring a reliable water supply during extreme conditions.

Call to action

The NWPA Water Supply Sustainability Plan is a valuable tool for guiding communities toward a more resilient water future. By volunteering to implement its recommendations, NWPA communities will take a significant step toward ensuring that water remains a reliable resource for generations to come.

To get started, communities can use this plan and take the following steps:

- **Understand local conditions**, including water supply and demand, source challenges, demand trends, and infrastructure systems and operations. This step is essential for assessing whether a community can meet its current and future water demands and the type and degree of water conservation and efficiency that may be needed if demand exceeds supply.
- **Examine water infrastructure systems and operations**, including regular audits, asset management and water loss control plans, water reduction goals, and water rates that promote conservation while ensuring affordability and a utility's ability to uphold ongoing maintenance and operations.
- **Evaluate water conservation options**, including water conservation and efficiency strategies that are most applicable, and local water supply and sustainability plans that focus on conservation and efficiency. This may involve using this plan or other guidance to estimate how specific strategies could impact water use and yield savings, creating programs to implement strategies, and identifying funding to support implementation.
- **Consider alternative supplies**, if conservation and efficiency practices alone will not address local challenges, by assessing options, obtaining necessary approvals, developing and executing the construction plan, and securing funding.

To advance this plan's vision and goals, NWPA municipalities must understand water supply and demand within the context of their water source and infrastructure conditions, and reduce water use by adopting water conservation strategies that align with their unique local context. To illustrate how conservation and efficiency actions can help NWPA communities reduce water use, the plan provides an in-depth look at five strategies and estimates the water savings each could achieve if implemented by communities within the NWPA region. While the five strategies are effective options for NWPA communities and demonstrate what could be achieved collectively, communities should evaluate which strategies work best for them and offer the greatest amount of savings. As seen at the county level, local factors like water use, housing stock, and projected development can influence the effectiveness of the strategies for a given community.

Looking ahead

Over the past 25 years, the NWPA has brought critical attention to water supply challenges facing groundwater and river-dependent communities across northeastern Illinois. The NWPA's Water Supply Sustainability Plan is a key initiative supporting the organization's mission to advance scientific understanding of the region's water resources, inform decision makers on sustainable water policies and practices, and build the collective knowledge and capacity needed to steward the region's shared river and groundwater resources.

A central component of the plan is the ISWS' Tier 1 sustainable supply estimates, the state's first comprehensive attempt to quantify how much water can be withdrawn from each source without compromising its long-term viability. This essential insight — long missing from water supply planning discussions — provides a foundation for communities to engage in regional dialogue about sustainable water management. Although the countywide estimates are based on simplified assumptions and may not fully reflect local supply challenges, they offer an important starting point for further analysis and informed decision making.

Looking ahead, the NWPA will actively promote the plan's implementation among its member communities, providing a forum for elected officials, utility managers, and resource professionals to exchange knowledge, learn about best practices in water conservation and efficiency, and stay informed on the latest scientific research regarding the health and sustainability of the region's water supplies.

As the region's understanding of water demand and supply evolves, the NWPA will monitor advancements in groundwater science, updates to the ISWS sustainable supply estimates, and other factors that could impact water resources, including population and employment forecasts, climate change, and opportunities for state and federal funding.

Chapter 1: Introduction

Drinking water supplies are essential to our communities and regional prosperity. Yet, a century of water use from northern Illinois' deep sandstone aquifers has led to declining water levels, with more water being withdrawn than naturally replaced. The use of road salt, per- and polyfluoroalkyl substances (PFAS), and other contaminants has degraded shallow groundwater and river water quality. These issues are expected to continue as the Northwest Water Planning Alliance (NWPA) region anticipates new people and businesses moving to the area between now and 2050. Against this backdrop, the NWPA saw the need for a water supply sustainability plan to identify key strategies that would extend the life of the region's water resources and provide sustainable water supplies for future generations.

The NWPA formed in 2010 to ensure a sustainable water supply for the people, economy, environment, and future generations. The NWPA region encompasses 5 counties and 5 councils of government representing over 80 communities and unincorporated areas in 5 counties — DeKalb, Kane, Kendall, Lake, and McHenry — on the northern and western edges of the Chicago metropolitan region (Figure 1.1).[1] As of 2024, the region is home to over 1.7 million residents and 862,744 jobs.[2] The NWPA is guided by four goals:

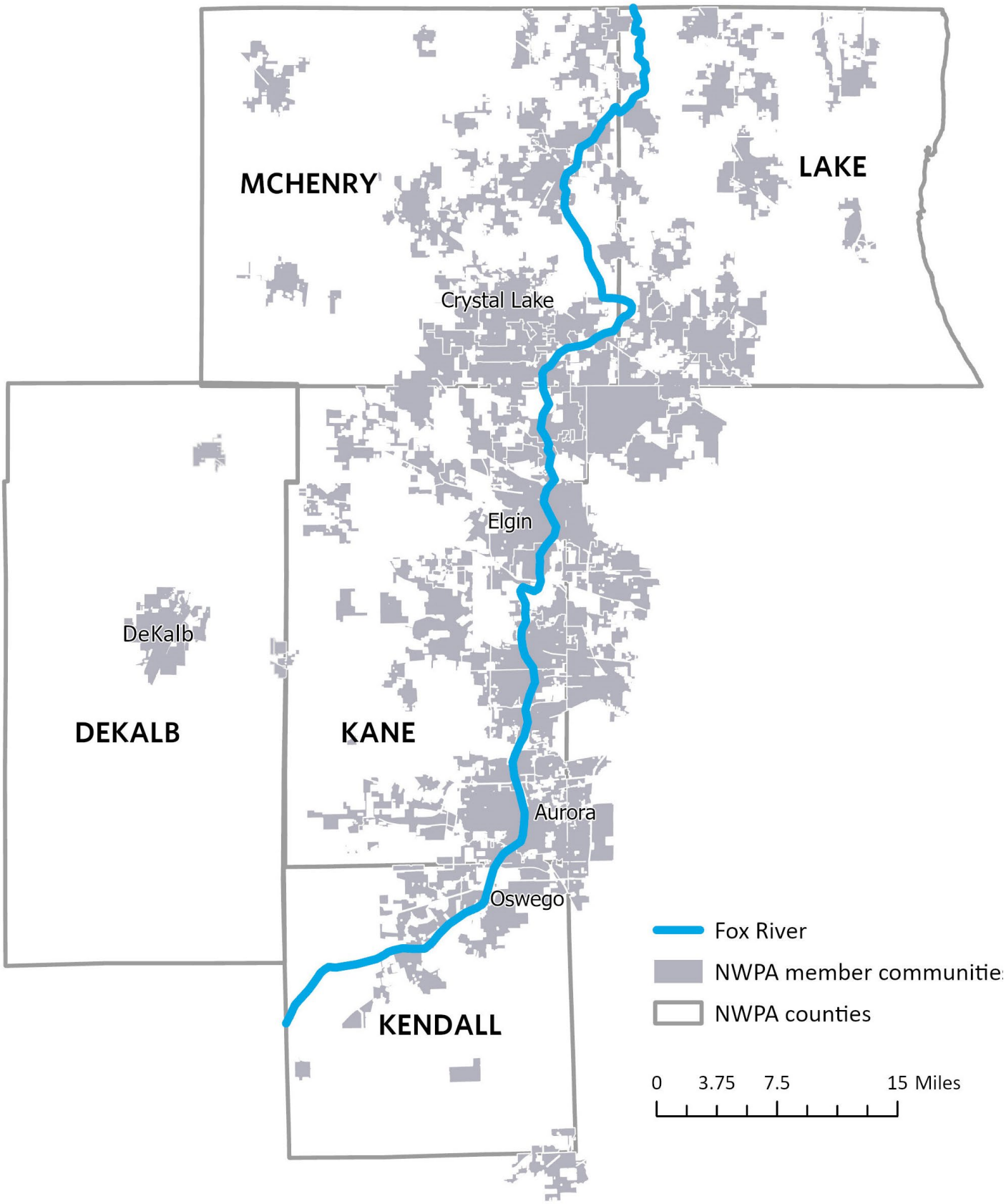
1. Develop and promote sustainable water policies and practices
2. Inform decision makers and the public on NWPA issues and best practices
3. Improve the scientific understanding of NWPA water supplies
4. Build organizational capacity to achieve its mission

The Water Supply Sustainability Plan is the result of a collaborative, two-year planning process undertaken by the NWPA in partnership with the Chicago Metropolitan Agency for Planning (CMAP) and the Illinois-Indiana Sea Grant (IISG).

The plan establishes sustainability goals for the NWPA's water supply sources and provides a menu of voluntary, feasible, and effective strategies that NWPA communities can use to reduce water use. Although improving and protecting water quality can play an essential role in achieving water supply sustainability, the plan focuses on what community water suppliers can achieve through water conservation and efficiency efforts.

While not all strategies may be suitable for all communities in the NWPA region, the plan is intended to enhance a community's understanding and awareness of effective strategies relevant to the region and showcase available resources to support their implementation. Additionally, the plan seeks to encourage communities to develop their own water supply and sustainability plans that reflect their unique challenges and opportunities.

Figure 1.1: NWPA region and member communities



Source: CMAP, 2024.

The planning process

With support from the Illinois Department of Natural Resources (IDNR), CMAP and the IISG partnered to assist the NWPA in developing a water supply sustainability plan. Throughout the two-year planning process, the project team relied on the expertise of the NWPA Technical Advisory Committee (TAC) as well as the Executive Committee to guide the plan's development. In addition, the ISWS provided critical information about current water supply conditions and sustainable yield values.

After launching the project in January 2023, the TAC and Executive Committee established the plan vision and drafted sustainability goals for each water supply source. By summer 2023, the TAC and project team identified, and the Executive Committee confirmed, water conservation and efficiency strategies that would undergo a strategy assessment. While multiple strategies were discussed during the selection process, strategies that may indirectly result in water savings or those requiring state or federal action were not considered for the detailed assessments. The assessments were intended for strategies that could directly result in water savings (i.e., conservation and efficiency strategies), based on the widespread implementation across the NWPA region. Additionally, the assessments sought to identify existing levels of strategy implementation, highlight potential barriers to implementation, and outline resources to facilitate implementation.

Five strategy assessments were conducted from summer 2023 to summer 2024. During the strategy assessment process, the team relied on the technical expertise of TAC members to provide feedback on the feasibility and implementation of selected water conservation strategies. In addition, the team involved partners, such as the Alliance for Water Efficiency, the U.S. Environmental Protection Agency (USEPA), and the IDNR, to get an understanding of additional resources that could help NWPA members implement the plan's water conservation strategies.

The **Technical Advisory Committee (TAC)** is a working group comprising water utility staff and consulting engineers representing municipalities and councils of government, as well as representatives of federal, state, county, and regional governments and nongovernmental organizations. NWPA member municipalities are encouraged to send representatives. The TAC reports to the Executive Committee with recommendations for formal adoption.

The **Executive Committee** consists of appointed elected officials representing the region's councils of governments and county boards. The Executive Committee is responsible for formal decisions and recommendations to member communities and counties regarding water planning topics.

Together, these committees provide a forum for elected officials, water utilities, and water resource managers to learn about the latest scientific research on the health of the region's water supplies and best practices, to collaboratively address pressing water resources challenges and ensure sustainable water supplies into the future.

Chapter 2: The NWPA profile

The following information details the five-county NWPA region's water sources and associated challenges, how water is being used and by whom, and the amount of water supply and demand now and into the future.

Demographics and development patterns

Population and employment are often the main drivers of water demand, and therefore, are useful context for understanding current and future water use. As of 2024, the NWPA region was home to over 1.7 million residents and 862,744 jobs.[3] By 2050, the NWPA region anticipates growing from 1.7 million to 2.2 million, adding approximately 441,531 residents and 79,043 jobs to the five-county area (Figure 2.1).[4] Within the NWPA region, Kane, Lake, and McHenry counties are each expected to see over 100,000 new residents and sizeable increases in new jobs.

Figure 2.1: Population and employment growth by county in NWPA region, 2018 and 2050

County	Population				Employment			
	2020	2050	Difference	Percent change	2020	2050	Difference	Percent change
Kane	516,522	652,543	136,021	26	203,838	228,566	24,728	12
Kendall	131,869	192,704	60,835	46	31,746	37,159	5,413	17
Lake	714,342	832,439	118,097	17	317,335	347,694	30,359	10
McHenry	310,229	419,298	109,069	35	108,541	123,681	15,140	14
DeKalb	101,539	119,048	17,509	17	36,431	39,834	3,403	9
Total	**1,774,501**	**2,216,032**	**441,531**	**25**	**697,891**	**776,934**	**79,043**	**11**

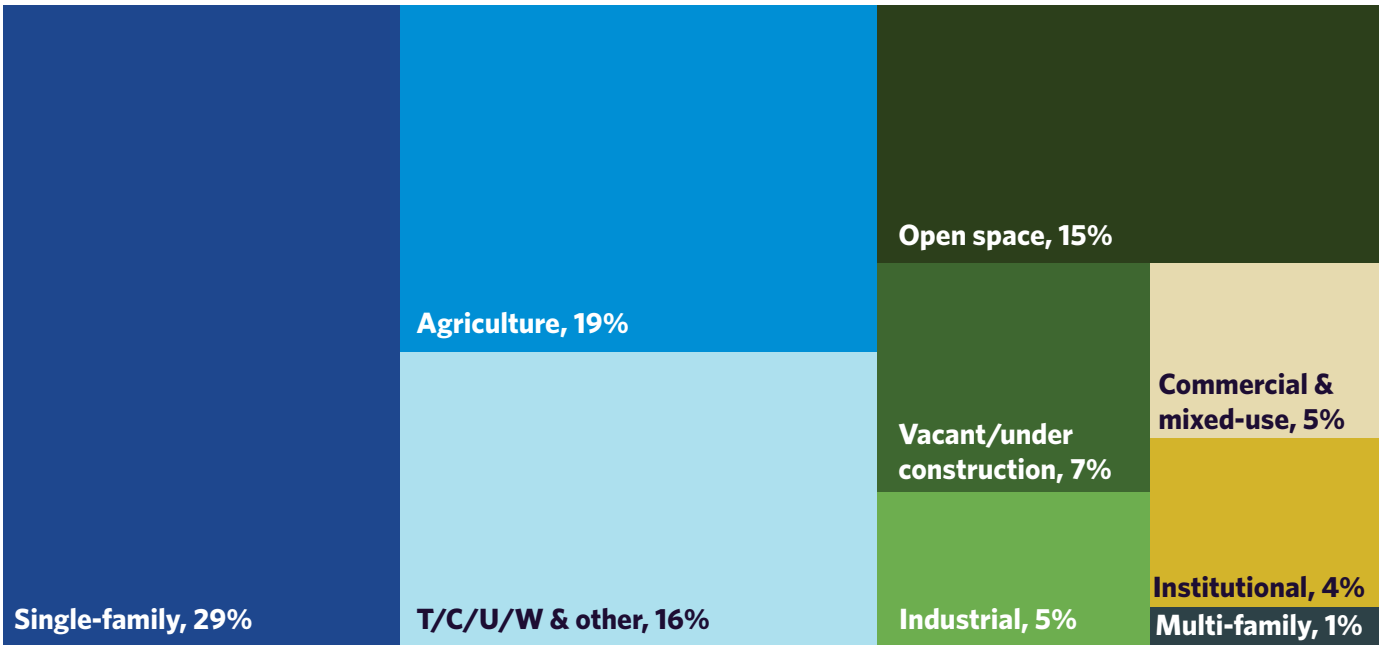
Source: 2022 update to CMAP ON TO 2050 Socioeconomic Forecast and UrbanSim Model for Kane, Kendall, Lake, and McHenry counties; 2020 population estimates are based on the U.S. Census Bureau redistricting data; 2020 population and employment data for DeKalb County is based on input data from CMAP's Travel Demand Model.

Note: 2020 employment data for Kane, Kendall, Lake, and McHenry counties is UrbanSim Model output data for the year 2020, scaled to match regional estimates.

Across the NWPA region, development patterns vary, from medium- and low-density development commonly seen in populated and economically diverse municipalities like Elgin and Aurora, to low-density development seen in more rural communities like Sugar Grove. Collectively, the region's land use in 2020 was largely made up of agriculture (47 percent) and single-family (21 percent) land uses. However, within incorporated municipalities, single-family residential (29 percent) is the largest land use, followed by agriculture (19 percent) and open space (15 percent) (Figure 2.2).[5]

With a large portion, or approximately 140,900 acres, devoted to single-family housing, over 81 percent of the NWPA region's housing units are single-family homes, with multi-family homes accounting for 18 percent of housing and mobile homes accounting for the remaining 1 percent (Figure 2.3).

Figure 2.2: Land uses by percent of acreage within incorporated municipalities in the NWPA region



Source: Analysis of CMAP's 2020 Land Use Inventory.

Note: T/C/U/W & other accounts for land dedicated to transportation, communications, utility uses, and water bodies. See CMAP's Land Use Inventory classification schema for more details.

Figure 2.3: Types and count of housing units within the NWPA region, 2018-2022

County	Single-family	Multi-family	Mobile/other	Total housing units
DeKalb	26,385	10,595	723	37,703
Kane	152,803	34,505	1,546	188,854
Kendall	41,271	3,738	69	45,078
Lake	206,377	58,273	4,766	269,416
McHenry	105,305	13,905	775	119,985
Total	**505,756**	**110,421**	**7,156**	**623,333**

Source: U.S. Census Bureau 2018-2022 American Community Survey five-year estimates.

Note: "Single-family" includes attached and detached single-family units. "Other" includes boats, recreation vehicles (RVs), vans, etc.

Water sources and sectors

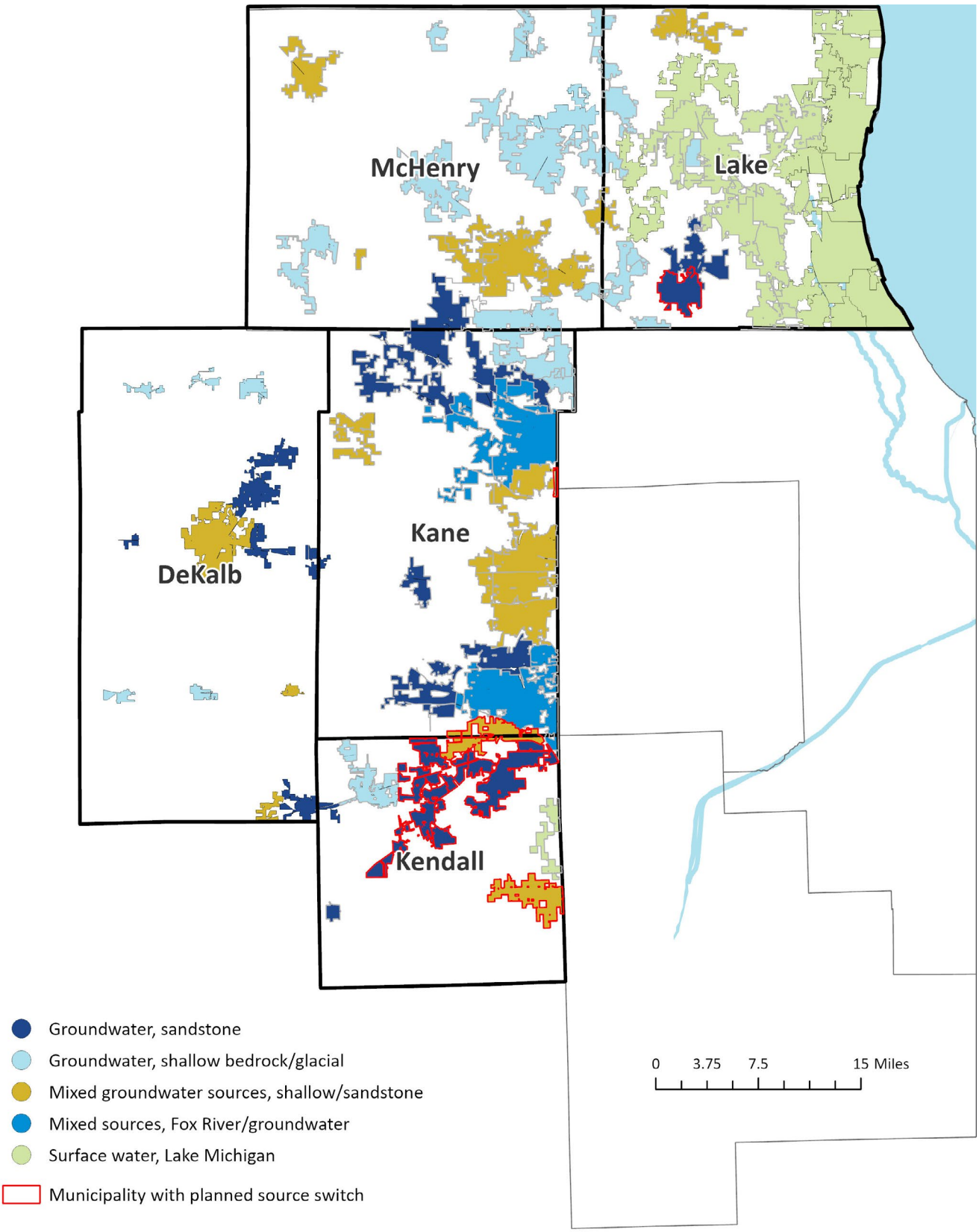
While most of the northeastern Illinois' drinking water is supplied by Lake Michigan, that is not the case for NWPA region. The five counties rely on shallow aquifers (sand and gravel or shallow bedrock) and deeper sandstone aquifers as well as the Fox River and Lake Michigan. Residents and businesses get water from a public water supply system, or they have their own private well(s) or intake(s).

Public water systems, either managed by a municipality or a private company, account for the largest share of water withdrawals in the NWPA region. Figure 2.4 provides a summary of the water sources used by NWPA municipalities within public water supply (PWS) systems based on the historical averages of water sources used between 2013 and 2018.[6] Most municipal PWS communities in McHenry County rely on shallow groundwater or a mix of groundwater sources, although many are increasingly relying on the deep sandstone aquifer for their primary water source, including some of its largest communities that solely rely on the Ironton-Galesville aquifer. The majority of municipal PWS communities in DeKalb, Kane, and Kendall counties also use the deep sandstone aquifers, often in combination with shallow sources. Lake County's municipal PWS communities on the eastern edge of the county primarily obtain their water from Lake Michigan, although others more inland are more reliant on groundwater sources. Additionally, a few PWS communities in Kane County use the Fox River as their main water source.

According to the *Regional Water Demand Forecast for Northeastern Illinois, 2020-2050*, 101 municipal-scale PWS systems pumped and delivered 81 percent of the NWPA region's total withdrawals, amounting to 131 million gallons per day (MGD) (Figure 2.5).[7] Additional public water supply systems, identified as small-scale PWS, withdrew 6 percent to provide water service to subdivisions, mobile home parks, and other areas.[8] The rest of the water withdrawals are managed by individual private residents and businesses and have been categorized as commercial, industrial, and institutional (CII); agricultural and irrigation; and municipal domestic self-supply sectors.

