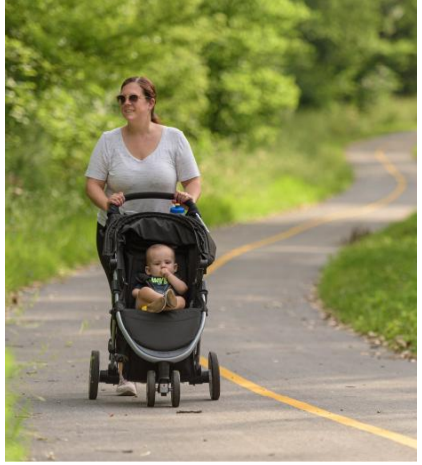
Chicago Metropolitan Agency for Planning

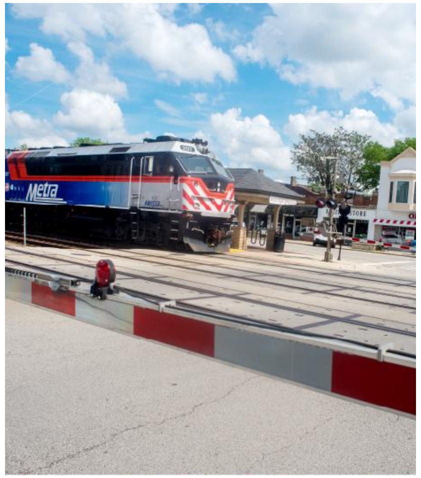
Sea Grant ILLINOIS–INDIANA