Unlike the CII and agricultural and irrigation sectors, which consist of high-capacity wells that are required to report their annual water withdrawals to the Illinois Water Inventory Program, domestic self-supply wells typically do not meet the reporting threshold, and withdrawal volumes are not known. Given this data gap, domestic self-supply values here are estimated only for NWPA municipalities with no known municipal-scale system.[9]

Figure 2.4: Water sources used by NWPA municipalities with PWS systems

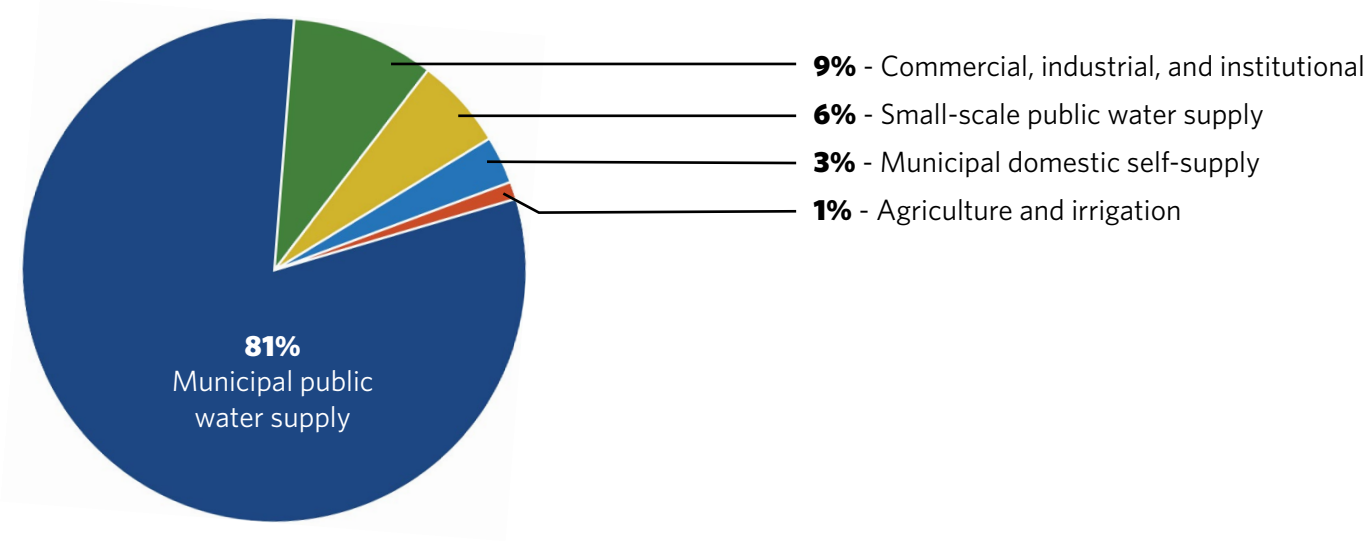


Source: Regional Water Demand Forecast for Northeastern Illinois, 2020-2050, 2024.

Note: Municipalities are categorized based on the average mix of sources used between 2013 and 2018, with the exception of systems that switched sources by 2020 (Lake Villa, Lindenhurst, Volo, and Wauconda). Communities assigned to a "mixed sources" category withdrew water from more than one source, with each source being at least 10 percent of total water withdrawals.

The municipal PWS sector serves both residential and non-residential water users in a community, though some users may be on private wells. Nationally, the largest share of water use in the sector is residential, followed by water loss associated with the supply and distribution system (when considered as an end use), and non-residential uses from CII businesses that rely on a municipal water provider (Figure 2.6). This breakdown is not available for the NWPA region but is assumed to follow national trends.

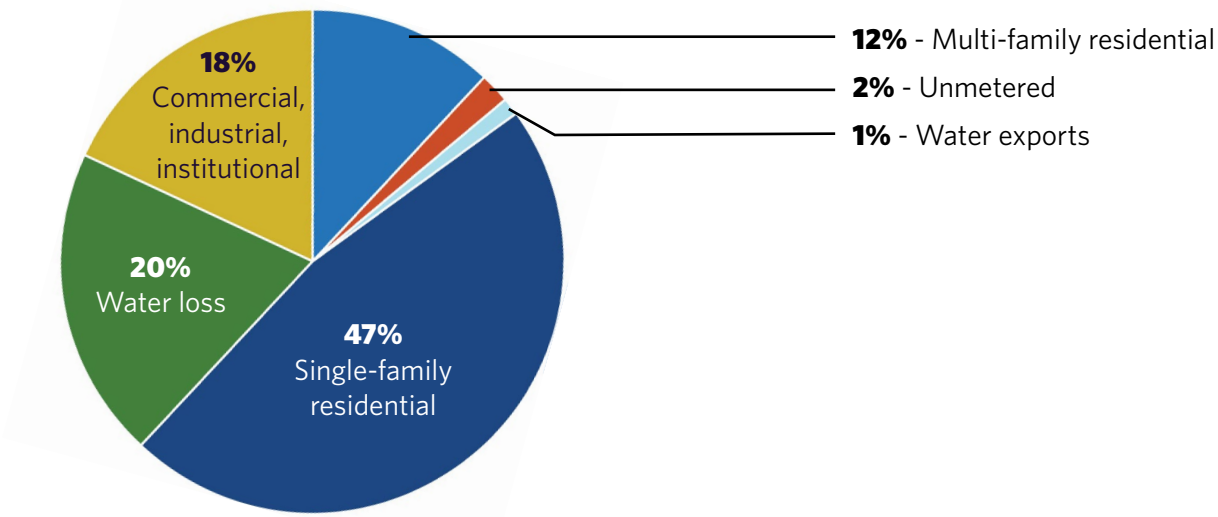
Figure 2.5: Share of water use by sector across the NWPA region in MGD, 2018



Source: Regional Water Demand Forecast for Northeastern Illinois, 2020-2050, 2024.

Note: The CII sector includes industrial, institutional, and commercial self-supply businesses with wells and intakes that pump at a rate of 70 gallons per minute or greater. The small-scale public water systems serve subdivisions, mobile home parks, and other primarily residential land uses and may be in municipalities or in unincorporated areas. The municipal domestic self-supply sector is an estimate of what private residential wells could be withdrawing in the portion of 28 municipalities that are within the NWPA region. The larger domestic self-supply sector comprises an unknown number of private residential wells that may be in municipalities or unincorporated areas and is not represented here. The pie chart only includes DeKalb County's municipal PWS water sector use. Water use totals for other sectors are not available for DeKalb County.

Figure 2.6: Public water supply system water uses, national averages

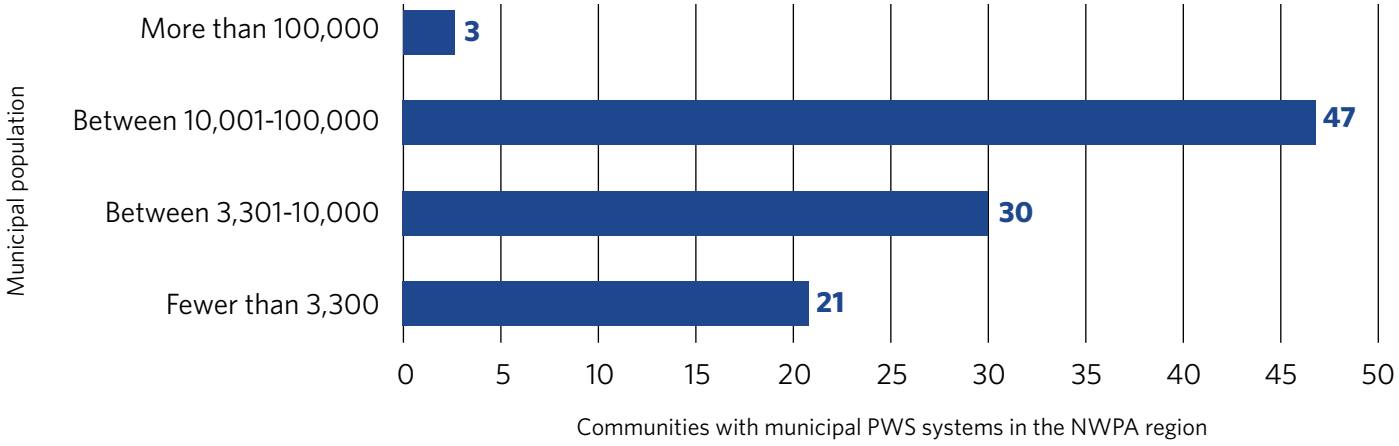


Source: Vickers and Dickensen, 2020.[10]

Note: Unmetered water includes unmetered (or partially metered) water consumption calculated or billed based on estimates or a flat rate. Water exports include the sale or transfer of water withdrawn and treated by one system to another.

The 101 municipal PWS systems with service areas within the NWPA region share similarities with one another, but also encounter different opportunities and challenges based on a variety of factors, including system size, age, and the development patterns they serve. Using the USEPA's water utility size classifications[11] and municipal population as a proxy for customers served provides some insights into the capacity of the systems. While the median population size is 15,000, 21 systems are very small, serving fewer than 3,300 customers. Small water systems can face unique financial and operational challenges. Thirty systems are medium-sized, serving between 3,301 and 10,000 people (Figure 2.7). However, 47 systems are large, serving between 10,001 and 100,000 people, with a median population size of approximately 25,000. The remaining three PWS systems — Aurora, Elgin, and Joliet — are very large, and serve more than 100,000 people.

Figure 2.7: Communities with municipal PWS systems in the NWPA region based on population



Source: U.S. Census Bureau, 2018-22 American Community Survey 5-year estimates; USEPA Water Conservation Plan Guidelines, 1998.

Note: Municipal population is being used as a proxy for population served by the municipal public water supply systems.

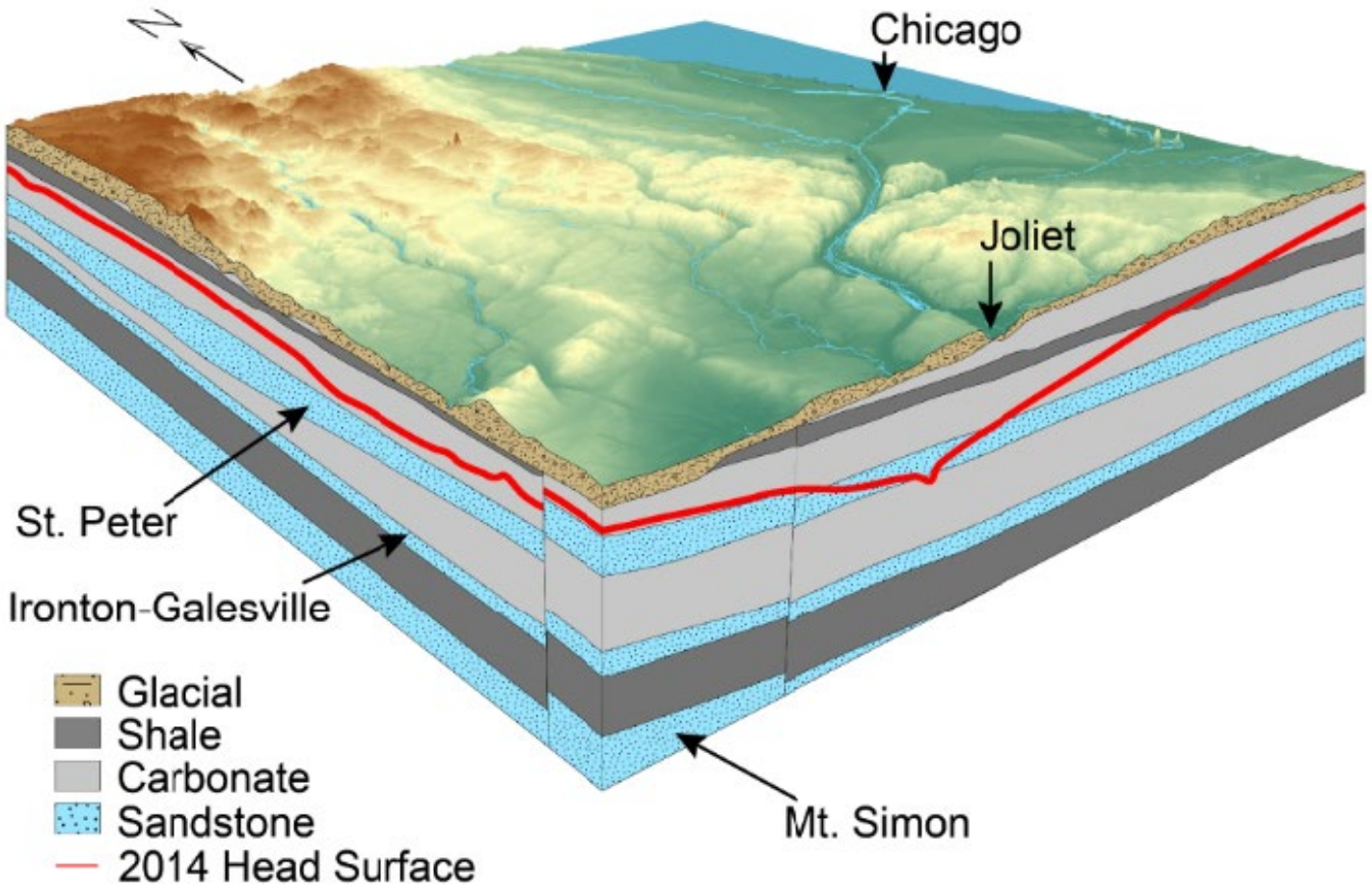
Water supply challenges

The water sources supporting the NWPA region face a variety of issues that could impact their long-term sustainability. Most challenges stem from water quantity, water quality, regulatory, and financial constraints. Although not exhaustive, the following are some key water access and supply challenges that communities are currently grappling with and may encounter in the future.

Excessive drawdown

Northeastern Illinois has been dependent on the deep sandstone aquifers for water since development proliferated across the region. These aquifers formed millennia ago, are located hundreds of feet below the surface, and are covered by layers of impermeable material, causing slow recharge rates (Figure 2.8).[12] With many communities and businesses reliant on this water, and no regulations limiting use, more water is being withdrawn than can recharge — leading to depletion. Pumping more water than is naturally recharged can decrease well yields, increase pumping expenses, and increase salinity and oxygen, which alter groundwater chemistry. This impacts the ability of deep sandstone wells to continue to provide the necessary quantity and quality of water to meet local water demands.[13]

Figure 2.8: Regional bedrock geology of northeastern Illinois' deep sandstone aquifers



Source: Illinois State Water Survey.

The challenges facing shallow groundwater supplies are more variable. Confined shallow sand and gravel aquifers that are buried under thick, impenetrable layers, like clay, are highly susceptible to excessive drawdown and depletion. On the other hand, unconfined shallow aquifers are more easily recharged from rainwater. This makes them less susceptible to depletion, with a major exception during periods of drought when recharge rates slow and water demand can increase. Excessive drawdown in shallow aquifers, where water withdrawal volumes also are not regulated, can result in greater interference between wells, additional streamflow capture, and degradation of local surface water quality.

Degraded water quality

Being closer to the land surface, shallow aquifers are more susceptible to contamination. Pollutants — like road salts, fertilizers, and other synthetic chemicals — from lawns, agricultural fields, and impervious surfaces can infiltrate through soils and impact water quality in shallow aquifers. Recent research has revealed that shallow public water supply wells in Illinois are experiencing increasing trends in chloride and total dissolved solids concentrations, primarily from the use of road salts. One study found that numerous private wells relying on the shallow aquifer in Kane County had chloride concentrations that exceeded secondary drinking water standards, which can result in a salty taste and pose challenges for residents.[14, 15]

Additionally, improper handling, management, storage, and disposal of solvents, fuel, or hazardous materials could lead to contamination of shallow aquifers. In such instances, water supplies can be rendered unusable due to the risks to human health, posing significant economic and environmental costs.

Other legacy contaminants such as per- and polyfluoroalkyl substances (PFAS) — commonly referred to as forever chemicals due to their persistence in the environment — are also a growing concern for water quality in both shallow aquifers and surface waters. PFAS exposure through the environment, including drinking water, may be linked to harmful health effects for humans and animals. Research into the health impacts of PFAS and how to address them is ongoing, and drinking water treatment standards may evolve over time.

Although the Fox River can potentially serve more communities in the future, the river is susceptible to water quality issues and changes in flow conditions due to water withdrawals and weather patterns. Fox River water quality can be impacted by upstream land use practices and discharges to the river, as well as events like harmful algal blooms, which make water more difficult and costly to treat for residential use. Communities that do not already use the Fox River as a water source would also be required to invest in an alternative source if the water level is too low to use for drinking water purposes. This requirement may make using river water a challenging endeavor.

Regulatory and financial limitations

A U.S. Supreme Court consent decree governs Illinois' withdrawal of water from Lake Michigan. The state's diversion is limited to 3,200 cubic feet/second (cfs), which amounts to roughly 2.1 billion gallons of water per day.[16] More than half of this withdrawal is used for public drinking water supplies, and the remaining portion is allotted to stormwater runoff, lockage, leakage, navigation, and the maintenance of the Chicago Area Waterway System.[17]

To ensure that Lake Michigan water does not exceed the diversion limit, the state requires communities to get a permit from the Illinois Department of Natural Resources (IDNR), receive a designated annual water allocation that is periodically reviewed and updated, and comply with several conservation practices.[18] These practices, such as metering new construction, restricting outdoor water use, and limiting non-revenue water loss, promote the wise use of this limited resource. For example, chronic or excessive water loss may indicate that a community's water allocation exceeds its needs. An allocation that accommodates excessive water loss, when multiplied by numerous communities with a similar problem, could reduce the amount of water available for existing and new allocations in the future.

New water withdrawals from rivers have the potential to adversely affect aquatic ecosystems and other users of the waterway, and a permit is required if it involves building a permanent intake into a river designated as a public water of the state (e.g., the Fox River). If permitted, the operator will be subject to special conditions restricting the withdrawal of water during periods of low flow (potentially due to drought) to prevent impacts to navigation, natural resources, and other public interests.[19]

Switching water sources, whether to Lake Michigan, the Fox River, or other alternatives, is a potential option, and many communities have done so in the past. However, the cost of the infrastructure needed to access and distribute the new water source can also be a challenge for communities. The construction of necessary distribution lines and water storage tanks and the energy it takes to transport the water are expensive capital and operating costs that often translate into higher water rates for water users. These factors pose a challenge for groundwater-dependent communities that may want to access alternative water sources.

Existing and projected water supply and demand

Understanding both the available supply of water and current and future demand is critical to making informed water management decisions. Recent IDNR investments in groundwater science and water demand forecasting provide the critical information needed to develop a sustainability plan. Used together, the NWPA now has information about the extent of current water withdrawals relative to the amount of water that can be sustainably withdrawn over the long-term without putting communities at risk of running out of water.

Water supply estimates

To ensure a sustainable water supply for all, as outlined in the 2022 Illinois State Water Plan,[20] the State of Illinois saw the need to improve its understanding of how much water each of the state's water sources could provide over the long term. With this water quantity information and available water quality data,[21] counties, municipalities, and water utilities across the state can engage in more informed discussions about regional supply and demand and seek further analysis to make regional and local water supply management decisions.

With support from IDNR, the ISWS developed county-level sustainable water supply estimates (also referred to as sustainable yield estimates), which identify the volume of water that can be withdrawn from each source without impacting the long-term viability of that source to provide water for future generations.[22, 23] These estimates (referred to as Tier 1) use statewide sustainable supply definitions based on a range of simplified assumptions and annual water withdrawal reporting from the ISWS's Illinois Water Inventory Program.[24]

Estimates are provided at the county level and are intended to guide statewide planning, particularly targeting state resources to the areas of greatest need, and inform regional planning efforts. These estimates do not account for water quality, seasonality, or drought conditions, which influence water availability. More detailed assessments could be developed that would allow for regionally-defined sustainable thresholds (Tier 2) or more localized study areas or considerations, such as economic or social variables, that are outside the expertise and purview of the IDNR and ISWS (Tier 3).[25]

Tier 1 sustainable supply estimate definitions

The Tier 1 estimates included here use the following methodologies and assumptions to calculate sustainable water supply for each water source:[26]

Shallow groundwater supply

Shallow groundwater supply estimates focus on reducing impacts to aquatic ecology. Estimates are based on a 15 percent reduction in recharge as a proxy for a 15 percent reduction in natural groundwater discharge to streams based on observational research by Zorn et al. (2012).[28] Additional research is needed to understand impacts specific to Illinois streams as well as localized impacts to aquifers that might occur using this threshold.

Deep groundwater supply

Deep groundwater supply estimates focus on limiting desaturation. This can be difficult to achieve because the deep aquifer system is heavily used by many communities, and variations in its geology leave recharge minimal or nonexistent in Illinois. Due to the geologic variations, some of which are present in the NWPA region, the methodologies used to estimate deep groundwater supply can vary by county.

For some counties in northern Illinois, including DeKalb, Kane, and Kendall counties in the NWPA region, the St. Peter sandstone aquifer is near the land surface and shares the same recharge as nearby shallow aquifers. As a result, the estimates for deep groundwater supply in these counties are based on the same methodologies and assumptions used for shallow groundwater supply.

For all other counties across the state, the deep groundwater supply is calculated as the maximum amount of natural recharge that can theoretically enter both the St. Peter and Ironton-Galesville sandstone aquifers, with most natural recharge occurring in the St. Peter sandstone aquifer. The Tier 1 estimates treat the two sandstone aquifers as one and assume the Ironton-Galesville sandstone aquifer has access to natural recharge through unmanaged recharge.[27] Unmanaged recharge refers to the movement of water between the St. Peter sandstone and Ironton-Galesville sandstone aquifers through older wells that are open to both aquifers. However, wells open to both aquifers are increasingly rare with modern well construction. Over time, as these wells are replaced, unmanaged recharge is anticipated to decline.

Wells that only have access to one of the two aquifers, particularly those completed in the Ironton-Galesville sandstone aquifer, are likely unable to access the full Tier 1 deep groundwater supply and are more likely to encounter supply challenges long-term. Deep groundwater supply also assumes demands are evenly distributed to access nearby natural or unmanaged recharge and underrepresents the risk of clustering demands, where local issues are more likely to occur.

River supply

River supply currently reflects the maximum existing demand from public rivers over the past five years based on existing users and infrastructure. The approach does not yet consider limitations during drought, water quality issues, or navigation concerns. As of 2024, the ISWS acknowledged additional research is needed to evaluate impacts to streamflow and aquatic ecology; for unregulated rivers, stakeholder feedback will be needed to evaluate acceptable thresholds.

Lake Michigan supply

Lake Michigan supply is calculated based on existing infrastructure and Lake Michigan allocations permitted by the state in 2017.[29]

Figure 2.9 provides the Tier 1 sustainable supply estimates. Given that the river and Lake Michigan estimates simply reflect existing demand, infrastructure, and permits, the truly enlightening values are for the shallow and deep groundwater sources. McHenry County stands out as having higher sustainable supply volumes for both shallow and deep groundwater sources. However, it is important to note that these estimates do not necessarily line up with where the wells and corresponding demand are located, and the water supplies may not be accessible to those who need it. Similarly, water quality, drought, and other seasonal variations that could influence water availability are not included in these quantity-focused estimates.

Figure 2.9: Tier 1 sustainable supply estimates by water source and NWPA county, MGD

County	Shallow groundwater	Deep groundwater	Rivers	Lake Michigan	Total
DeKalb	11.3	11.3	n/a	n/a	22.6
Kane	11.3	11.3	14.8	2.3	39.8
Kendall	5.1	5.1	n/a	2.6	12.7
Lake	8.1	2.3	n/a	73.5	83.9
McHenry	26.9	17.8	0.1	n/a	44.8
Total	**62.7**	**47.8**	**14.9**	**78.4**	**203.8**

Source: ISWS, Water Budget Vista, 2024.

Note: Lake Michigan values reflect existing allocations as of 2017 and do not include planned source switches by several NWPA communities. They also do not consider the Illinois Water Inventory Program purchase network, which accounts for the purchasing or selling of water by municipal PWS systems or water commissions that supply water to multiple municipal PWS systems. Therefore, the Lake Michigan value in Kane is associated with demand in Hoffman Estates and the value in Kendall is associated with demand in Plainfield. The ISWS plans to update these estimates to reflect the purchase network work in the future. The deep groundwater values for Kane, Kendall, and DeKalb counties are the same as the shallow supply values because the sandstone aquifer in these counties is near the land surface and shares the same recharge as nearby shallow aquifers. As a result, the estimates are based on the same methodologies and assumptions used for shallow groundwater supply. ISWS plans to revise this approach as they make improvements to the groundwater models used to generate these estimates.

Water demand forecast

In addition to the water supply, current and future water demand is needed to understand if water withdrawals are in line with the sustainable supply estimates. With support from IDNR and assistance from IISG, CMAP maintains a regional water demand forecast to inform local and regional planners. Water demand is influenced by key factors including population and employment. Like previous efforts, this latest forecast uses the unit use method, which estimates current per-capita, per-employee, or per-acre water consumption (depending on the sector) and multiplies these values by projected population, employment, and land use conditions.

The 2024 forecast spans 30 years (2020-2050) with projections at five-year intervals, aligning with CMAP's 2022 Socioeconomic Forecast. The socioeconomic forecast incorporates population and employment trends, factoring in birth, death, and migration data from county health departments and the U.S. Census Bureau. Employment trends are derived from Moody's Analytics. The forecast includes policy impacts from recommendations in ON TO 2050, northeastern Illinois' comprehensive plan.

The water demand forecast includes five sectors: municipal PWSs systems, municipal domestic self-supply, smaller PWS systems, CII self-supply, and agriculture and irrigation self-supply. Two forecast methods were used for each sector forecast, with variations to reflect each sector's unique characteristics. The current conservation forecast was selected as the basis for the regional water demand forecast and is reflected in all regional totals. It assumes base-year unit use (measured either in gallons per capita, employee, or acre per day) and incorporates an annual percentage reduction to reflect recent conservation and historic trends.

The forecast assumes that communities and facilities will continue to rely on their current water source (Figure 2.4), unless they have taken official actions to change supplies. Seven municipal PWS are executing plans to switch sources during the forecast period.[30] See the *Regional Water Demand Forecast for Northeastern Illinois, 2020-2050* for details on the forecast methodology.

Across northeastern illlinois, water demand is expected to continue to decline thanks to steady advances in water conservation and efficiency that are outpacing population and employment growth. While the larger region can expect to see an 8 percent decrease from 2018 level by 2050, the NWPA counties are expected to only see a 2.2 percent decrease from 2018 levels due to continued population and employment growth projected for this area (Figure 2.10). Most declines in demand are projected to occur in Lake County and to a lesser extent McHenry County. DeKalb, Kane, and Kendall counties are projected to see demand increases by 2050.

Figure 2.10. Percent change in water demand by NWPA county, 2018 and 2050

County	Total use, MGD		Change in demand	
	2018	2050	MGD	Percent
DeKalb	8.3	10.0	1.7	20.7%
Kane	45.2	47.9	2.7	6.0%
Kendall	8.5	10.2	1.7	19.8%
Lake	73.0	64.0	-9.0	-12.3%
McHenry	24.6	24.0	-0.6	-2.6%
Total	**159.6**	**156.1**	**-3.5**	**-2.2%**

Source: Regional Water Demand Forecast for Northeastern Illinois, 2020-2050, 2024; ISWS, 2024.

Note: DeKalb County demand estimates are from ISWS, Water Budget Vista, 2024, which uses a different forecasting methodology and does not account for passive conservation trends.

The forecast projects demand by water source (Figure 2.11). Within the NWPA, water withdrawals from deep groundwater sources are projected to see the greatest decline, 8.5 MGD or 19.1 percent by 2050. This is likely due in part to the planned transitions from this source to Lake Michigan, where we see demand increasing in anticipation of new service areas. Shallow groundwater demand is anticipated to grow while demands on river water decline.

Figure 2.11: Percent change in withdrawals by source for NWPA counties, 2018 and 2050

County	Total use, MGD		Change in demand	
	2018	2050	MGD	Percent
Rivers	23.4	19.3	-4.1	-17.7%
Lake Michigan	51.9	57.8	5.9	11.4%
Sandstone aquifer	44.5	36.0	-8.5	-19.1%
Shallow aquifer	39.8	43.1	3.3	8.2%
Total	**159.6**	**156.1**	**-3.5**	**-2.2%**

Source: CMAP and IISG, 2024; ISWS, 2024.

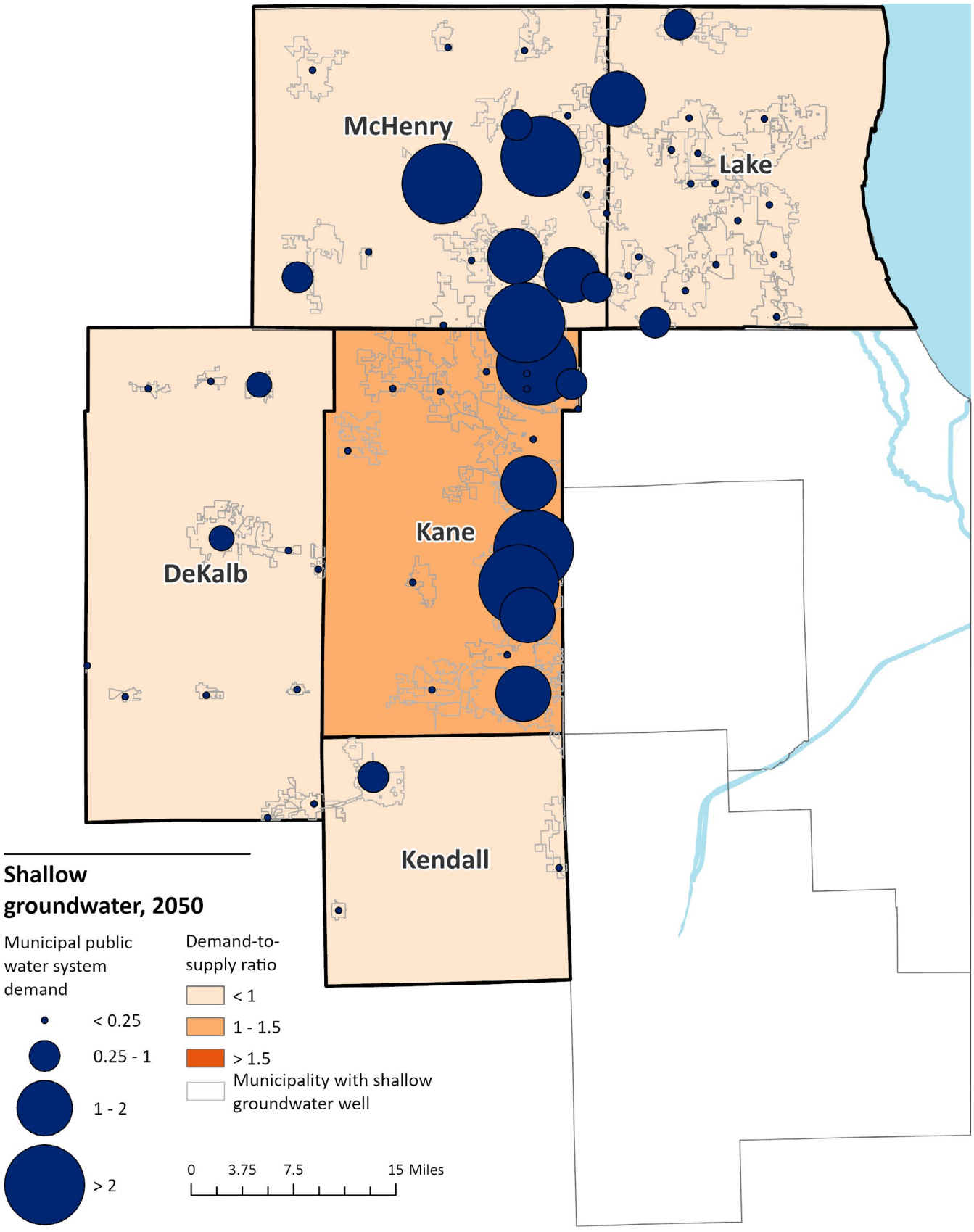
Note: Withdrawal totals are rounded to the nearest tenth; therefore, totals may not equal the sum of individual values due to rounding. DeKalb County demand estimates are from ISWS, Water Budget Vista, 2024, which uses a different forecasting methodology and does not account for passive conservation trends.

Supply and demand comparison

When compared to the sustainable water supply estimates by county and by source, the regional water demand forecast identifies areas where demand is expected to exceed supply. Figures 2.12 and 2.13 illustrate this comparison using a simple demand-to-sustainable-supply ratio for shallow and sandstone aquifers across the five counties in the NWPA region. Ratios greater than one indicate that demand surpasses the county's estimated sustainable supply.

Figure 2.14 provides estimates of how much demand should be reduced within each county so that total demands remain within sustainable supply estimates. In 2018, Kane County's total groundwater water demand of 34.0 MGD exceeded its estimated total groundwater supply of 22.6 MGD. This imbalance is projected to worsen by 2050 as Kane County's total groundwater water demand increases slightly to 35.3 MGD or approximately 3.8 percent.

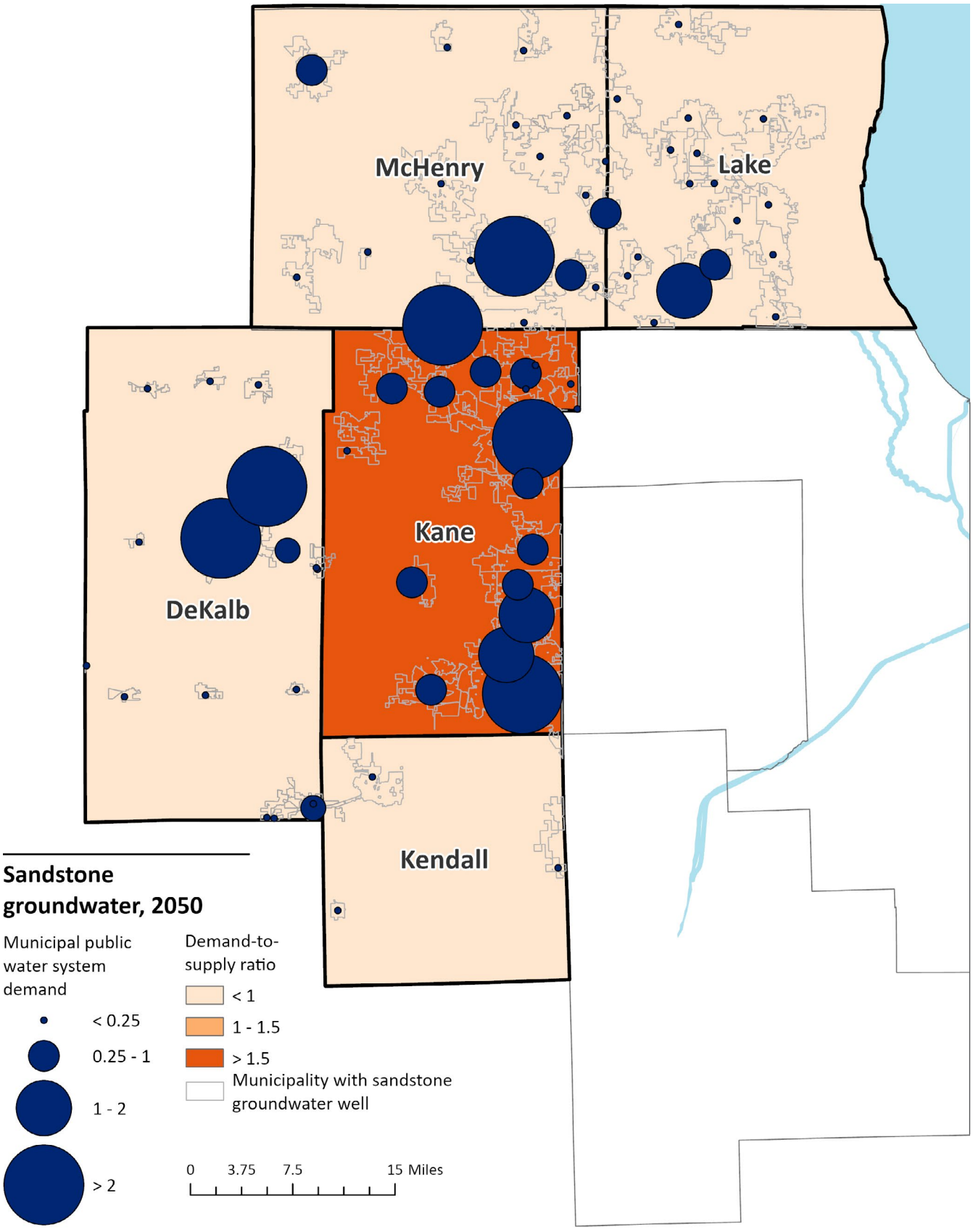
Figure 2.12: Demand-to-sustainable-supply ratio for shallow groundwater in the NWPA region, 2050



Source: CMAP and IISG analysis of the CMAP-IISG regional water demand forecast, 2024.

Note: Demand-to-supply ratios at the county scale will not capture localized mismatches between demand and supply.

Figure 2.13: Demand-to-sustainable-supply ratio for deep groundwater, 2050



Source: CMAP and IISG analysis of the CMAP-IISG regional water demand forecast, 2024.

Note: Demand-to-supply ratios at the county scale will not capture localized mismatches between demand and supply.

Figure 2.14: Demand reduction needed to align with shallow and sandstone sustainable supply estimates in the NWPA region, 2050

County	Reduction needed (MGD)
DeKalb	- *
Kane	12.2
Kendall	- *
Lake	- *
McHenry	- *
NWPA region	**12.2**

Source: CMAP and IISG, 2024.

Note: *Demand-to-supply ratios at the county scale will not capture localized mismatches between demand and supply.

While wells in these counties may still be productive, others may face risks such as reduced yields, drying up, or water quality challenges associated with the dewatering of an aquifer. Even in counties where overall demand remains within the sustainable supply estimates, localized challenges can still be present. Specific areas in DeKalb, Kendall, and McHenry counties are known to face risks of water stress due to concentrated demand or unique geological conditions (Figures 2.12 and 2.13).

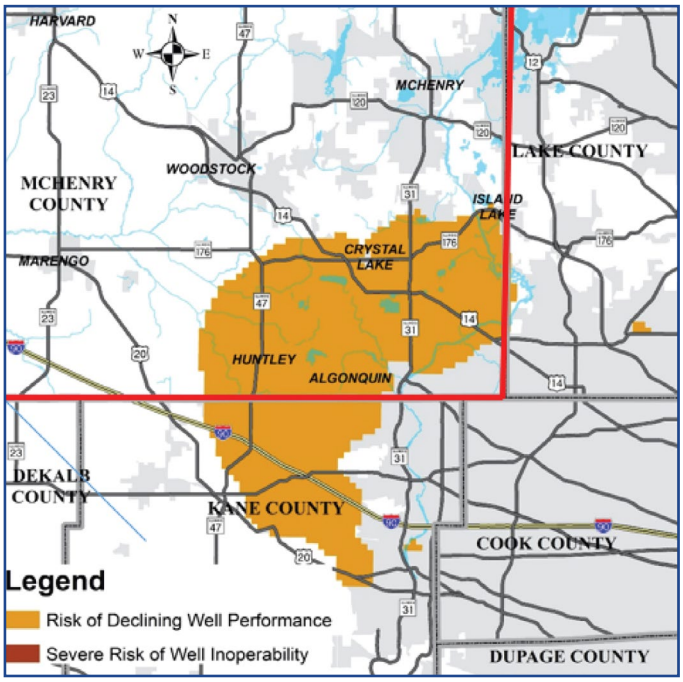
Even in counties where overall demand remains within the sustainable water supply estimates, localized challenges may arise. Specific areas in DeKalb, Kendall, and McHenry counties face risks of water stress due to concentrated demand or unique geological conditions.

The ISWS has performed more detailed local analyses that highlight risk levels within counties. For example, the ISWS was contracted by a group of stakeholders to investigate the status of the groundwater supplies in Will and Kendall counties.[31] The study used refined local data and explored where wells could be at risk of declining well performance and inoperability by 2030 and out to 2070. While the scope of the analysis did not include the full region, the modeling effort updated the regional groundwater flow model. The effort revealed that the southeast corner of McHenry County and northeast portions of Kane County were at risk of declining well performance in 2020. By 2050, the area at risk could extend further into McHenry and Kane counties, with some areas in the southeast corner of McHenry County becoming at risk of well inoperability (Figure 2.15).

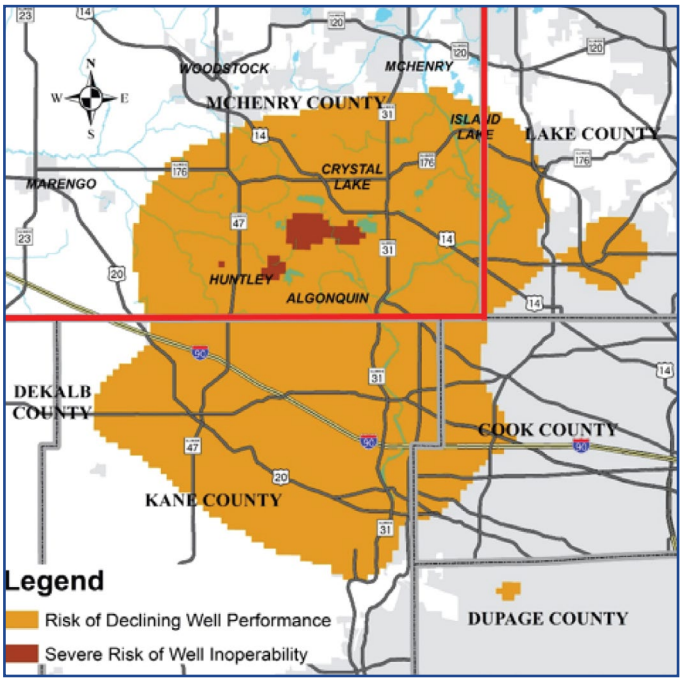
It is important to note that this analysis uses risk metrics developed based on analysis and feedback from the stakeholders involved. Similar localized studies would need to be completed to determine the risk thresholds deemed appropriate for other parts of the region.

Figure 2.15: Risk zones of declining well performance and well inoperability, 2020 and 2050

Risk zones, 2020



Risk zones, 2050



Source: Provisional results from the Illinois State Water Survey's groundwater flow model discussed in Abrams and Cullen 2020, prepared in April 2020 for a presentation for the McHenry County Water Resources Action Plan. The model included Joliet switching off the aquifer by 2030, but additional assumptions related to withdrawals and risk categorizations may differ from those documented in Abrams and Cullen, 2020 (CR-2020-04).[32]

Note: Risk of declining well performance is defined as areas having static water levels between 400 and 600 ft above the top of the Ironton-Galesville. Risk of well inoperability is defined as areas with static water levels that are less than 400 ft above the top of the Ironton-Galesville.

Water supply estimates are based on the land area of each county and the composition of the underlying aquifers. However, these estimates do not reflect where current demand exists or account for the accessibility of that demand to sustainable water supplies. This discrepancy is particularly significant for communities affected by degraded water quality and seasonal groundwater variability. In areas with seemingly abundant water, poor water quality can render the resource effectively unusable due to the high costs of treatment.

Despite these known limitations, the demand-to-sustainable-supply ratios give the NWPA region some insights into the scale of action needed to maintain a long-term supply. Further study, such as Kane County's forthcoming shallow aquifer study, could help illuminate where reductions are needed most and identify water quality or seasonality constraints that could refine these values.

As a part of a Kane County-sponsored study, the ISWS is refining the sustainable supply estimates for shallow groundwater in Kane County, with a focus on building a better understanding of areas where water withdrawals and land use change have shifted natural groundwater discharge to streams.[33] The study includes three parts — detailed groundwater sustainability modeling, a groundwater quality study similar to past county-wide studies, and the establishment of a groundwater monitoring network. Other counties, like McHenry County, have taken on similar efforts to build a comprehensive groundwater monitoring well network and conduct studies that provide more local insights into the county's shallow groundwater quality and quantity.

Chapter 3: Water conservation and efficiency framework

Ensuring the long-term viability of the region's water resources is both a shared challenge and a collective responsibility.

Vision and water sustainability goals

At the onset of the planning process, the project team worked with the NWPA Technical Advisory Committee and Executive Committee to craft a vision and a set of goals for each water source used within the NWPA region to guide the plan's development.

Plan vision

The NWPA Water Supply Sustainability Plan will serve as a roadmap for members seeking to take voluntary steps toward feasible and effective long-term use of water supply resources.

Goals for each water source

In addition to the overall vision for the water supply sustainability plan, the project team worked with the two committees to establish the following water sustainability goals for each of the water sources in the NWPA region.

Shallow aquifer
Shallow aquifers will provide NWPA communities and households with an affordable, safe, and sufficient water supply while supporting healthy aquatic ecosystems.

Sandstone aquifer
Water withdrawals will be managed at a rate that extends the life of the deep aquifers and gives NWPA communities experiencing adverse dewatering impacts adequate time to switch water sources.

Fox River
The Fox River will provide NWPA communities with an affordable, safe, and reliable water supply while sustaining aquatic ecosystems.

Lake Michigan
NWPA communities needing an alternative water source will have access to a sufficient, affordable, and safe water supply within the legal limits of Illinois' Lake Michigan allocation.

These goals identify multiple dimensions of water sustainability — water affordability, reliability, quality, and availability (i.e., water quantity). While each of these dimensions is related and equally important to address, the plan focuses on water quantity and measuring the direct water savings that can be achieved through water conservation and efficiency strategies.

Achieving sustainable supply through water conservation and efficiency

Recognizing that communities with municipal PWS systems are the primary users and providers of water in the NWPA region, the plan sets forth a series of water conservation and efficiency strategies targeting municipal water suppliers. Communities with municipal PWS systems can do a lot to reduce demand and ensure a sustainable supply for their residents and businesses, making them key leaders in water conservation and sustainable water management. The plan pays close attention to water use by single-family residential and commercial, industrial, and institutional properties and water loss within the system itself.

One community may use water conservation strategies to address short-term droughts impacting shallow groundwater, whereas another community may use water conservation to help extend the life of existing supplies and gain time to seek alternative water sources. In addition to helping ensure a long-term water supply for the region, communities can receive many other benefits and cost savings through water conservation and efficiency.

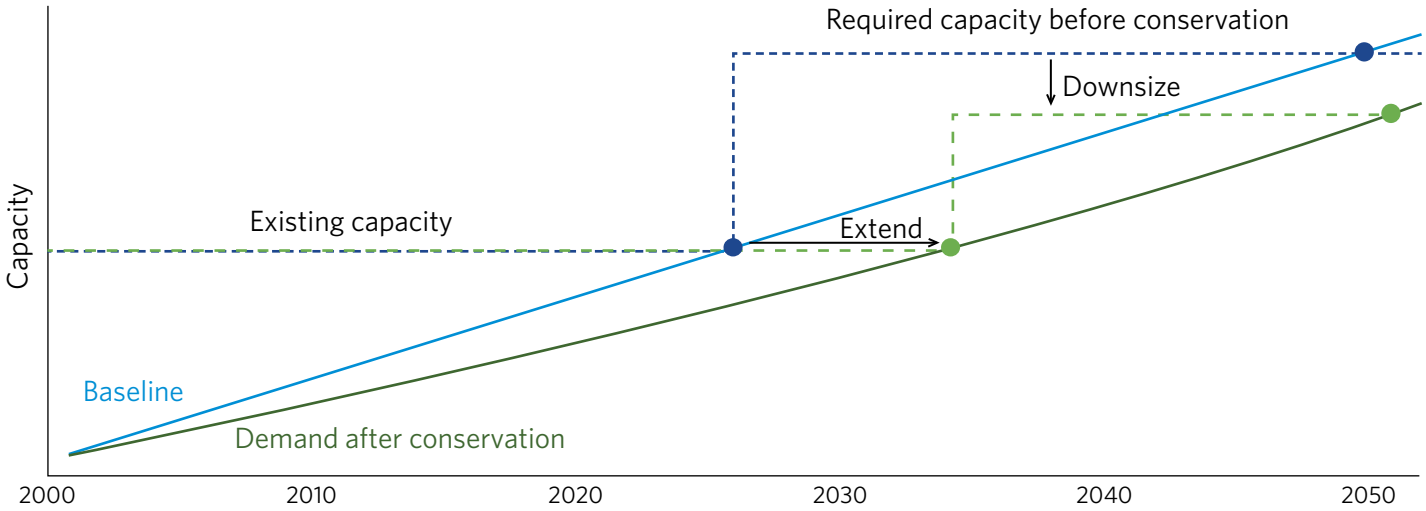
Manage peak demand

Peak demand is the maximum demand for a water supply system within a given timeframe. Since public water supply systems are often sized to accommodate peak demand, reducing demand spikes can have major infrastructure and cost implications, particularly when a water infrastructure system is at or near capacity. Water conservation strategies, such as outdoor watering policies and public information campaigns on outdoor watering best practices, can help keep demand low, particularly in the summer months when the peak demand is typically at its highest. These strategies are also likely to be most beneficial to municipal PWS communities that rely on water sources that are influenced by seasonal flows, such as shallow groundwater and the Fox River. Depending on a community's needs, reducing demand may also provide increased capacity for additional users of the existing water supply system. For more information on peak demand management, see CMAP's *Water 2050*.[34]

Delay and minimize expensive infrastructure investments

Water conservation can have an additional benefit of helping public water systems reduce the costs of expensive capacity expansion. When a community's water system is at or near capacity, they typically design expanded capacity to meet future projected demand. However, reducing water demand through conservation strategies can potentially achieve two cost-saving measures — delaying when new expansion is needed and reducing the size of the expansion when it becomes necessary. Figure 3.1 shows how effective water conservation efforts can affect the timing of capital facility construction and, thus, save money for the water system.[35, 36] The benefits can be applicable to all municipal PWS systems, no matter the water sources used.

Figure 3.1: Effect of conservation on when and what kind of investment is needed in a public water system



Source: American Water Works Association, 2006. Water Conservation Programs – A Planning Manual. American Water Works Association Manual M52, First Edition, page 75.

Reduce climate emissions and energy costs

Community PWS systems are responsible for treating and delivering water to homes and businesses, which requires large amounts of energy. When water demand increases, energy demand increases, with additional energy being used to heat the water once inside the home. Decreasing demand for municipal water systems and increasing efficiency can result in energy and cost savings while reducing greenhouse gas emissions.

Minimize the need to switch water sources

Water conservation and efficiency may be a more economical alternative for communities looking to switch or find new water sources, such as those that rely on deep sandstone aquifers. By reducing overall demand, a community can postpone the need for additional supply, or at least extend the life of its existing sources. If switching sources is necessary, extending the life of existing sources can give communities more time to secure a new source, which can take multiple years and require significant resources.

Priority water conservation strategies

The NWPA selected several priority water conservation measures based on their ability to achieve water sustainability goals, the feasibility of quantifying potential water savings with available data, the potential of the strategy to result in water savings based on sectors with the highest use, and the potential for implementation of the strategy across NWPA communities. The selected water conservation measures include:

- Residential retrofits, focused on appliances and fixtures
- Outdoor landscape efficiency
- Water efficiency in new development, focused on WaterSense Homes
- Water loss control
- Commercial, institutional, and industrial water conservation programming

Each water conservation strategy was explored to better understand the potential actions and techniques communities can take to implement the strategy, the current level at which communities are implementing the strategy, the potential water savings that could be achieved if implemented, and available resources to promote implementation (see chapter 4). The technical expertise of TAC members helped to confirm the feasibility and implementation levels of selected water conservation strategies.

While the plan focuses on these five strategies prioritized by the NWPA, there are many other strategies that communities can take to reduce their water demand and protect supply. See chapter 5 for brief descriptions of other water conservation strategies that municipalities may consider as they embark on water conservation planning and implementation.

Potential water savings estimates

The plan estimates the potential water savings that could be achieved if municipal PWS communities throughout the NWPA region implemented the five prioritized active water conservation strategies between 2025 and 2050. Estimates are derived from the *Regional Water Demand Forecast for Northeastern Illinois, 2020-2050*. They also consider the strategy's target audience, existing levels of implementation, market penetration rates, anticipated implementation rates, and other available data to craft an estimate tailored to the NWPA region (see chapter 4).

Estimates are provided under a moderate water conservation and efficiency scenario and a high water conservation and efficiency scenario. The moderate scenario represents 50 percent program participation expected during the planning period and is characterized by a 50 percent standard. The high scenario represents the maximum program participation expected during the planning period and is characterized by a 100 percent standard. Program participation metrics vary by strategy, but the standards are applied equally across each.

Comparison of sustainable supply and combined savings

Active water conservation and efficiency can help the NWPA region become more aligned with their sustainable supply estimates. Under the high (100 percent program participation) water conservation and efficiency scenario, the NWPA region can save 38.4 MGD from the prioritized water conservation and efficiency strategies, with 61 percent (23.3 MGD) being attributed to groundwater savings and 31 percent (11.8 MGD) being attributed to Lake Michigan savings (Figure 3.2).

Figure 3.2: Water savings achieved from prioritized water conservation and efficiency strategies by NWPA county and water source under the high water conservation and efficiency scenario (100 percent program participation), in MGD

County	Potential saving estimates, MGD			Total
	Groundwater	Fox River	Lake Michigan	
DeKalb	2.1	0.0	0.0	2.1
Kane	9.4	3.3	0.0	12.7
Kendall	3.0	0.1	0.1	3.2
Lake	2.1	0.0	11.7	13.8
McHenry	6.7	0.0	0.0	6.7
NWPA region	**23.2**	**3.5**	**11.8**	**38.4**

Source: CMAP and IISG, 2024.

Note: Savings estimates are rounded to the nearest tenth; therefore, totals may not equal the sum of individual values due to rounding.

On a county level under the high (100 percent program participation) water conservation and efficiency scenario, Kane County's municipal PWS communities can decrease their groundwater demand to meet 77 percent of the total reduction needed to align with sustainable supply estimates. This would leave 2.80 MGD that would need to be addressed by additional strategies (Figure 3.3).

Figure 3.3: Demand reduction remaining after savings achieved from prioritized water conservation and efficiency strategies under the high water conservation and efficiency scenario, in MGD

County	Reduction needed to align with groundwater sustainable supply estimates	Groundwater savings estimates (100% program participation)	Reduction remaining to align with groundwater sustainable supply estimates
DeKalb	- *	2.1	-
Kane	12.2	9.4	2.8
Kendall	- *	3.0	-
Lake	- *	2.1	-
McHenry	- *	6.7	-
NWPA region	**12.2**	**23.2**	**2.8**

Source: CMAP and IISG, 2024.

Note: Savings estimates are rounded to the nearest tenth; therefore, totals may not equal the sum of individual values due to rounding. Groundwater refers to both shallow and deep aquifer sources. *Reductions will be needed in local areas facing risks of water stress due to concentrated demand or unique geological features.

Of the five prioritized strategies, water loss control measures, residential retrofits, and building water-efficient, single-family residential development broadly implemented throughout the region can achieved the greatest savings (Figure 3.4). On a county level, the strategy that can offer the greatest savings varies based on water use, housing stock, and projected development. In Kane and Lake counties, water loss techniques are estimated to provide the greatest savings, followed by residential retrofits. In Kendall and McHenry counties, which are anticipated to see an increase in population, constructing water-efficient, single-family residential development would provide the greatest savings.

Figure 3.4: Water savings by NWPA county and prioritized water conservation and efficiency strategies under the high (100 percent program participation) water conservation and efficiency scenario, in MGD

County	Potential saving estimates, MGD					Total
	Residential retrofits	Outdoor landscape efficiency	New residential development	Water loss	CII conservation programming	
DeKalb	0.6	0.1	0.4	0.7	0.3	2.1
Kane	3.2	0.3	2.9	4.3	2.1	12.7
Kendall	0.6	0.1	1.3	0.8	0.4	3.2
Lake	3.9	0.4	1.4	5.5	2.6	13.8
McHenry	1.8	0.2	2.0	1.9	0.9	6.7
NWPA region	**10.1**	**1.1**	**7.9**	**13.1**	**6.2**	**38.4**

Source: CMAP and IISG, 2024.

Note: CII building data was not available for DeKalb County. Estimates are based on DeKalb's non-residential base water use and CII building share equivalent to Kendall County.

However, it is the sum of these actions that will bring the region in better alignment with its sustainable supply estimates. For Kane County, where current data indicates that it needs to reduce its groundwater demand by 12.2 MGD, water loss control techniques implemented across the county's municipal PWS communities would only get the county a reduction of 3.1 MGD, making them only 26 percent closer to its sustainable groundwater supply estimate (Figure 3.5).

Figure 3.5: Water loss control savings by NWPA county and water source under the high (100 percent program participation) water conservation and efficiency scenario, in MGD

County	Groundwater Savings Estimates, 100% scenario	Fox River Savings Estimates, 100% scenario	Lake Michigan Savings Estimates, 100% scenario	Total
DeKalb	0.7	0.0	0.0	0.7
Kane	3.1	1.1	0.0	4.3
Kendall	0.8	0.0	0.0	0.8
Lake	0.8	0.0	4.6	5.5
McHenry	1.9	0.0	0.0	1.9
NWPA Region	**7.3**	**1.1**	**4.7**	**13.1**

Source: CMAP and IISG, 2024.

Note: Savings estimates are rounded to the nearest tenth; therefore, totals may not equal the sum of individual values due to rounding.

The water demand and sustainable supply estimates, and the remaining groundwater demand reduction needed, is based on the demand and supply across all water sectors, not just the municipal PWS sector. While the municipal PWS sector is the largest water user within the NWPA region and the comparison is helpful to demonstrate what is possible, there is a need for other sectors, such as the agriculture and irrigation and the CII self-supply sectors, to contribute to the region's efforts in reducing demand and bringing all counties in better alignment with their sustainable supply estimates.

Chapter 4: Water conservation strategies and potential water savings

Municipal water suppliers in the NWPA region are well positioned to save water through passive and active water conservation. Passive water conservation refers to measures that manage or reduce water consumption, such as the installation of more efficient fixtures as a result of natural replacement over time or through regulation (e.g., plumbing codes), without requiring major behavior change or investment from the customer or water utility.[37,38] Active water conservation refers to the intentional, direct investments or actions taken to reduce water consumption and enhance water efficiency. Active conservation can also accelerate the pace of passive conservation.

The plan's five water conservation strategies encompass active and water conservation measures aimed at reducing water consumption and improving water efficiency within the NWPA's municipal PWS sector. The strategies specifically target three subsectors, or water uses, common within municipal PWS systems: single-family residential (strategies 1-3), water loss within the system's supply and distribution (strategy 4), and non-residential commercial, institutional, and industrial (CII) (strategy 5) customers (Figure 4.1). These subsectors were selected based on the NWPA's land use profile, which identifies single-family residential as the predominant land use, and national averages that indicate they account for the largest shares of water use in the PWS sector (see chapter 2).

Figure 4.1: Water conservation and efficiency strategies and municipal PWS subsectors

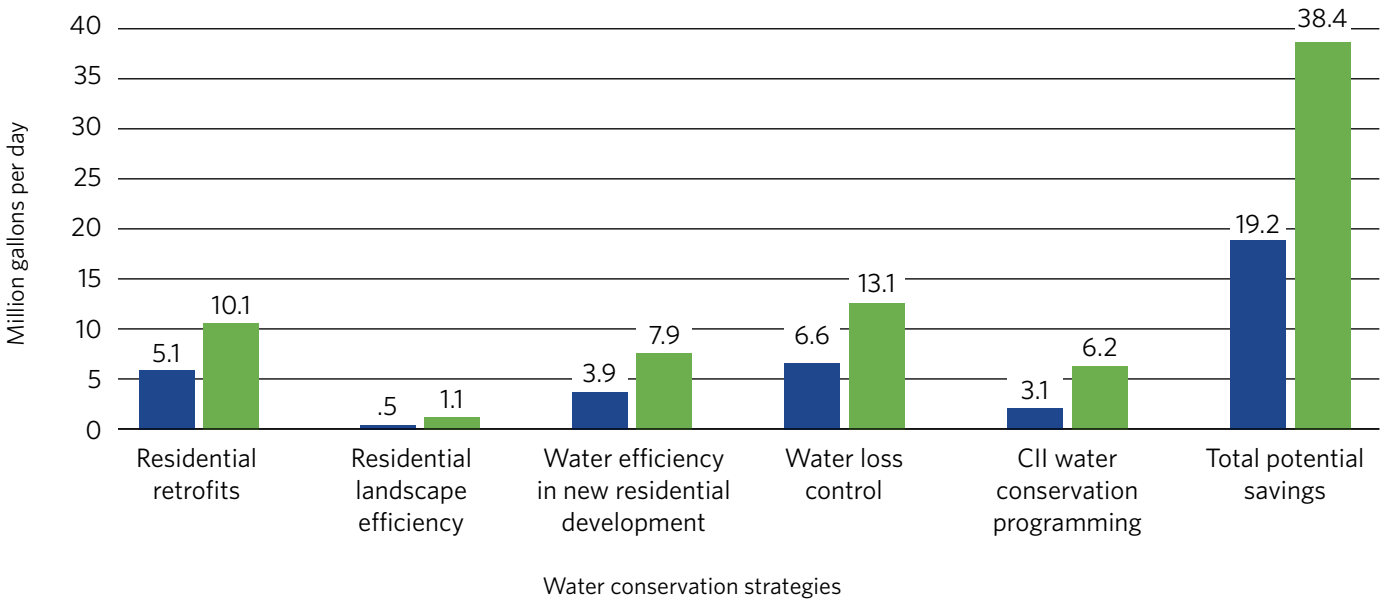
Water conservation strategy	Water uses (subsectors)
Residential retrofits	Single-family residential customers
Outdoor landscape efficiency	Single-family residential customers
Water efficiency in new development	Single-family residential customers
Water loss control	Water loss within system supply and distribution
Commercial, institutional, and industrial water conservation programming	Non-residential commercial, institutional, and industrial customers

Potential combined water savings

If the NWPA's municipal PWS sector implemented the five strategies under the high water conservation and efficiency scenario, communities could collectively reduce the region's water demand by 38.4 MGD (Figure 4.2). Under the moderate scenario, they would reduce demand by 19.1 MGD. This illustrates how communities can reach more significant savings when they all actively engage in multiple water conservation efforts.

Among the five strategies, water loss control initiatives and residential retrofits present the greatest potential for water savings across the NWPA municipal PWS sector (Figure 4.2). Under the high conservation and efficiency scenario, water loss control measures could reduce municipal water demand by 13.1 MGD; under the moderate water conservation and efficiency scenario, they could reduce demand by 6.6 MGD. Residential retrofits can provide between 5.1 and 10.1 MGD in water savings.

Figure 4.2: Potential water savings achieved by water conservation strategies, individually and combined



Source: CMAP and IISG, 2024.

The five selected water conservation strategies are described in more detail below. Each strategy includes a brief description detailing its significance, the assumptions used to estimate the potential water savings, and a summary of its potential water savings. Additionally, each strategy provides an overview of current implementation levels and identifies various implementation approaches that a municipal public water supplier can adopt to implement the strategy. To further support municipal public water systems with implementation, outreach and educational resources and relevant case studies are provided.

Calculating potential water savings

Baseline water use

With 2018 as the base year, water use for the NWPA region's municipal PWS sector was 131.5 million gallons per day (MGD). When looking at these withdrawals by source, 33.8 MGD came from shallow groundwater sources, 39.5 MGD from deep groundwater sources, 11.5 MGD from river sources, and 46.6 MGD from Lake Michigan. A base year of 2018 was selected because it is the most recent data available across all water users in the NWPA region. Additionally, unlike 2019 and subsequent years, 2018 was also a relatively normal year in terms of weather conditions and does not include pandemic-related impacts.

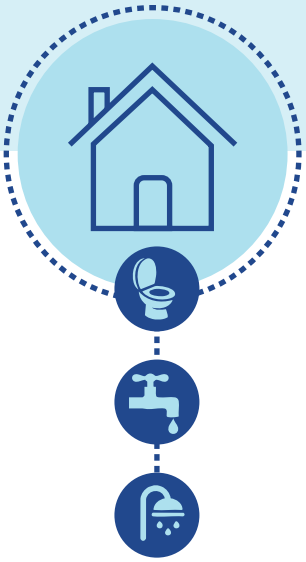
Implementation rates

Savings are calculated in relation to the proportion of the NWPA region's municipal PWS sector water use for a given end use of water (e.g., residential and non-residential customers, water loss). The moderate water conservation and efficiency scenario assumes 50 percent program participation (i.e., adoption and implementation of the strategy). The high scenario assumes 100 percent program participation.[39] Program participation metrics vary by strategy, but the standards are applied equally across each. Program participation inherently assumes that PWS communities have the necessary programs, policies, tools, and funding, and that the water utility and their customers adopt these strategies and achieve the savings to the degree specified by the scenario.

Note that the estimated savings represent active conservation, where PWS communities are directly engaging in activities that reduce water use. These savings are in addition to passive savings, which generally occur without specific actions from an individual community or utility. These include water savings gained from the installation and/or replacement of more efficient water appliances and fixtures due to natural replacement rates and any federal standards focused on accelerating technological efficiencies. The passive savings are assumed to be accounted for in the regional water demand forecast.

Point-in-time water savings

The potential water savings estimates for each strategy are point-in-time water savings, meaning savings are estimated as if the strategy were implemented in its entirety in the current period and participation rates achieved through the end of the planning period. One exception is a strategy that estimates the savings gained from the integration of water efficiency into new development, which has tailored projected water savings between 2020 and 2050, in five-year increments.



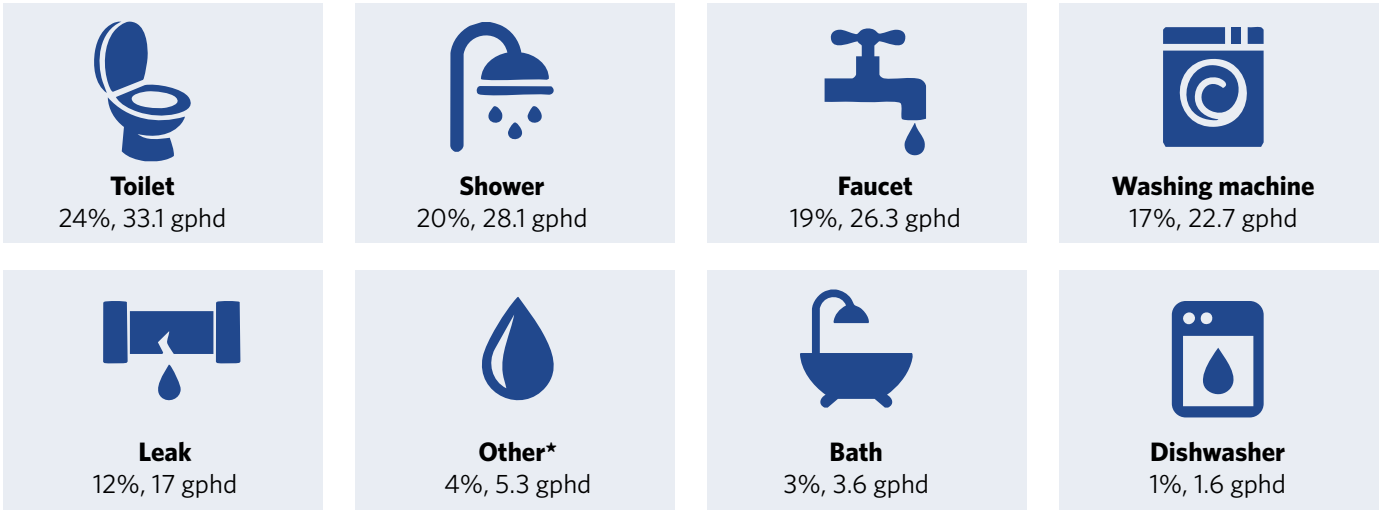
Residential retrofits

Residential indoor water use often accounts for the largest share of a community's total water demand, since water used inside a home can make up nearly two-thirds of residential water use annually.[40] Changing how water is used inside is an effective approach to reducing a community's overall water demand. Specifically, replacing older fixtures or devices with more water-efficient fixtures can be a cost-effective and reliable strategy for reducing indoor residential water use. According to the 2016 Residential End Use of Water study, indoor household water use could drop by 35 percent or more if all household devices were high-efficiency.[41]

Indoor activities, from prepping a meal to showering, rely on water supplied through various fixtures and appliances. The most common and water-intensive devices within a home are toilets, kitchen and bathroom faucets, showerheads, dishwashers, and washing machines. The amount of water supplied through these devices depends on their efficiency and the frequency and duration at which the device is used. Water-efficient devices are designed to slow the flow rate through a device.

The residential retrofit strategy focuses on the replacement of four devices — toilets, shower heads, and faucets (kitchen and bath) — in single-family residential homes with more efficient options. While there are multiple fixtures and appliances that can be replaced, toilets, kitchen and bathroom faucets, and showerheads have the highest water use (Figure 4.3).[42] Communities can encourage residents to replace these fixtures through financial incentives or rebates, building code requirements, and/or education.

Figure 4.3: Indoor household water use by fixture by gallons per household per day (gphd)



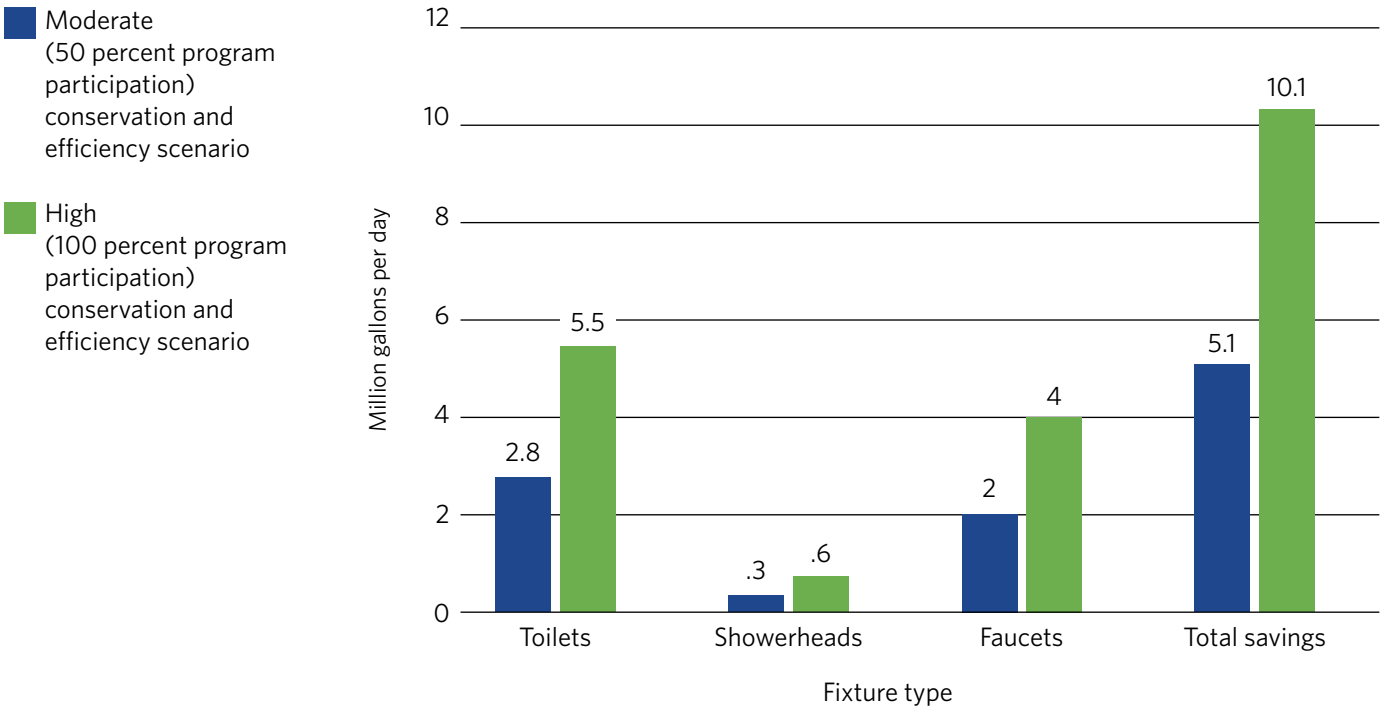
Source: Water Research Foundation, Residential End Uses of Water, Version 2, Executive Report.

Note: The other category includes evaporative cooling, humidification, water softening, and other uncategorized uses.

Potential water savings

The potential water savings from the replacement of single-family residential toilets, faucets, and showerheads is approximately 5.1 MGD under the moderate scenario or 10.1 MGD under the high scenario. Of the three device types, toilets have the greatest water savings potential ranging from 2.8 MGD to 5.5 MGD, followed by faucets at 2.0 MGD to 4.0 MGD (Figure 4.4).

Figure 4.4: Residential retrofits water savings estimates by fixture type



Source: CMAP and IISG, 2024.

How was this calculated?

Current indoor water use

In 2018, indoor water use from toilets, showerheads, and kitchen and bathroom faucets in single-family homes is estimated to be 35.8 MGD. Toilets account for 24 percent of this water use (13.6 MGD), followed by showerheads at 20 percent (11.4 MGD) and faucets at 19 percent (10.8 MGD). These estimates assume that single-family residential water use accounts for 48 percent (63.1 MGD) of the NWPA region's total municipal PWS water sector use (131.5 MGD), with 90 percent of that use (56.8 MGD) used indoors.

Device efficiency standards

The strategy assumes that the devices being replaced will meet USEPA's WaterSense efficiency standards shown in Figure 4.5. The Energy Policy Act of 1992 required the use of more efficient plumbing fixtures, including toilets, urinals, showerheads, and faucets. In Illinois, homes built before 1993 typically installed plumbing fixtures that use double or triple the amount of water as compared to the water efficiency standards established by Energy Policy Act. The USEPA then created the WaterSense program in 2006, which set more efficient standards for fixtures, such as toilets, showerheads, and faucets, and created the WaterSense-branded label certifying that a product meets USEPA's water efficiency and performance standards. On average, WaterSense labeled fixtures use 20 percent less water than the federal water-efficiency requirements.[44]

Figure 4.5: Water efficiency standards for common indoor water fixtures

Water fixture	2006 USEPA WaterSense Standards
Bathroom faucet (gallons per minute, gpm)	1.5
Kitchen faucet (gpm)	1.2
Toilets (gallons per flush, gpf)	1.28
Showerheads (gpm)	2

Source: USEPA WaterSense.

Market penetration

All single-family residential homes built before 2007 are assumed to be apt for residential retrofits, given that these homes are more likely to have fixtures that pre-date the WaterSense standards.[45] Single-family residential homes built before 2007 were estimated using a buildings dataset derived from CMAP's 2022 Socioeconomic Forecast's land use-based model, UrbanSim. Additional assumptions around the number of devices and device use per household were derived from US census data.[46]

These devices were further adjusted to assume some fixtures had been naturally replaced since 2007. A 2019 Plumbing Manufacturers International study, which assessed the prevalence of USEPA WaterSense labeled products, estimated that nationally 16.8 percent of all residential tank-type toilets were WaterSense, 40.1 percent of bathroom faucets were WaterSense, and 45.4 percent of showerheads are estimated to meet the WaterSense standard.[47]

In addition to natural replacement rates, few communities in northeastern Illinois offer water conservation incentives to encourage the active replacement of water fixtures. The City of Joliet is the only municipality within the NWPA region with a water fixture replacement rebate program. This program provides rebates to homeowners if they are a water customer and replace a high volume toilet with a high-efficiency model (see case studies section below).

Implementation approaches

With only one municipal PWS community in the NWPA region with a water fixture rebate program, there are ample opportunities for communities to develop programs and policies that promote the high-efficiency water fixture replacements. Municipal PWS communities can use financial incentives and local policies to advance adoption of and realize the potential water savings associated with the residential retrofits strategy.

Financial incentives

Rebates are a common incentive used to facilitate residential retrofits. Rebate programs are typically administered by a public water utility and offer a monetary incentive, often in the form of a check or credit, for purchasing and installing high-efficiency fixtures to accelerate the replacement rate of older, less efficient fixtures. Read more about the City of Joliet's Low Flow Rebate program and other programs within the Midwest in the case studies section below.

Local policy

The retrofitting or replacement of residential water end use fixtures can also be done through local policy. Plumbing codes typically require the use of WaterSense labeled fixtures when repairing or replacing plumbing components and when reselling a home. When a home is resold, an inspector may look for compliance with the plumbing codes and require the fixtures to bear a WaterSense label. If fixtures are not WaterSense labeled, the seller might need to replace them to meet requirements. Currently, six communities within the NWPA region require WaterSense labeled fixtures through local plumbing codes.[48]

Case studies

Low Flow Rebate Program (Joliet, IL)
The City of Joliet offers a $100 rebate to water customers who replace a high-volume toilet (more than 1.6 gallons per flush) with a WaterSense high-efficiency toilet (1.28 gallons per flush). The program applies to homes built before 1994, and the customer must be the property owner.[49]

Metropolitan Council Water Efficiency Grant Program (Twin Cities metropolitan area, MN)
The Metropolitan Council, the regional planning agency serving the Twin Cities metropolitan area that also provides wastewater service, provides grants to municipalities for purchasing and installing water-efficient products. These grants range from $5,000 to $50,000 and aim to reduce costs for residents, commercial properties, and government facilities, covering items like toilets, washing machines, dishwashers, and irrigation systems. Between 2015 and 2023, the program has replaced 6,137 toilets, 2,965 washing machines, 750 residential dishwashers, 723 irrigation spray sprinkler bodies, and 4,757 irrigation controllers; conducted 174 irrigation audits; and saved 207.8 MGD annually.[50]

Toilet Rebate Program (Verona, WI)
The City of Verona, Wisconsin, is a suburb of Madison home to 14,000 residents. The city runs a program to incentivize residential and multi-family property owners to replace old, inefficient toilets with newer, high-efficiency models. Eligibility is limited to properties replacing less-efficient toilets with those that have a flush rate of 1.28 gallons per flush or less. The program offers rebates of $100 per toilet, with varying limits based on property meter size. The total program funding is capped at $10,000 per calendar year.[51]

Toilet Rebate Program (Marshall, MN)
The City of Marshall, Minnesota, is a small rural community of 13,500 residents. Marshall Municipal Utilities offers a rebate of $50 for installing qualifying WaterSense labeled high-efficiency toilets when replacing an existing older unit, remodeling, or in new construction.[52]

Outreach and education resources

WaterSense Products
The USEPA WaterSense Products webpage has a multitude of resources on water-efficient fixtures, including one-page overviews, fact sheets, and performance and specifications details for residential toilets, showerheads, bathroom faucets, and urinals. WaterSense also has a tool for calculating potential water savings from retrofitting older fixtures.

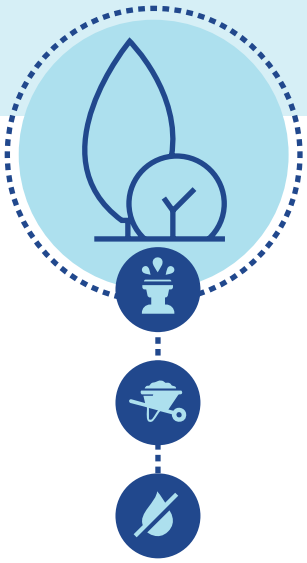
Website: www.epa.gov/watersense/watersense-products

WaterSense Rebate Finder
The WaterSense Rebate Finder allows users to search for rebates on water-efficient products and services in their area. The website lists various WaterSense labeled products, such as toilets, showerheads, and faucets, and connects users with local water providers that offer rebate programs. It does not directly provide rebates but facilitates finding available incentives to encourage water conservation. Users can search by partner name, rebate type, building type, and state.

Website: www.lookforwatersense.epa.gov/rebates

WaterSense Partner resources
While the WaterSense Product and Rebate Finder are tools that are geared toward water customers, communities that are a WaterSense Partner have access to an array of resources that are geared toward municipalities, non-profit organizations, schools, and other entities that are positioned to create, administer, and education customers about water conservation. The NWPA is a USEPA WaterSense Partner and communities can become members, too. It is free to become a WaterSense Partner.

Website: www.epa.gov/watersense/join-watersense



Outdoor landscape efficiency

Residential outdoor water use accounts for a significant share of a community's total water demand. On average, water used outside a single-family home can make up nearly one-third of residential water use annually, though it can be closer to 10 percent for wet, cooler climates.[53] Outdoor water use, which is primarily used for landscaping and irrigation, can be attributed to water-intensive landscapes as well as inefficient watering techniques and technologies. Increased outdoor watering during the summer months and inefficient watering techniques can strain the region's drinking water supplies and raise sustainability concerns. Changing how water is used for landscaping and irrigation can help reduce a community's overall and peak water demand.

The outdoor landscape efficiency strategy aims to promote the adoption of landscaping and irrigation technologies, practices, and policies that decrease residential outdoor water use. Although there are many actions a community can take, the strategy highlights three measures: the use of water-efficient landscaping, efficient irrigation systems and management, and outdoor water use restrictions.[54] Through these activities, the NWPA region can work toward reducing outdoor water loss and waste from inefficient and poorly managed irrigation systems and technologies, using less water for water-intensive landscaping and inefficient landscape maintenance practices, and managing peak water demand from inefficient watering practices like overwatering, particularly during the summer months and times of drought.

Water-efficient landscaping

Creating and maintaining more water-efficient landscapes (naturally requiring less water) is one way to help reduce residential outdoor water use. Designing a water-efficient landscape may involve grading outdoor spaces to avoid runoff, constructing rain gardens to capture runoff, and using native plants, turf varieties, and ground covers like mulch that require less water. Maintaining a water-efficient landscape can involve adopting natural lawn care and land management practices, including sustaining soil health and applying natural fertilizer. Municipalities can also require efficient landscaping techniques through new development standards; see the "water efficiency in new development" strategy for more details.

Potential savings vary widely due to the different measures that can be taken, as well as factors such as climate change, precipitation rates, the size of outdoor space, and other drivers that influence outdoor aesthetics. Studies have shown that residential properties can achieve a 20- to 50-percent reduction in outdoor water use by implementing water-efficient landscaping practices.[55]

Efficient irrigation systems and management

Efficient irrigation systems and management practices aim to efficiently use water resources with irrigation systems and technologies that optimize watering schedules and applications. Systems and technologies like drip or subsurface irrigation and high-efficiency sprinklers help apply water more directly and efficiently to plants and their root zones. Smart irrigation controllers, such as weather-based and soil moisture-based controller systems, monitor weather or soil conditions to determine if watering is needed. These types of technologies can help users avoid overwatering and reduce water loss through runoff or evaporation. The USEPA estimates that weather-based WaterSense irrigation controllers can save 7,600 gallons of water annually per household, and soil moisture-based irrigation controllers can save 15,000 gallons of water annually per household.[56] Research has also shown that irrigation system controllers for automatic in-ground sprinkler and drip systems can save 10 to 15 percent of outdoor water use.[57]

Maintaining efficient irrigation systems and technologies is key to ensuring they achieve water savings benefits. Irrigation system management measures can include outdoor water system audits and regularly monitoring for breaks and leaks in sprinkler heads and pipe connections. Other measures include adjusting sprinkler heads for direct water application and winterizing the system to reduce water use and prevent water waste.

There are two different types of smart irrigation controllers: weather-based controls and soil moisture-based controllers. Weather-based controllers use sensors to monitor the weather conditions which directly affect daily evapotranspiration rates. Soil moisture-based controllers measure the amount of moisture in the ground to override scheduled irrigation when plants don't need water. Irrigation controllers can be used as a part of a larger in-ground irrigation system or as a standalone device in an outdoor space without an in-ground irrigation system.

Outdoor water use restrictions

Adopting outdoor water use restrictions through local ordinances is another measure communities can use to promote water-efficient landscaping and reduce outdoor water use. Restrictions help direct and manage how residents use water outdoors, specifically in relation to outdoor lawns and landscaping, as well as other secondary water uses.

Restrictions can be categorized into three major buckets: time restrictions, emergency restrictions, and landscaping (seed and sod) provisions. (See the implementation approaches section for an in-depth description of each restriction). One or more of these provisions can be adopted and enforced year-round, during drought conditions, or in the summer months when outdoor water use is the greatest.

Time restrictions

Time restrictions limit the duration and frequency at which watering is allowed. Time-of-day restrictions aim to prevent water use during the hottest, sunniest part of the day when water would most likely evaporate rather than be taken up by grass or plants. There are also consecutive-day and calendar-day restrictions that prohibit watering on two or more consecutive days, or on certain days. Even-odd address restrictions limit which days people can water based on their address. These types of restrictions can help lower peak demands and make it easier for utilities to identify non-compliant customers. National case studies show that time restrictions, such as consecutive day watering restrictions, can result in a zero- to seven-percent reduction in outdoor water use.[58]

Emergency restrictions

Emergency restrictions include tier- or status-based limits as well as emergency proclamations. Tier- or status-based restrictions are set and enforced based on weather and drought conditions. Each tier specifies the types of water behavior allowed and will become more restrictive as weather and drought conditions become dry and severe.

Emergency proclamations are implemented when a community declares a water emergency. Emergencies can be climate-related or infrastructure-related. Restrictions under proclamations can also vary, but those that fully ban non-essential outdoor water use are often used to ensure supplies are available for essential use. Research has shown mandatory restrictions like these can result in a 4 to 22 percent savings in outdoor water use when enacted alongside high levels of information and enforcement.[59] Other studies show that emergency proclamation watering restrictions can result in 18 to 30 percent annual savings.[60]

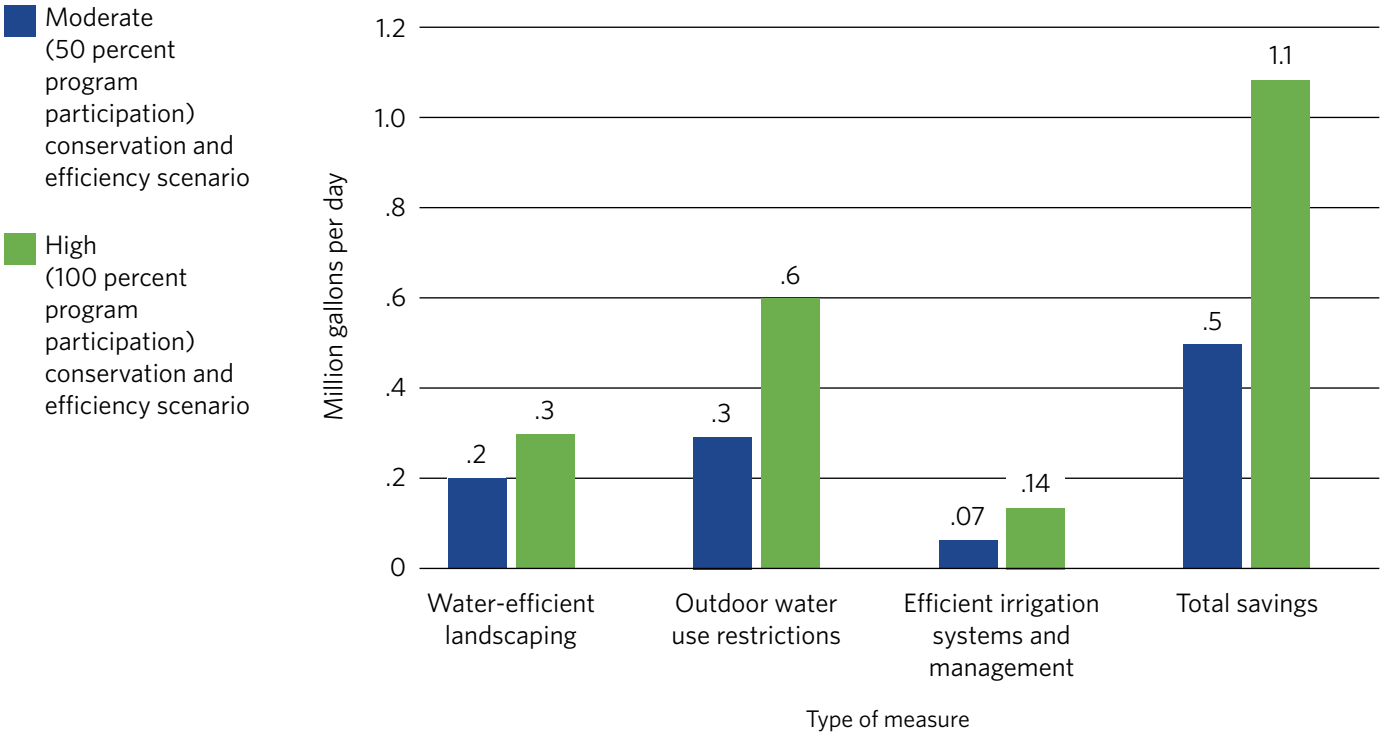
Landscaping provisions

Seed and sod restrictions prohibit the installation of new, water-intensive landscaping (planting seed or sod), particularly in the summer months when outdoor water use is high. Other restrictions can also be put in place to prevent water waste, such as the use of unattended sprinklers and a ban on "watering" sidewalks, driveways, and roads.

Potential water savings

The potential water savings from the outdoor landscaping efficiency strategy would be 0.5 MGD under the moderate water conservation and efficiency scenario or 1.1 MGD under the high scenario. The outdoor watering restrictions measure has the highest water savings potential of the three measures, which is reflected in the overall savings ranging from 0.3 MGD to 0.6 MGD (Figure 4.6).

Figure 4.6: Outdoor landscape efficiency water savings estimates by measure



Source: CMAP and IISG, 2024.

How was this calculated?

Current outdoor water use

Outdoor water use in 2018 for single-family homes is estimated to be 5.4 MGD. Several assumptions were needed to estimate the amount of water currently used outdoors. Derived from national studies, it is estimated that 48 percent of PWS water (63.1 MGD) is provided to single-family residential customers. Of that use, 10 percent (6.3 MGD) is assumed to be used outdoors. Based on water end use literature, it is estimated that 85 percent of that water is dedicated to landscaping, and the remaining 15 percent is dedicated to other uses, such as swimming pools and washing cars.

Outdoor efficiency rates and savings potential

The three landscape efficiency measures — water-efficient landscaping, efficient irrigation systems, and outdoor watering restrictions — have the potential to achieve 22 percent savings in single-family residential outdoor water use. Potential savings estimates for each measure were developed based on national and local case studies (Figure 4.7). Savings could be higher for some of these measures. For example, national estimates find voluntary outdoor water use restrictions to save 4 to 12 percent in outdoor water use. However, there are local case studies where the cities of Aurora and Elgin saw approximately a 20 percent reduction in outdoor water use through water restrictions during the summer.[61]

Figure 4.7: Potential water savings estimates for selected outdoor efficiency measures

Measure	Savings estimates
Water-efficient landscaping	6.9%[62]
Efficient irrigation systems and management	3%[63]
Outdoor watering restrictions	12%[64]

Source: CMAP and IISG, 2024.

Market penetration

Residential homes, historically, have the most land dedicated to outdoor landscaping; single-family land use is also the largest residential land use type by acreage within NWPA PWS communities. However, due to a lack of information on the prevalence of single-family homes practicing landscaping efficiency measures, available research was used to estimate that 10 percent of existing homes already engage in activities to reduce their water use, which brings the baseline water use to 4.8 MGD.[65]

Implementation approaches

This strategy focuses on existing single-family homes that have not already implemented the landscape efficiency measures. PWS communities are most equipped to create water conservation programs targeting residential customers as well as adopt and enforce outdoor water use regulations within their respective municipal codes. Communities can promote the adoption of water-efficient landscapes, irrigation technologies, and management techniques through targeted programs that encourage residents to voluntarily take on water-efficient practices or require adoption through policy and enforcement. Programs encouraging voluntary action often provide residents with technical assistance, financial incentives, and training and education to make it easier and more convenient for residents to adopt water-efficient landscaping practices, whereas required action is often achieved through design standards, plumbing and irrigation codes, and outdoor water use ordinances. Although some of these approaches are currently being used by NWPA communities, there are ample opportunities for communities to create new ones as well as leverage, expand, and improve those that already exist in the region.

Technical assistance

Technical assistance in the form of landscape consultations and assessments can equip residents with recommendations and information tailored to their outdoor space and climate to create a water-efficient landscape. This could include providing residents with customized re-grading plans, plant selection lists, and the most effective irrigation options.

Communities can also provide technical assistance to help residents with the installation and maintenance of water-efficient irrigation systems and technologies. Landscape irrigation audits are the most common form of this type of assistance. Audits that result in residents correcting malfunctioning irrigation controlling, adjusting watering times, and installing hardware like automatic shut-off values may reduce outdoor water demand by 10 to 15 percent.[66]

Technical assistance programs can be carried out by municipal staff or in partnership with third-party organizations or landscape contractors with dedicated staff and expertise to provide the needed assistance and information. Review the Healthy Landscape Assessment Program listed under the strategy and the Metropolitan Council Water Efficiency Grant Program listed under the residential retrofit strategy to learn how other communities and regional utilities are offering technical assistance to advance the use of water-efficient landscaping and irrigation systems.

Financial incentives
Financial incentives in the form of rebates, discounts, or credits reduce the upfront costs of investing in landscape materials (e.g., plants, native turf grass varieties, and mulch), irrigation systems, and technologies to create and maintain a water-efficient landscape. Rebates are most common for encouraging landscape conversions as well as the installation and use of smart irrigation controllers. Rebates and discounts for landscape conversions are often associated with the area of the outdoor space converted to a more water-efficient landscape, whereas a rebate for an irrigation controller is provided after the device is purchased. Financial incentive programs are typically implemented by states, counties, or any other (local or regional) water utility or authority.

Training and education
Providing training and education to landscape professionals or residents can equip them with the knowledge and skills necessary for installing and maintaining water-efficient landscapes and irrigation systems.

Most training and education for irrigation systems and technologies are aimed at irrigation professionals or contractors. For example, the Irrigation Association, in partnership with the USEPA WaterSense program, offers irrigation professionals certification programs that, upon completion and continuing education, enable them to market themselves as being certified by the WaterSense program.[67] Municipal PWS communities can encourage local irrigation professionals to pursue one of these certifications to further the adoption of best practices in water-efficient irrigation systems and management.

While water-efficient landscaping training and education can exist on its own, it is often paired with technical assistance or rebate programs. Data on the use of water-efficient landscaping practices in the NWPA region is limited. However, there are several voluntary programs providing education and technical assistance in creating native landscapes across the Midwest.[68] Notable programs include The Conservation Foundation's Conservation at Home program and the Lawn to Lake Midwest program led by the Illinois-Indiana Sea Grant. These programs are also detailed below in the outreach and educational resources section of this strategy. NWPA communities can leverage these initiatives to promote natural lawn care practices and educate homeowners and property owners of the benefits of water-efficient landscaping.

Local policy
Communities can also promote water-efficient landscaping through policies that influence landscaping and watering practices. Some of these policies can include — but are not limited to — development standards and landscaping ordinances, plumbing and irrigation codes, and outdoor water use. Development and landscaping policies tend to direct how a landscape is designed, while watering and irrigation policies control how a landscape is managed and irrigated over time.

Development and landscaping standards
Development standards can impact lot size and surface permeability, and therefore how much of a lot can be landscaped. For example, development standards regulate building setbacks and can require a certain percentage of undeveloped space to be dedicated to open or outdoor space. At the same time, landscaping ordinances can regulate the extent to which outdoor spaces can be landscaped, including guidelines on permeability and vegetation. Ordinances could require a certain percentage of permeable open space and limit vegetative cover to native turf grasses and vegetation types that are native and resilient to local climate conditions.

Outdoor water use restrictions
Outdoor water use restrictions can also be incorporated into municipal or county codes to help direct and manage how residents use water outdoors, specifically for outdoor lawns, landscaping, and secondary water uses.

To help communities reduce outdoor water and lower peak demand, the NWPA developed a regional lawn watering ordinance that includes multiple watering restrictions that promote outdoor water conservation (Figure 4.8).[69] Based on a CMAP analysis of municipal codes in 2019 and 2020, there were 24 NWPA communities that have adopted most provisions of the NWPA lawn watering ordinance.[70] There are 26 additional communities

that have only adopted two to three provisions of the ordinance. The most commonly adopted provisions are the emergency proclamation provision (49 communities), consecutive day restrictions (44 communities), time of day restrictions (39), watering exemptions (21 communities), and status-based or color-coded tiers to communicate restrictions (21 communities). Although not included in the CMAP code analysis, in fall 2019, Lake County adopted summer water use restrictions that included some of the time and emergency restrictions identified by the NWPA model ordinance.[71]

Figure 4.8: Elements of the NWPA lawn watering ordinance

Type of provision	Provision	How provision reduces outdoor water use
Enforcement period	Year-round	Promotes year-round reductions in outdoor water use.
Time restrictions	Consecutive day restrictions	Discourages overwatering, helps reduce peak water demand, and makes it easier to identify non-compliance.
	Time-of-day restrictions	Prevents water use during the hottest, sunniest part of the day, when water would most likely evaporate rather than being taken up by the grass.
	Exemptions for handheld devices, drip irrigation, rainwater harvesting, greywater reuse	Handheld watering devices generally use less water than sprinkler systems because the watering is directly controlled, whereas sprinkler systems are often led to run on their own.
Emergency restrictions	Emergency proclamation	Rare water supply conditions that warrant the ban of outdoor water use to ensure supplies for essential use. During these times, full bans can also help with enforcement.
	Use of status-based or color-coded tiers	Tiers communicate outdoor water use restrictions, may include the prohibition of sprinklers to reduce water waste and ensure supplies for essential use.
Seed & sod restrictions	Seasonal limits	Prohibits the installation of new, water-intensive landscaping (planting seed or sod) in July and August.
	Permit requirements	Helps with enforcement of seasonal limits.
Other	Waste of water prohibited	Reduces water waste by prohibiting the "watering" of sidewalks, driveways, and roads.

Source: CMAP and IISG, 2024.

It's important to note that outdoor water use restrictions do not always result in compliance and, therefore, limits water savings. Education and enforcement are equally important to ensuring that policies are effective and achieving their intended use. For example, an outdoor watering ordinance case study from Texas, which promoted water savings from a time-based watering restriction that limits watering to no more than two days per week, year-round, showed a 7.5 to 16.6 percent savings in average annual single-family residential demand.[72] This range of potential water savings assumes a low (7.5 percent) and high (16.6 percent) level of education and enforcement.

Plumbing and irrigation codes

Plumbing and irrigation codes can also be used to increase the adoption of water-efficient technologies like smart irrigation systems and controllers. Codes will often require the use of certain system or controller types, such as water-sense certified irrigation fixtures, when installing or retrofitting a home's irrigation system. Approximately 10 NWPA communities have policies that require newly installed irrigation controls to be WaterSense-labeled controllers.[73] Additionally, 21 NWPA communities exempts watering restrictions if the devices are water efficient, like handheld watering devices, shutoff valves, and drip irrigation.

Case studies

The following case studies highlight how communities, counties, and water utilities across the region and nation are promoting outdoor water-efficient landscaping and irrigation practices and technologies through water use policies and water conservation programs focused on providing technical assistance, education, and rebates.

Technical assistance and education

Healthy Landscape Assessment Program (Guelph, Ontario)

The City of Guelph is home to 120,000 people in southern Ontario. Their Healthy Landscape Assessment Program provides an on-site, 45-minute consultation designed to assist residents in establishing water-efficient and natural, pesticide-free outdoor areas. The program uses local university staff who provide instructions on selecting plants that attract pollinators, how to build a rain garden and the best way to start a new garden, as well as mulching practices. Guelph works with nurseries and landscape companies to offer discounted plants for program participants. The estimated water savings for residential program participants is 6.9 percent per participant.[74]

Sustainable Landscapes and WaterSmart Landscape Makeover Programs (San Diego, CA)

The San Diego County Water Authority's Sustainable Landscapes Program is designed to enhance resource efficiency in urban landscapes by promoting water conservation and stormwater management. The program includes various components, such as rainwater capture, soil enhancements, climate-appropriate plants, and water-efficient irrigation methods. The WaterSmart Landscape Makeover Program, part of the Sustainable Landscapes Program, offers educational resources like workshops and online videos to empower homeowners to convert turf areas into sustainable landscapes. Managed by the Water Authority and external vendors, the program has a budget of about $1.4 million, with $748,600 spent on the WaterSmart Landscape Makeover series from 2012 to 2016. Marketing relies on social media and regionally coordinated messaging. Participants in the program reduced their water usage by 34.8 percent, saving 114.8 gallons per day per meter from a pre-intervention average of 329.6 gallons per day per meter.[75]

Rebate programs

Irrigation Equipment Rebates (Seattle, WA)

Seattle Public Utilities' Irrigation Equipment Rebate Program, introduced in 2016, encourages customers to upgrade their irrigation systems to more efficient models. The program offers rebates of up to $100 for replacing standard timers with WaterSense labeled timers, specifically targeting single-family homes. To qualify, customers must be members of the utility-based organization, Saving Water Partnership, have an operational in-ground sprinkler system, and currently use a non-WaterSense timer. With an annual budget of around $30,000 for rebates, the program has faced challenges with marketing, as most participants learn about the rebate after purchasing their new timers.[76]

Life After Lawn Program (Greeley, CO)

The City of Greeley, Colorado, is home to 110,000 residents. Its Life After Lawn program offers rebates for residential and commercial water customers who replace healthy, well-watered turf grass with low-water landscaping. Approved projects can receive $1 per square foot, with homeowners eligible for up to $3,000 annually and commercial properties up to $30,000 annually.[77] The program encourages water conservation through the adoption of water-wise landscaping practices.

The Otay Water District, (San Diego County, CA)

The Otay Water District provides water service to southeastern San Diego County and offers a variety of rebates, including weather-based irrigation controls, rotating sprinkler nozzles, moisture sensors, flow monitoring devices, rain barrels and cisterns, and turf replacement ranging from $3 to $6 per square foot. The program includes extra incentives for adopting other water-saving measures such as weather-based irrigation controllers and rain barrels. By providing substantial rebates and additional incentives, this program seeks to encourage residents to adopt comprehensive water-saving practices, thus contributing to a more sustainable water usage pattern in the district.[78]

Landscape Rebate Program (Santa Clara Valley)
The Santa Clara Valley Water District provides wholesale water supply and flood protection for Santa Clara County, California. The district provides a base rebate rate of $2 per square foot for both residential and commercial properties that convert their landscapes to more water-efficient alternatives. In specific cost-sharing areas, homeowners may qualify for even higher rebates.[79] The goal of this program is to incentivize landscape conversions that lead to significant water savings, especially in areas with collaborative funding agreements, thus enhancing community-wide water conservation efforts. In addition to receiving incentives for replacing grass lawns with native plants and drought-resistant landscaping, participants can receive financial incentives for other water-saving methods, such as upgrading irrigation systems and installing smart irrigation controllers. The program also helps raise awareness about the importance of water conservation, encouraging participants to adopt water-efficient practices and technologies.

Water Smart Landscapes Rebate Program (Southern Nevada Water Authority)
The Southern Nevada Water Authority, made up of seven local water and wastewater agencies, manages water and wastewater needs for more than 2 million residents across southern Nevada. The authority offers a financial incentive for converting lawns to water-efficient landscapes. Homeowners can receive $3 to $5 per square foot for the first 10,000 square feet of lawn converted. For any additional area beyond this, the rebate is $1.50 to $3.50 per square foot.[80] This program aims to promote water conservation by encouraging residents to replace their lawns with drought-tolerant plants and landscaping, thereby reducing overall water usage.[81]

WaterWise Landscape Rebate Program (Austin, TX)
In 2009, Austin Water Utility introduced an incentive to encourage residents to replace lawns with native or adapted plants. Through the WaterWise Landscape Rebate Program, homeowners can receive $35 for every 100 square feet of turf removed, with an average of 20 projects completed per year. To qualify, participants must have live turf, and their new landscape must cover 50 percent of the area with plants at maturity. Water savings from participants in the program are significant, with an average reduction of 47.7 gallons per day per meter, translating to an 18.9 percent decrease in water use from the pre-intervention average of 252.4 gallons per day per meter.[81]

Watering ordinances
NWPA lawn watering ordinance – Long-term infrastructure cost savings (Aurora, IL)
In 2006, the City of Aurora adopted the NWPA's regional lawn watering ordinance to save on long-term infrastructure costs for drinking water. The adoption resulted in a water demand reduction of 20 gallons per person per day and has allowed the city to maintain a much lower than anticipated peak day demand, even as its population has continued to grow.[82]

NWPA lawn watering ordinance – Color-coded restrictions (Algonquin, IL)
The Village of Algonquin uses enforcement of color-coded emergency proclamations alerts to reduce outdoor water use. Although the village has not fully adopted the NWPA ordinance, they have adopted some provisions, including status-based or color-coded restrictions. From 2003 to 2009, the village saw a 2- to 3-MGD reduction (from 6 MGD) during the summer months.[83]

Outreach and education resources

NWPA outdoor lawn watering ordinance
The NWPA outdoor lawn watering ordinance uses an even-odd outdoor watering schedule according to addresses ending in even and odd numbers and limits outdoor watering to early morning and evening hours (6:00-9:00 AM and PM). NWPA ordinance applies year-round and discourages the use of unattended sprinklers in favor of more water-efficient handheld devices, irrigation systems, and water reuse options, such as captured rainwater. It also prohibits the installation of new, water-intensive landscaping (planting seed and sod) in July and August and includes emergency proclamations that ban outdoor water use during droughts and water emergencies.[84] Communities can visit NWPA's website to learn more about the model ordinance and other related outreach and educational materials.

Website: www.nwpa.us/reduce-outdoor-water-use.html

WaterSense Rebate Finder
The WaterSense Rebate Finder lets users search for rebates on water-efficient products and services in their area. The website lists various WaterSense labeled products, such as soil moisture and weather-based irrigation controllers, and connects users with local water providers that offer rebate programs. It does not directly provide rebates but helps water users find available incentives to encourage water conservation. Users can search by partner name, rebate type, building type, and state or province. Communities and local water utilities should connect with USEPA's WaterSense program as they develop rebate programs to ensure their customers can find them through this platform.

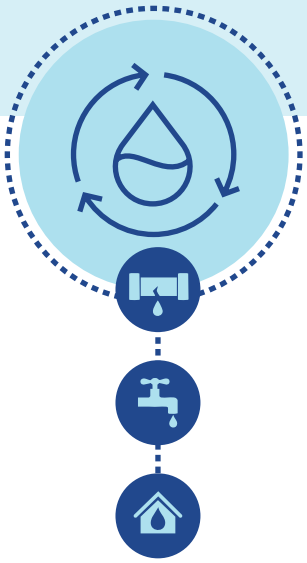
Website: www.lookforwatersense.epa.gov/rebates

Conservation at Home
The Conservation Foundation's Conservation at Home program encourages residents to replace some turf grass with native plants in their yards and gardens. The program includes yard assessments that educate property owners about the benefits of native plants for water conservation and provides yard improvement recommendations. The program also provides services to residential and non-residential property owners and municipalities.

Website: www.theconservationfoundation.org/conservation-home

Lawn to Lake Midwest
The Lawn to Lake Midwest program, which started in 2010, promotes healthy lawn and landscape practices in the Great Lakes region. The goal of the program is to improve water conservation and quality through natural and water-efficient landscapes. The program provides homeowners, businesses, and landscape companies with best practice information on natural lawn care, plant selection, fertilizers and best management, and water conservation through guides, manuals, brochures, and self-assessment tools such as a Natural Lawn Care Quiz.

Website: www.lawntolakemidwest.org



Water efficiency in new development

Water efficiency in new development focuses on incorporating water conservation measures into the construction of new homes to ensure water savings are built in from the start. Common measures include proactively reducing leaks and incorporating water-efficient fixtures and appliances that reduce water use and the need for future retrofits. Luckily, rating programs for water, energy, and other green building metrics are increasingly becoming a way for developers to demonstrate the performance of new development. These programs can also be required or incentivized during the development review process to increase the adoption of these water-efficient building methods.

The USEPA launched a rating program, WaterSense Homes, which outlines specifications for the construction of new water-efficient homes. Through the "water efficiency in new development" strategy, the NWPA decided to evaluate the potential water savings that could be achieved if all new single-family residential development within the NWPA region was constructed to meet the criteria in the WaterSense Homes program.

WaterSense Homes are required to be free of leaks and must have WaterSense labeled toilets, bathroom sink faucets, and showerheads. Aside from the mandatory checklist items, other water efficiency features need to be incorporated for a home to achieve the 30 percent efficiency requirement to earn the WaterSense label. These could include water-efficient landscaping practices and irrigation systems, efficient kitchen faucets, and efficient hot water delivery.[85]

The WaterSense Homes certification process involves builders and developers working with USEPA-approved home certification organizations (HCOs). HCOs are responsible for overseeing the certification and labeling of homes for WaterSense, and help builders decide on how best to achieve the 30 percent efficiency requirement based on local market conditions and climate. USEPA verifies that the HCO's methodologies accurately and consistently identify homes that are at least 30 percent more water-efficient than a typical new home before the property is certified as a WaterSense Home.[86]

Compared to typical new construction homes, WaterSense-labeled homes are at least 30 percent more water-efficient, which helps consumers and builders save water, energy, and money.[87] The USEPA estimates that the average WaterSense-labeled home could save homeowners more than $700 in water and energy utility costs a year.[88] To ensure the 30 percent water savings, WaterSense-labeled homes must meet all the items on the mandatory checklist (Figure 4.9). The home is then certified by an HCO using a process approved by the USEPA.[89] These established processes and procedures reduce the technical expertise needed by local governments to ensure compliance with these specifications.

Figure 4.9: Mandatory checklist for WaterSense labeled homes

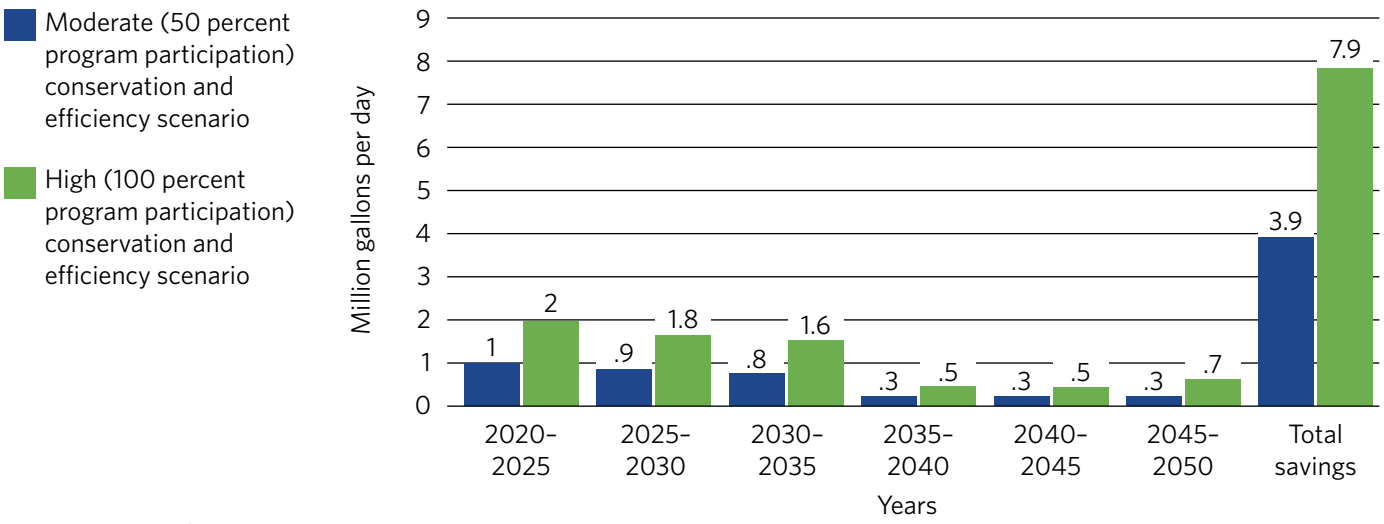
Item	Requirement
Leaks	Pressure-loss test on all water supplies detects no leaks
	Free of visible leaks from toilets
	Free of visible leaks from bathroom faucets
	Free of visible leaks from showerheads
	Free of visible leaks from bathroom tub faucets (tub spouts) when showerheads are active
	Free of visible leaks from kitchen and other sink faucets
	Free of visible leaks from other fixtures or appliances (water heaters, washing machines, dishwashers, hose bibbs, irrigation systems)
Toilets	WaterSense labeled
Bathroom sink faucets	WaterSense labeled
Showerheads	WaterSense labeled

Source: USEPA WaterSense, 2021.

Potential water savings

If municipal PWS communities established new residential development standards, resulting in new homes being at least 30 percent more efficient than homes built without water efficiency between 2025 and 2050, they would save between 3.9 and 7.9 MGD (Figure 4.10). Under the moderate conservation and efficiency scenario — assuming 50 percent of NWPA-region PWS communities implement water-efficient development standards for single-family homes — the region may save 3.9 MGD. The savings under the high water conservation and efficiency scenario that assumes all municipal PWS communities implement water-efficient standards, are 7.9 MGD.

Figure 4.10: New residential development water savings estimates, 2020-2025 (5-year increments)



Source: CMAP and IISG, 2024.

How was this calculated?

Estimates of new development and savings potential

The water efficiency in new development strategy focuses on residential single-family units that are projected to be built between 2020 and 2050, and are located within NWPA municipalities served by a municipal PWS system. Homes built before 2020 were not included in this strategy. Using an analysis of CMAP's UrbanSim data, socioeconomic forecast, and *Regional Water Demand Forecast for Northeastern Illinois, 2020-2050*, it is estimated that 135,798 new single-family units will be built in the NWPA region between 2020 and 2050.[90]

Between 2020 and 2050, the average water use across the NWPA region municipal PWS sector is projected to decrease from 81 and 68 gallons per capita per day, assuming new single-family homes are not constructed with water conservation and efficiency in mind (Figure 4.11). If these homes are to be constructed under a program like USEPA's WaterSense at Homes program that requires a newly constructed home to be 30 percent more efficient than the average single-family home, the strategy assumes the saving is 30 percent from the estimated average water use relative to the homes being built within a given year. Based on data collected through an HCO,[91] there are no municipalities with PWS systems in the NWPA region that have adopted the WaterSense Homes program, so no market penetration adjustments were made.

Figure 4.11: Single-family units and estimated water use, 2020-2050 (5-year increments)

	2020-2025	2025-2030	2030-2035	2035-2040	2040-2045	2045-2050
Total new single-family units in NWPA PWS communities	32,615	29,592	27,291	22,621	9,855	13,824
Average gallons per capita per day (weighted), baseline forecast	81	78	75	73	70	68
Estimated water use, MGD	6.6	5.8	5.1	4.1	1.7	2.3

Source: CMAP and IISG, 2024.

Implementation approaches

Municipalities and water utilities can incorporate USEPA's WaterSense Homes into new development standards in several ways, including requiring or incentivizing the builder to pursue WaterSense Homes certification.

Development standards

Communities can require new development to meet WaterSense certification standards. This could be done through the adoption of standards or code updates. Municipalities may choose to adopt water-efficiency standards into their building codes, which would require builders seeking permits for new construction to adhere to the required water-efficiency standards. When building codes are updated, municipalities may also choose to include specific requirements related to water efficiency, such as the installation of WaterSense labeled fixtures. During construction, local building authorities may conduct inspections to ensure that homes under construction comply with the water efficiency requirements or may require builders to work with an HCO to obtain the WaterSense Homes certification. Based on information gathered from an HCO,[92] certification requests are higher, on average, in municipalities that require WaterSense Homes certification rather than incentivize it.

Incentives

Financial incentives, such as rebates, could be given to builders to encourage the construction of WaterSense-certified homes. Some municipalities and utilities offer incentives or rebates for builders who voluntarily exceed the minimum code requirements, which can encourage the incorporation of additional water-efficiency features. One example of this approach comes from the Central Arizona Groundwater Replenishment District, where builders can get a $1,000 rebate per home that is WaterSense certified.[93]

Case studies

Arizona Groundwater Replenishment District

The Central Arizona Groundwater Replenishment District (CAGRD) was created in the mid-1990s to help water providers and landowners comply with Arizona's groundwater laws. The CAGRD plays an important role in Arizona's groundwater management by replenishing groundwater pumped by its members.[94] The CAGRD is a special function of the Central Arizona Project, which delivers water to nearly 6 million people — more than 80 percent of the state's population — in Maricopa, Pima, and Pinal counties.[95] The CAGRD encourages water conservation and reduction of groundwater use for its members through various means, one of which is a pilot incentive program. In 2023, the CAGRD started the WaterSense 2.0 Incentive Program that offers builders a $1,000 rebate per home that is WaterSense certified. The objective of the program is to encourage water conservation by current and future CAGRD members to lower costs and lessen competition for scarce water resources.[96]

Sustainable Desert Development Policy (Phoenix, AZ)

In 2023, the Phoenix City Council approved the Sustainable Desert Development Policy, which aims to advance the city's drought management and water conservation goals and support sustainable development. To achieve these objectives, the policy requires new development within the city to meet USEPA WaterSense or equivalent certification as a stipulation in all rezoning cases. The city's Planning and Development Department is in charge of communicating the stipulations to applicants and communicating how, when, and where they should be utilized. The zoning stipulations were derived from the city's work on a residential neighborhood in North Pheonix, which, through water conservation strategies, is projected to use 55 million fewer gallons of water per year compared to a standard subdivision.[97]

Oak Shade and Durango WaterSense Labeled Homes Communities (Menifee, CA)

KB Home, a national homebuilder based in the Unites States, collaborated with the USEPA's WaterSense Homes program to assess the impact of water-saving initiatives in residential communities. Specifically, in Menifee, California, they developed two communities — Oak Shade and Durango — comprising over 200 WaterSense labeled homes. These homes were designed to decrease water usage by 30 percent and energy consumption by 40 percent compared to standard new construction. EPA estimates yearly savings of 13.5 million gallons of water and 530,000 kWh of water-related energy.[98]

Outreach and education resources

WaterSense-labeled Homes Program

The USEPA's WaterSense-labeled Homes website includes tools and resources that help builders and others in the building industry learn how to develop more water-efficient homes.

Website: www.epa.gov/watersense/watersense-labeled-homes

WaterSense Partnership

The WaterSense program offers opportunities to partner with builders who construct homes in accordance with the WaterSense specifications. Partnering with WaterSense is free and offers peer networking opportunities, access to outreach and educational resources, and other benefits.

Website: www.epa.gov/watersense/watersense-partners

RESNET's Water Efficiency Rating System $HERS_{H2O}$

RESNET is a national non-profit organization that develops standards for the certification and oversight of home energy and water ratings. Building on the Home Energy System (HERS) index, $HERS_{H2O}$ is a system for rating water efficiency in homes. The rating system is a performance-based program that allows builders to use any combination of indoor and outdoor water efficiency measures to achieve the target score. The system is also an approved WaterSense certification methodology, which means that builders can earn the WaterSense label through the $HERS_{H2O}$ standard.

Website: https://www.resnet.us/about/hersh2o/

Funding resources

WaterSMART Grants

Offered by the Bureau of Reclamation, these grants support projects that achieve quantifiable water savings and broader sustainability benefits. Funding is available for both smaller projects (up to $500,000) and larger initiatives (up to $5,000,000). These grants can be used by local governments, tribes, and non-profits to improve water efficiency in new housing developments.

Website: www.usbr.gov/watersmart/weeg

45L Tax Credit

As part of the Inflation Reduction Act, this tax credit offers $5,000 for new homes that meet the Zero Energy Ready Home program requirements. This initiative encourages the construction of highly energy-efficient homes, which often include advanced water-saving technologies.

Website: www.energy.gov/eere/buildings/section-45l-tax-credits-zero-energy-ready-homes

Water loss control

Every day, millions of gallons of water are lost to leaky pipes and infrastructure used to deliver water to customers. The American Society of Civil Engineers estimates that there are about 240,000 water-main breaks annually in the U. S., which results in not only water loss but also lost revenue for utilities.[99]

The American Water Works Association defines water loss as the difference between the amount of water produced and the amount of water that is billed to customers. Water loss is categorized as real and apparent water losses, both of which are considered nonrevenue water. Real water loss is the physical loss of water from a water distribution system through leaks, main breaks, or storage overflows, while apparent water loss occurs when water is consumed but not paid for or properly accounted for.

Controlling water loss is an important strategy for addressing water conservation at the system level, as well as ensuring that utilities do not lose revenue and put stress on their water resources and capital expenditures. Water loss control can include measures to address real losses from distribution system leakage and storage tank overflow, as well as apparent losses from billing and meter reading errors and unauthorized consumption. All utilities can implement these measures. However, some may be more feasible to implement depending on the size and capacity of the utility.

Measures to control water loss

Water audits
Water audits track water supply volumes, consumption, and losses within the utility's water system. Ideally, water audits would be done on an annual basis to assess the system's capacity and check for possible leaks. Audits are essential for pursuing other water loss control measures and are recommended for all utilities.

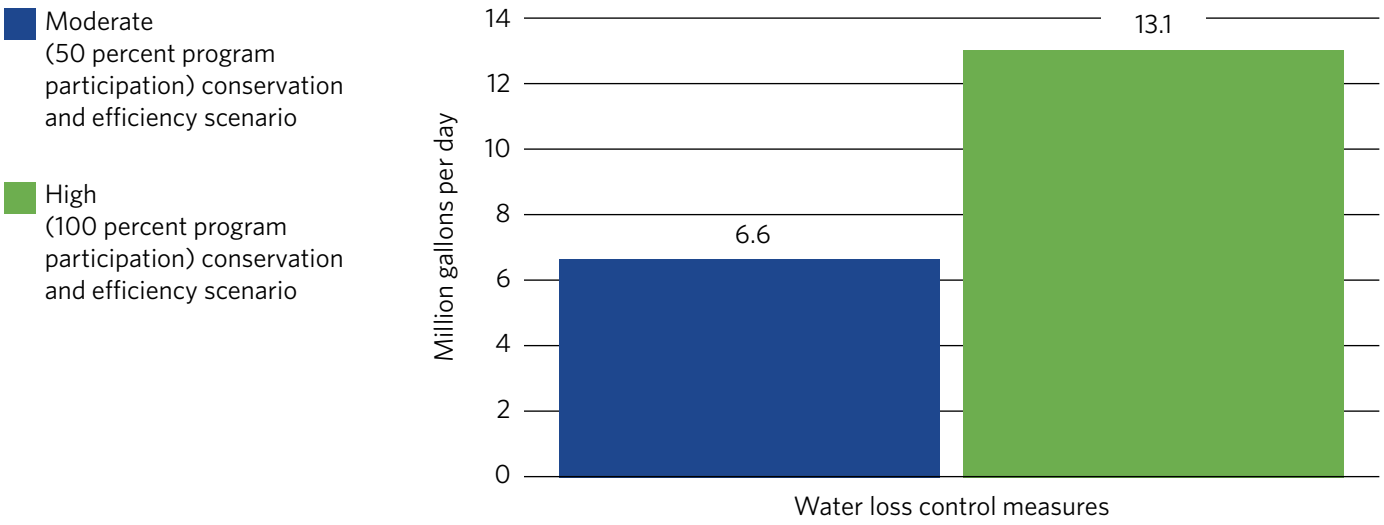
Loss prevention programs
Loss prevention programs, such as water main rehabilitation and replacement, can help communities address real water loss. These programs focus on pipe inspection, cleaning, lining, and other maintenance efforts, as well as pipe replacement to improve the distribution system and prevent leaks and ruptures from occurring. Communities of all sizes should proactively inspect and replace water mains to prevent future leaks or breaks.

Leak detection and repair
Leak detection and repair is a measure communities can take to address real water losses. This measure focuses on seeking hidden, or unreported leaks with regular on-site testing using computer-assisted leak detection equipment, sonic leak-detection surveys, or other methods. After the leaks are discovered, utilities should focus on repairing them.

Potential water savings

Under the high (100 percent program participation) conservation and efficiency scenario, the NWPA region can save 13.1 MGD (Figure 4.12). Under the moderate (50 percent program participation) scenario, the region can save 6.6 MGD.

Figure 4.11: Potential water savings from water loss control measures



Source: CMAP and IISG, 2024.

How was this calculated?

Current levels of water loss
While 2018 water loss across the NWPA region's PWS communities is estimated to be 26.3 MGD or (20 percent of the NWPA region's total PWS sector withdrawals of 131.5 MGD), the strategy assumes that real water loss for all PWS systems is no greater than 10 percent of their net annual pumpage (13.1 MGD).

Water loss control savings potential
The strategy assumes that PWS communities in the NWPA region can maintain water loss at or below 10 percent of their net annual pumpage. This threshold is based on the non-revenue water loss standard set by IDNR for Lake Michigan water allocation requirements, which require that nonrevenue water be kept at or below 10 percent of the total amount of water supplied.[100]

Implementation approaches

Water loss control measures addressing apparent and real losses can be implemented in several ways. Currently, few NWPA communities are addressing water loss. The communities that are working on this are doing so as part of larger capital planning efforts and/or are working to meet Lake Michigan water allocation and permit requirements.[101] See the case studies below for detailed information on select NWPA communities that are addressing water loss.

Utility and infrastructure planning
Communities can start to address water loss by first developing a water loss control strategy designed to find, measure, and address losses within a water supply system. This often includes conducting an audit, detecting and repairing leaks, and monitoring and ensuring metering accuracy, which can help conserve available water

supply and increase revenue. Once communities have a better understanding of their system, they can use capital improvement planning and budgeting to invest in infrastructure maintenance and repair, including water main replacements and water loss prevention programs. Communities use the capital improvement planning process to increase budget allocations, establish timelines for capital improvements, or fund studies, such as infrastructure assessment or water rate studies. Such studies can help communities understand the state of their system's infrastructure and/or the revenue needed to maintain it while meeting the needs of their customers.

Technical assistance
Technical assistance and partnerships with organizations or government entities can help communities control water loss through annual water audits. An example of this approach is the Washington State Department of Health water audit technical assistance pilot. Washington requires utilities to maintain water loss below 10 percent, and the department is offering a free pilot technical assistance program to 10 utilities to complete the American Water Works Association (AWWA) water audit and customize water loss prevention strategies.[102]

Rebate programs
Rebate programs can be offered to utilities to support the implementation of measures like leak detection and repair of their water systems. An example of this approach is the municipal leak detection and repair rebate program offered through the Energy Trust of Oregon.

Local policy
Municipalities can add specific requirements for water utilities to conduct regular water loss monitoring activities or ensure that customers and new development are contributing to water loss prevention. They could require practices that make addressing real or apparent water losses easier, such as regular leak detection, source-water metering, regular water audits, metering requirements for all water use, sub-metering of multi-tenant buildings, and prohibiting unauthorized use of unmetered water through measures such as fines.

Case studies

Water system master plan (Elgin, IL)
The City of Elgin, Illinois, is currently developing a water system master plan, which is a comprehensive planning process designed to guide the development, management, and enhancement of the city's water supply and distribution systems. Elgin is already addressing water loss by completing a water audit to better understand water loss levels. Through the water system master planning process, the city is working on identifying future water loss reduction strategies.[103]

Municipal Leak Detection and Repair Rebate Program (The Energy Trust of Oregon)
The Energy Trust of Oregon Municipal Leak Detection and Repair Rebate Program has a goal of addressing water leaks to improve energy performance of water and wastewater treatment facilities across Oregon municipalities. The trust offers municipalities a once-a-year $1,000 rebate for the cost of assessing and repairing underground water leaks.[104] Municipalities can receive funding from the Energy Trust once a year for hiring professional services to conduct leak detection surveys, which help locate leaks in water lines that might otherwise go unnoticed. The program also provides rebates to cover the costs of repairing leaks, which encourage municipalities to address water loss.

Unbilled authorized use, apparent and real loss initiatives (Montgomery, IL)
The Village of Montgomery is a NWPA community addressing water loss. The village aims to reduce water loss to less than 10 percent of its water supplied annually and is focusing its efforts on unbilled authorized use, apparent losses, and real losses. To address real losses, the village is conducting annual water main leak detection, replacing leaky water mains, and developing a district-metered area to better track potential leaks. To address apparent losses, the village is replacing customer meters with advanced metering infrastructure technology, which is set to be completed by 2026, and conducting annual master meter testing. To address

unbilled authorized water use, Montgomery is conducting a forensic data investigation and analysis of billing data by a third-party consultant, replacing meters for water that is recirculating through an effluent water treatment plant meter, and metering automatic flushing hydrants. In the future, the village plans to continue preparing annual water audits based on the American Water Works Association's M36 methodology, as well as monitoring progress and pivoting strategies as necessary.[105]

Unbilled authorized use, apparent and real loss initiatives (Yorkville, IL)
The City of Yorkville is another NWPA community that aims to reduce water loss to less than 10 percent by focusing on unbilled authorized use, apparent losses, and real losses. Yorkville is addressing real losses through annual leak detection and water main replacements and focusing on annual master meter testing to address apparent losses. To address unbilled water use, the Yorkville is developing policies to better track unbilled water use and bill where feasible. In addition, the city is reviewing enforcement efforts, including local ordinances, related to the unauthorized use of water. Some of the city's upcoming steps include continuing to conduct annual water audits based on the AWWA M36 methodology, as well as monitoring progress and pivoting strategies as necessary.[106]

Outreach and education resources

American Water Works Association (AWWA) Free Water Audit Software
The AWWA water audit software helps utilities estimate and quantify volumes of water losses due to leakage and poor metering. This can help utilities get a better understanding of where water loss is happening within their systems, and address losses with appropriate water loss control measures.

Website: www.awwa.org/Resources-Tools/Resource-Topics/Water-Loss-Control/Free-Water-Audit-Software

Illinois AWWA Annual Water Loss Seminar and Audit Trainings
The Illinois AWWA Annual Water Loss Seminar and Audit Trainings address water loss in public water systems by equipping water utilities with the knowledge and skills needed to effectively measure and manage water loss. These events typically include educational sessions, case studies, technical trainings, and networking opportunities.

Website: www.isawwa.org/events

USEPA Water Loss Learning Module
The USEPA Water Loss Learning Module is an educational resource designed to help water utility managers, engineers, and decision-makers understand and address water loss in distribution systems. The module outlines methods for accurately measuring water loss and strategies for reducing water loss, such as regular maintenance, leak detection technologies, and improving metering accuracy. In addition, the module emphasizes the financial implications of water loss, including how reducing losses can lead to cost savings and improved service.

Website: www.ordspub.epa.gov/ords/wfc/f?p=165:9:12318472373846:::9:P9_MODULE:WATER_LOSS

USEPA Water Conservation Plan Guidelines
The USEPA's Water Conservation Plan Guidelines can help utilities develop water conservation plans, including identifying the most appropriate strategies to address real and apparent water losses. Various water loss control measures are organized based on their feasibility, which can help a community determine which measures may be appropriate for implementation based on a utility's size and capacity.

Website: www.epa.gov/watersense/water-conservation-plan-guidelines

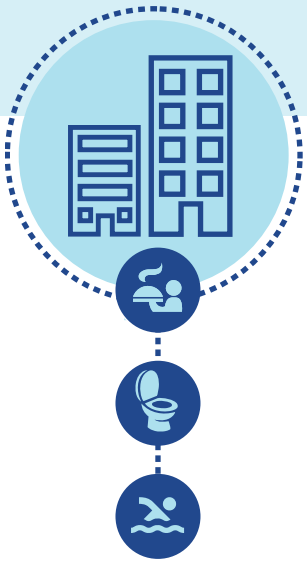
Funding resources

Illinois Environmental Protection Agency Drinking Water Loans (State Revolving Fund Loans)
The Illinois Environmental Protection Agency (IEPA) State Revolving Fund Loan program offers low-interest loans to communities to make investments in their public water supply systems. Eligible projects include upgrading or rehabilitating existing infrastructure as well as the construction of new drinking water infrastructure. The State Revolving Fund yearly cycle is based on the State of Illinois fiscal year, which starts July 1 and ends June 30.

Website: www.epa.illinois.gov/topics/grants-loans/state-revolving-fund.html

USEPA's Water Infrastructure Finance and Innovation Act
The Water Infrastructure Finance and Innovation Act provides low-interest loans for large-scale water infrastructure projects, including those focused on reducing water loss. Communities can leverage these funds to modernize their water systems and implement advanced leak detection technologies.

Website: www.epa.gov/wifia

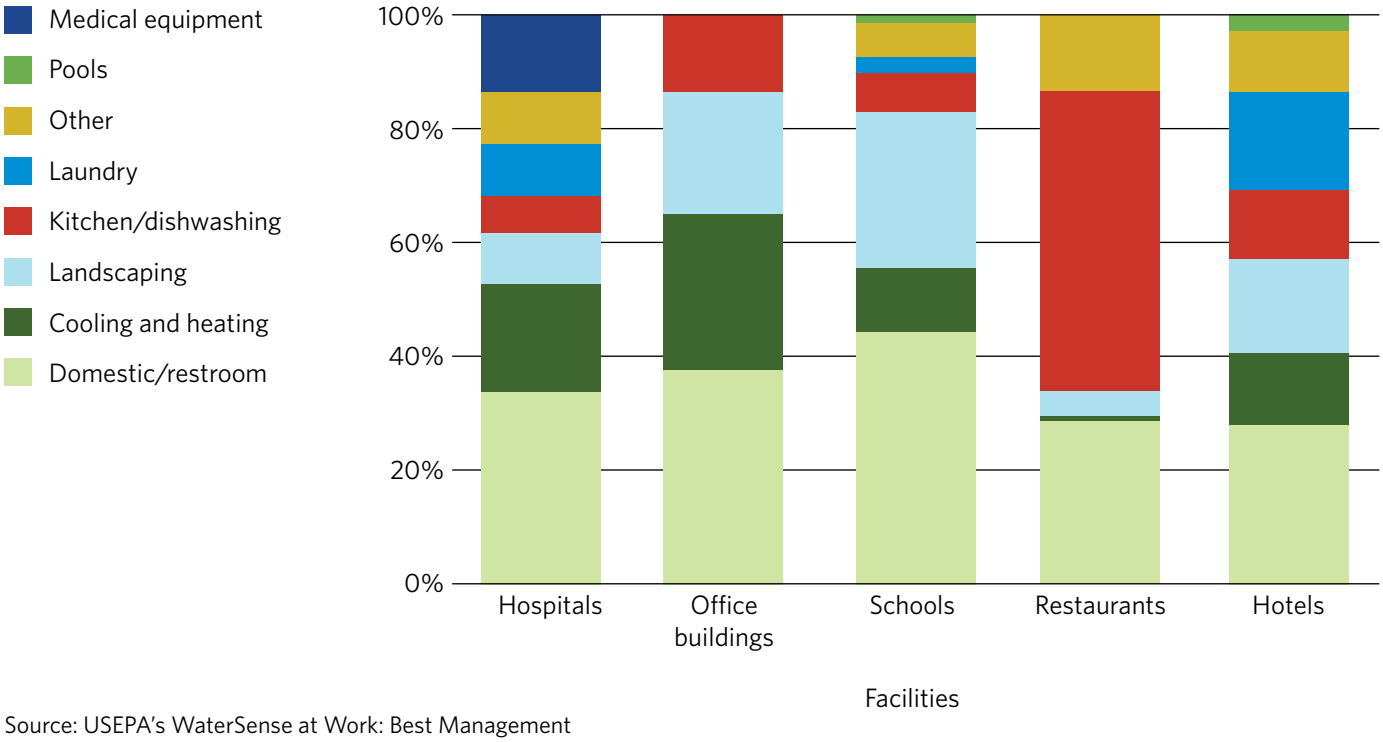


Commercial, institutional, and industrial water conservation programming

Looking beyond residential water use and water loss, the commercial, institutional, and industrial (CII) sector is often the second-largest user of a community's water supply. The CII sector includes non-residential water users like offices, restaurants, hospitals, schools, hotels, and small industrial and manufacturing businesses.[107] Nationally, the sector uses approximately 18 percent of a community's public water supply (PWS).[108] The CII PWS water demand is less than the residential PWS water demand, and communities often have fewer CII customers compared to residential customers. This can mean there is a smaller audience to target, making CII water conservation a cost-effective approach for communities to pursue.

CII water use is associated with the facility type, activities within a facility that rely on the water (water end use), and the frequency of their use. The USEPA estimates that more than half of the public water supplied to commercial and institutional facilities can be attributed to restaurants (15 percent), hotels (15 percent), offices (9 percent), hospitals (7 percent), and schools (6 percent).[109] Some of the most water-intensive end uses within these commercial and institutional facilities include domestic or bathroom uses, kitchen and dishwashing uses, landscaping, and cooling and heating operations (Figure 4.13). Industrial facilities have similar water end uses, such as indoor domestic use and landscape irrigation. However, they also have additional water-intensive uses related to raw material processing, the production or manufacturing of products, as well as the management of byproducts, such as wastewater. These water needs can vary significantly based on the industry and the material being processed or products being created.

Figure 4.13: End uses of water in various types of commercial and institutional facilities[110]



Source: USEPA's WaterSense at Work: Best Management Practices for Commercial and Institutional Facilities.

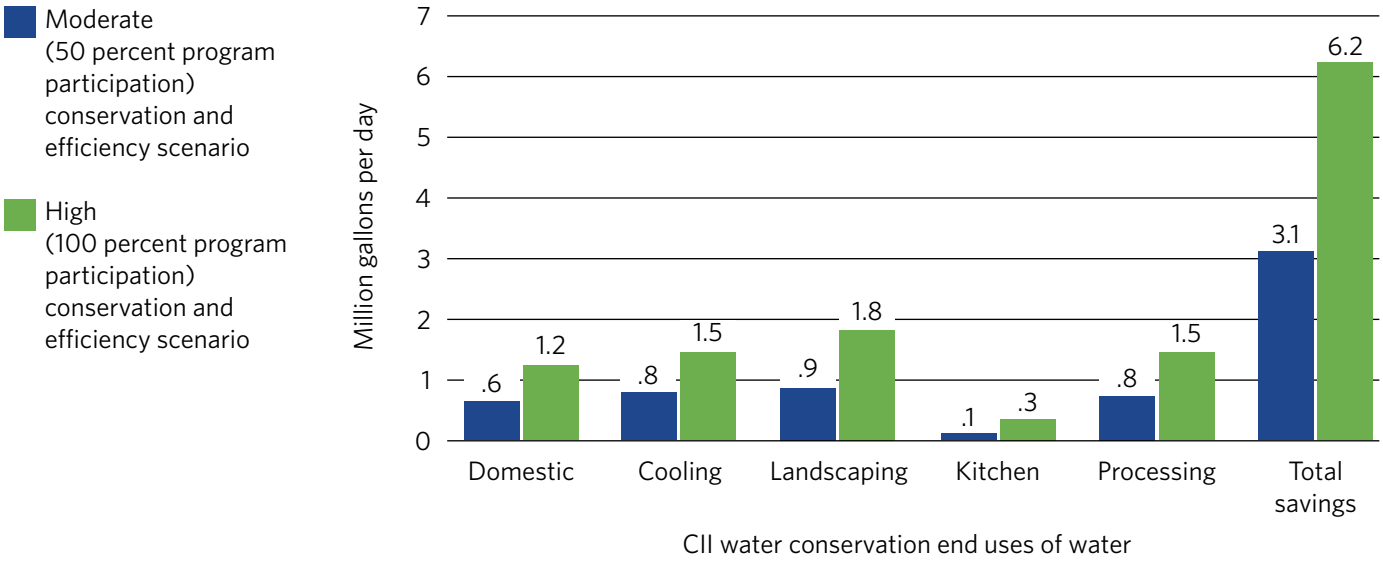
Recognizing the potential water savings that can be achieved through non-residential water users, the USEPA developed *Water Sense at Work* — a compilation of water-efficiency best management practices for commercial and institutional facilities to help them implement projects and programs that can effectively reduce water consumption. The guide focuses on strategies that apply to different commercial and institutional facilities and targets the various water fixtures, equipment, and systems commonly found within them. While national public water use estimates for industrial facilities are limited due to the high variability across facility types and water end uses, WaterSense at Work asserts that many practices and programs outlined in the guide also apply to industrial facilities.[111]

The commercial and institutional water conservation strategy focuses on the water savings that can be achieved by a subset of CII facilities within the NWPA study area engaging in water conservation programs and practices that target their highest end uses of water (based on national averages). The targeted CII facility types include office, hospital, hospitality (including restaurants and hotels), educational, retail (including grocery stores), and industrial facilities. These facility types were selected because they were the most prevalent across the NWPA's municipal PWS communities in 2020.[112] The highest end uses of water include domestic (restroom), heating and cooling, landscaping, and processing uses. Water conservation programming and practices would support measures, including but not limited to conducting water audits, installing water-efficient fixtures, adopting efficient landscaping and irrigation practices, eliminating single-pass cooling, taking additional monitoring and inspection strategies of heating and cooling systems, and educating employees about water conservation.

Potential water savings

The potential water savings from the CII water conservation programming under the high water conservation and efficiency scenario is 6.2 MGD (Figure 4.14). Under the moderate scenario, the region could see 3.1 MGD in water savings. To realize the potential savings under these scenarios, municipal PWS communities would need to implement CII programs that target CII customers and achieve between 20 and 35 percent reduction across each of their high end uses of water: domestic, heating and cooling, landscaping, kitchen, and processing. Of the highest end uses of water under the full participation scenario, the greatest potential water savings can be attributed to landscaping with 1.8 MGD in savings, followed by cooling and industrial processing, each with a water savings of 1.5 MGD.

Figure 4.14: Potential water savings from CII water conservation programming



Source: CMAP and IISG, 2024.

How was this calculated?

Baseline CII water use

Based on national studies, it is estimated that 20 percent of PWS water is provided to CII customers. In 2018, this was approximately 26.2 MGD. Water use then was assigned to the select CII facility types (i.e., office, hospital, hospitality, educational, retail, and industrial) using the share of CII water facility types served by municipal PWSs derived from national estimates and the share of CII facilities across the region in 2020 derived from CMAP's socioeconomic forecast and corresponding UrbanSim data. Water use was assigned to each CII facility type as follows: 4.1 MGD for offices, 0.3 MGD for hospitals, 0.9 MGD for hospitality (hotels and restaurants), 1.0 MGD for educational facilities, 13.4 MGD for retail (including grocery stores), and 6.6 MGD for the industrial facilities. Using national averages, water use was further split across the highest end uses, which account for 24.5 MGD or 93.1 percent of the CII water use across the NWPA region's municipal PWS communities.

Estimates of commercial and institutional buildings and savings potential

The strategy assumes different rates of water savings can be achieved across the highest end uses among the select CII facilities. Using national averages, it assumes domestic and kitchen end uses can achieve 20 percent in water savings, heating and cooling can achieve 26 percent, landscaping can achieve 25 percent, and industrial processing can achieve 35 percent. These rates were then applied to estimate the potential savings by the highest end uses. The rates are assumed to apply equally to existing and new development, with existing facilities achieving savings through retrofits, technical assistance, and incentives. New CII facilities are assumed to achieve savings through accelerated local ordinances, standards, technical assistance, and incentives.[113]

The AWWA conducted a national survey on CII water efficiency programs and found that the proportion of water utilities with CII programs is 20 percent or less.[114] Given the lack of nationwide programming and comprehensive data on existing CII water conservation programs and participation within the NWPA study area, the strategy assumes the water utilities do not have CII water conservation programs. Additionally, no adjustments were made to account for market penetration of CII-based adoption of water-efficient devices or equipment.

Implementation approaches

There are a handful of ways that these strategies can be put into action, ranging from technical assistance programs that provide facility assessments or audits aimed at identifying custom water savings solutions to fixture rebates.

Technical assistance

Technical assistance programs can provide CII customers with an understanding of current water use and recommendations to improve indoor and outdoor water use efficiency. These programs could include tools such as water use surveys, water audits, and landscape evaluations, which can help inform conservation practices and retrofits. These types of programs can be offered by communities and water utilities. They also can be hosted through research institutions and third-party contractors or partners, such as Illinois' Smart Energy Design Assistance Center, an applied research program at the University of Illinois at Urbana-Champaign and a public-private partnership with 360 Energy Group in Chicago.

Financial incentives

Financial incentives, such as rebates, grants, or loans, can help CII customers replace older fixtures, appliances, and equipment with more water-efficient technologies. Communities and water utilities could offer financial incentives to CII customers. With domestic and restroom-related end uses being prominent across all CII facility types, communities can consider rebate programs or incentive programs that encourage CII customers to retrofit or replace old fixtures, such as toilets, faucets, and sinks. Rebate programs, or other forms of financial assistance, could also be offered at the state and federal levels and be tied into other cost benefits, such as those associated with energy efficiency.

Local policy
Local policies, such as building codes or ordinances, can require CII customers to install water-efficient appliances and fixtures. These regulations can help save water by requiring upgrades to more efficient equipment when less efficient equipment needs repair or replacement. Other policy approaches include ordinances that require new commercial development to install smart outdoor irrigation systems, which can help achieve outdoor water savings.

Case studies

The following case studies showcase both CII water conservation programs as well as CII customers that have voluntarily implemented water conservation measures. PWS communities interested in CII programming can use these case studies to craft initiatives that are tailored to the needs of their CII customers.

East Bay Municipal Utility District CII rebates and assessments (East Bay, CA)
The East Bay Municipal Utility District offers various programs to help commercial, industrial, and institutional customers save water and reduce costs. These include rebates for up to $15,000 for landscape and equipment upgrades, free water-saving devices, and on-bill financing. They also provide free on-site water use surveys, commercial irrigation services, and access to water management tools like the "My Water Report" portal. Businesses can also pursue Green Business Certification for water and energy efficiency.[115]

San Antonio Water System CII conservation program (San Antonio, TX)
CII customers, though only 6 percent of San Antonio's meters, use 25 percent of the water, driven by scaled operations crucial for economic activity. In 2023, nearly half of their water savings came from these customers. With input from stakeholders, San Antonio developed a robust conservation program funded by commercial meter fees. Rebates for retrofits and new technologies, especially in irrigation, are offered. An annual irrigation checkup ensures large properties operate efficiently, with penalties for non-compliance enhancing adherence. This program has resulted in significant water savings and system improvements.[116]

Green Restaurants Association's certification program (nationwide)
With the growing emphasis on social and environmental responsibility, many restaurants are adopting water and energy-efficient equipment. However, quantifying the impact of these efforts is often difficult due to factors like flat water fees or utility bills being managed by building owners or corporate offices. Despite this, restaurants certified by the Green Restaurant Association have successfully reduced their environmental footprint in various areas, including water usage, even if specific savings are not always measurable.[117]

Green Restaurants Association-certified restaurant: Uncommon Ground (Chicago, IL)
Uncommon Ground, a Chicago-based restaurant, expanded from a small café to two 4,000-square-foot locations. To reduce its environmental impact, the restaurant installed water-efficient fixtures, ENERGY STAR® dishwashers and ice machines, and uses a self-contained steam kettle for food preparation. Additionally, it created a rooftop organic farm with drip irrigation and rainwater collection systems. These efforts led Uncommon Ground to become the first restaurant in the U.S. to achieve a four-star rating from the Green Restaurant Association.[118]

Granite Park office complex (Plano, TX)
The Granite Park office complex in Plano, Texas, has significantly reduced its outdoor water use through landscape and irrigation improvements, earning LEED® Gold certifications. Managed by Precision Landscape Management the complex upgraded to weather-based irrigation controllers, installed pressure-regulating nozzles, and added rain and freeze sensors. Regular maintenance, including monthly inspections, ensures the system's efficiency, helping maintain the landscape while conserving water.[119]

Ford Motors (Dearborn, MI)
Ford's water stewardship commitment focuses on reducing water usage in manufacturing, improving wastewater quality, and supporting water-related initiatives in local communities. The company has implemented water-saving technologies in its facilities and is working toward water neutrality by 2035. Ford's efforts include reducing freshwater consumption, reusing treated water, and supporting access to clean water in water-stressed areas.[120]

USEPA laboratories (nationwide)
A USEPA study on laboratories highlights strategies for reducing water usage in 29 laboratory facilities nationwide. Key actions include implementing water-efficient technologies, optimizing cooling systems, and reusing water in processes. These measures reduced water use intensity by 8.4 percent, improved operational efficiency, and reduced environmental impact.[121] The study emphasizes the importance of regular audits, staff training, and integrating water conservation into facility management practices.

Providence St. Peter Hospital (Olympia, WA)
Providence St. Peter Hospital in Olympia, Washington, reduces water consumption through efficient technologies and process improvements. Key initiatives included upgrading the steam sterilization process, implementing low-flow fixtures, and improving cooling tower efficiency. These actions resulted in water savings and lower operational costs.[122] The USEPA has recognized Providence St. Peter Hospital for its success in showcasing the importance of facility audits and employee engagement in achieving water conservation goals.

Outreach and education resources

WaterSense at Work
WaterSense, a program by the USEPA, promotes water efficiency to protect the nation's water supply. It certifies products, homes, and professionals that use 20 percent less water while maintaining performance. The WaterSense at Work initiative offers best practices for commercial and institutional facilities to manage water use, achieve cost savings, and reduce environmental impact. Adopting water-efficient practices can enhance a facility's competitive edge, reduce risks, and demonstrate environmental leadership, contributing to sustainability goals and community water conservation efforts.

Website: www.epa.gov/watersense/best-management-practices

City Energy Project Resource Library Water Audit Guidance for Commercial Buildings
City Energy is a joint project between the National Resource Defense Council and the Institute for Market Transformation. City *Energy's Water Audit Guidance for Commercial Buildings* is a best practice guide for water auditors, building owners, managers, and governments.

Website: www.imt.org/resources/city-energy-project-water-audit-guidance-for-commercial-buildings

U.S. Department of Energy Better Buildings Water Savings Network
Through the Better Buildings Water Savings Network, the U.S. Department of Energy connects organizations to conserve water in buildings, plants, and multifamily housing. Partners work with the department to set water use intensity goals, share successful water efficiency solutions and progress, network with peers, receive technical assistance, and more. Since 2015, the initiative has reduced the water use of participating partners by more than 10 billion gallons.

Website: www.betterbuildingssolutioncenter.energy.gov/water-savings-network

The H2Otel Challenge
The USEPA created the H2Otel Challenge help hotels understand their water footprint by encouraging hotels to "ACT": assess water use and savings opportunities, change products or processes to incorporate best management practices, and track their water-saving progress and achievements. Over 860 hotels participate in the program. Interested hotels can sign up for the H2Otel Challenge to start receiving free outreach and technical tools that will help save water, energy, and money.

Website: www.epa.gov/watersense/h2otel-challenge

Funding resources

Illinois Green Business Program
The Smart Energy Design Assistance Center has partnered with the Illinois Green Business Association to operate the Illinois Green Business Program and provide businesses with high-quality technical assistance and assessments that drive environmental and economic savings.

Website: www.smartenergy.illinois.edu/green-business

Additional water conservation and efficiency best practices to consider

There are many other water conservation practices that a community or local water utility can use that were not evaluated through this planning effort. While the plan identifies a set of effective water conservation strategies for the NWPA region, and the savings they could achieve if implemented, communities should evaluate all water conservation strategies and pick those that work best for them. The following are other strategies that communities can consider as they seek to engage in water conservation.

Conservation coordinator

A conservation coordinator is a full- or part-time position dedicated to developing and overseeing water conservation programs to educate and engage with the public and internal staff on water conservation best practices. While beneficial at all levels of government, conservation coordinators are often most effective at the municipal or water utility level as they are best positioned to understand local needs. County and state coordinators, or existing water conservation programs, can also be a great resource for municipalities or water utilities that seek to create a water conservation program, develop a water-use conservation ordinance, or implement other water conservation practices.

A conservation coordinator position can be filled through an external hiring process or by appointing an internal staff member with knowledge of water conservation. Funding for the position can be through federal or state funds, water-user fees, conservation surcharges, or membership fees.[123]

Indoor water audits

While the residential retrofits strategy focuses on fixture replacements and upgrades, indoor residential water audits can also result in significant water savings in single-family as well as multi-family homes. In addition to fixture efficiency, auditors look for plumbing leaks, assess meter functionality, measure flow rates, and recommend fixture retrofits or replacements based on the home's needs. Audit programs can be labor intensive and vary based on local conditions and resources, with costs depending on factors like administration, marketing, implementation, and evaluation. Success relies on ongoing tracking, follow-up, and commitment, as water savings can decline over time as devices age or are replaced.[124]

Graywater use

Graywater — used water from laundry machines, bathtubs, showers, etc. — can be reused for lower indoor water uses like toilet flushing or lawn irrigation. Integrating graywater systems into homes reduces the strain on wastewater systems, conserves drinking water, and helps replenish groundwater reserves through irrigation. When promoting the use of graywater for water conservation, municipalities need to ensure that existing zoning codes and ordinances do not conflict with the installation of graywater systems. Public education about graywater and system installation will help inform residents and increase comfort with the permit process. Municipalities should make the permit process efficient and easy to understand to reduce barriers to this water conservation strategy.

Graywater system regulations are based on performance or system design. Performance-based regulations offer more flexibility for water users, while design-based regulations are more restrictive. Municipalities may regulate the use of graywater by either prohibiting graywater for the use of toilet flushing or lawn irrigation. Incentives like conservation tax credits can be incorporated into the process. Lastly, graywater systems can be regulated by the level of water filtering, as some systems can disinfect and dye the graywater.

Wastewater reuse

Reusing treated wastewater can redirect demand from the potable water supply to lower-value uses like turf irrigation (parks, golf courses, cemeteries, etc.), industry, and agricultural irrigation. Reclaiming wastewater can reduce the amount of water discharged into waterways and decrease system stress during drought or high demand. Current regulations regarding design standards for applying treated wastewater to land exist only at

the Illinois state level. While some parts of the country reuse wastewater for other potable uses, such as drinking water, it is not a practice currently being used in Illinois. Municipal water suppliers should stay abreast of regional conversations and related legislation in the event that wastewater can become a potential source in the future.

Public information programs

Public information programs or campaigns can provide overall awareness for water conservation and support technological approaches. A public information program can be in the form of paper or digital media, workshops, advertising, public relations, events, or other promotional tactics. The City of Joliet's Rethinking Water Joliet is an example of successful a public information program in the NWPA region.[125] Community water suppliers can use these programs to provide regular updates about their water supply and demand and communicate actions their customers can take to engage in water conservation. Increasing the frequency of billing and related communications directly on monthly bills or bill inserts can increase transparency and help customers better understand their water usage. Providing additional information like comparative usage data, unit conversation equations, and conservation tips directly on water bills can further increase customers' awareness of water use.[126]

Residential retrofits: large appliances

The residential retrofit strategy includes retrofits for toilets, showerheads, and faucets. However, retrofitting other fixtures like washing machines and dishwashers can also result in water savings. Washing machines account for 16 percent of indoor residential water use. Conventional top-loading washers use more water than high-efficiency washers, which are typically front-loading and designed to save water. Replacing a conventional washer (with a high-efficiency washer can save 12 gallons per load, leading to significant annual water and energy savings for a household. Dishwashers account for only one percent of indoor residential water use.[127] However, high-efficiency dishwashers can use up to 30 percent less water than standard models, which can result in water savings.
To encourage the adoption of these water-efficient appliances, communities often offer cash incentives like rebates. While financial incentives can be provided by a community or local water utility, they may also already exist through a local gas or electricity utility, given the energy savings that can be gained through the use of high-efficiency appliances, such as those certified by ENERGY STAR.[128] To lower costs and increase adoption, financial incentives are typically provided in the form of a cash rebate, discounts on purchase costs, or discounts applied directly to a customer's utility bill.[129]

School education

Public education can be integral to advancing water conservation. Targeting grades K-8 with water conservation programming instills the value of water and knowledge of watersheds, water quality, and water conservation techniques at an early age. Water utilities can work with municipalities and county governments to promote and support the integration of water conservation awareness into school curricula and facilitate collaboration with public water suppliers to give classroom presentations and facility tours.

Water pricing

Water pricing is a tool PWS communities can use to encourage water conservation and ensure sufficient revenues for water services being provided. Two pricing strategies associated with water conservation and efficiency are full-cost pricing and conservation pricing.

Full-cost pricing

Full-cost pricing sets water rates that reflect the true cost of water supply and distribution. As water resources become increasingly scarce and population growth slows, it is essential for utilities to adopt pricing models that ensure sustainability, equity, and financial viability. Full-cost pricing includes both direct costs of water treatment and distribution and indirect costs, such as infrastructure maintenance, environmental impacts, and future capital investments. By incorporating these elements into the pricing structure, PWS communities can promote responsible water use, encourage conservation, and secure the necessary funding for ongoing operations.

Conservation pricing

Conservation pricing involves charging customers based on the volume of water used. This can take various forms, including uniform charges, increasing block rate, or a two-part schedule. In a uniform charge structure, rates vary based on customer characteristics, such as customer class, meter size, geographic location, and water source. An increasing block rate structure applies increasingly higher rates as water usage rises. A two-part schedule separates water usage expenses from non-water use expenses like customer service-related costs, meter reading, billing, and collection. In most cases, this includes a minimum water charge for all customers accessing the service. However, implementing this structure can be challenging due to capital intensity of water utilities.

Another form of conservation pricing focuses peak demand rather than total usage. During peak demand periods — often during the summer months — PWS communities may implement high rates for outdoor water use to discourage excessive consumption and help cover the cost of operations associated with more demand. Additionally, some communities enact ordinances to restrict water usage during peak demand times, such as limiting the watering of lawns. While these can be effective, literature suggests that price-based strategies linked to peak water demand can be more efficient than municipal ordinances, given the resources needed for enforcement.

Chapter 5: A guide to local action in the NWPA region

As communities pursue water conservation and efficiency efforts, it is critical for them to understand water supply and demand within the context of local water source and infrastructure conditions. There are various factors within a community's broader water system that present challenges that can impact water availability. These may include issues related to water quality, well operability, and/or the maintenance needs of the water treatment plant or water mains. Communities can use local knowledge of their water sources and systems to identify the most effective water conservation and efficiency strategies that meet their needs. Communities can take the following steps to chart this course.

Understand local conditions

Identify local water supply and demand

Understanding water supply and demand at the local level is critical in determining whether a community's available supply exceeds or is within the limits of existing and future demand. Regional water supply and demand estimates can enable counties, municipalities, water utilities, and residents to engage in informed discussions about supply and demand; however, more localized data, such as water use data from utilities and population projections, is needed to gain a comprehensive understanding of local capacity and constraints. Additionally, many water sources can present challenges and impact communities differently. Examining and understanding these challenges can help communities understand how supply and demand are altered and how they may influence water conservation and efficiency actions.

Communities with water supplies constrained or threatened by degraded water quality may want to consider strategies that protect source water and enhance water quality in addition to tackling strategies that reduce water demand. Alternatively, communities that experience seasonal water level variability, such as those that rely on shallow groundwater or the Fox River, may want to consider water conservation strategies that aim to lower peak demand or minimize the impacts of short-term drought. On the other hand, if communities are dependent on the deep sandstone aquifer in areas where well desaturation threats exist, they may want to adopt strategies that can help reduce overall demand, such as tackling water loss or decreasing the water consumption among its largest water users.

Examine water infrastructure systems and operations

Water conservation and efficiency can also be influenced by a community's water infrastructure systems and operations. By regularly conducing audits to inventory assets and review infrastructure conditions, communities

can monitor water usage, find opportunities to recover water losses through maintenance and repairs, and identify areas for system-wide improvements. They can use information gathered during audits to develop asset management and water loss control plans, set water reduction goals and targets, and inform capital improvement planning.

Water rates — the prices communities charge for water use — are closely tied to a water system's operations and underlying infrastructure conditions. Revenues generated from these rates serve as the primary source of income for most municipal water systems, making them a critical factor in a system's operational success. Municipalities can set rate structures, such as full-cost pricing, that cover both the operational costs and the long-term capital investments needed for infrastructure maintenance and upgrades. Communities that are interested in water conservation but are contending with low water revenues and compounding infrastructure needs can conduct cost-of-service rate studies to help determine a rate that can promote water conservation, affordability, and financial security for the utility.

Evaluate water conservation options

As communities understand their local water conditions and system characteristics, they can better identify and evaluate water conservation and efficiency strategies that will help them move toward a more sustainable water supply. Using a similar process laid out within this plan for the NWPA region municipal PWS systems should consider reviewing their community's population, employment, land use, water demand, and other water use information to identify strategies that are most applicable to largest water uses. (If communities are tackling aspects of water sustainability to go beyond water quantity — the focus of this plan — there may be additional considerations to explore.)

Additionally, the five detailed water conservation and efficiency strategies can serve as examples of how communities can evaluate and estimate water savings. Communities can use them to guide estimating savings from other strategies or directly apply local data to one or more of these detailed strategies and corresponding savings methods to estimate potential water reductions.

Once communities assess water conservation options, they should also develop water conservation and efficiency plans that detail the desired strategies and programs to reduce water use, as well as set local targets to measure progress. In addition to the information laid out in this plan, there are multiple resources that can guide communities through the development of water conservation and efficiency plans, such as USEPA's Water Conservation Plan Guidelines, CMAP's Northeastern Illinois Regional Water Supply and Demand Plan (also referred to as Water 2050), and USEPA's Best Practices to Consider When Evaluating Water Conservation and Efficiency as an Alternative for Water Supply Expansion.

Consider alternative sources of supply

For communities wrestling with water quantity and quality issues, water conservation and efficiency can be a low-cost alternative to seeking alternative sources of supply. However, there are instances where the scale of the issue cannot be addressed through these practices alone. In instances where switching water sources is necessary, communities can use water conservation and efficiency strategies to prolong the life of their existing supplies, give themselves more time to find and secure an alternative source, and potentially meet permit requirements of the alternative source.

Switching to an alternative water supply is a costly and timely endeavor that requires significant coordination and evaluation of options. For example, Channahon, Crest Hill, Joliet, Minooka, Romeoville, and Shorewood are now engaged in over 10 years of active work to make the transition to Lake Michigan water. Similarly, Montgomery, Oswego, and Yorkville have worked together on a variety of tasks to secure an alternative supply. Although some communities in the NWPA region are turning to Lake Michigan as a potential water source, it is not feasible for all communities and should be considered as one of the last alternatives.

Transitioning to Lake Michigan water

The United City of Yorkville, Village of Montgomery, and Village of Oswego are working together to transition from groundwater to Lake Michigan water, ensuring access to a more long-term and safe water source. The transition process has included these major tasks:

Forming the Water Link partnership

In 2021, the United City of Yorkville, Village of Oswego, and the Village of Montgomery formed the WaterLink partnership in response to concerns around the depletion of their shared water source, the deep sandstone aquifer, and given the economies of scale that can be achieved by working together.

Studying groundwater supplies

Each of the three communities hired engineering firms to compile research to improve their understanding of their community's water demand related to the projected impacts the demand would have on the source in the future. By comparing local water demand projections along the ISWS groundwater modeling of well performance across the deep sandstone aquifer, it became clear that municipalities could be at risk of well inoperability by as early as 2050.

Assessing alternatives

Through collaboration, the WaterLink communities evaluated potential water source options, including the Fox River and Lake Michigan, by conducting cost analyses and exploring different water withdrawal and transmission options. Withdrawal options included accessing water through already established water commissions, developing sub-regional systems, or building new infrastructure as individual municipalities. In December 2021, the WaterLink communities made the decision to pursue an agreement with the DuPage Water Commission to purchase Lake Michigan water.

Obtaining Lake Michigan water

In October 2024, the WaterLink communities and DuPage Water Commission reached an agreement to construct a 30-mile pipeline extension from Naperville. As a part of this agreement, WaterLink communities will provide $250 million to cover construction. Communities will be connected to the new water source once the pipeline is complete. In addition to covering the pipeline costs, WaterLink communities had to obtain a Lake Michigan water allocation from the IDNR Office of Water Resources. As part of the allocation requirements, communities will also need to demonstrate the need and their path to meet the Lake Michigan permit requirements, which include a goal of minimizing water loss to less than 10 percent and implementation of other required water conservation best practices.

Developing and executing the construction plan

Construction for the project is expected to begin in 2025, through a two-phase process, and be completed in 2028. Phase one will include eight projects to determine engineering solutions to ensure the existing systems meet relevant regulations. Phase two will consist of three projects related to expanding the pipeline and transmission systems from the DuPage Water Commission to the WaterLink municipalities.

Funding the plan

To fund the $250 million project, each community plans to institute gradual rate increases. However, communities will continue to seek alternative funding sources to reduce the cost burden on customers. For example, the United City of Yorkville recently applied for a USEPA Water Infrastructure Finance and Innovation Act loan, that could potentially provide up to $130 million for the project.

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The Chicago Metropolitan Agency for Planning (CMAP) is the region's comprehensive planning organization. The agency and its partners developed and are now implementing ON TO 2050, a long-range plan to help the seven counties and 284 communities of northeastern Illinois implement strategies that address transportation, housing, economic development, open space, the environment, and other quality-of-life issues.

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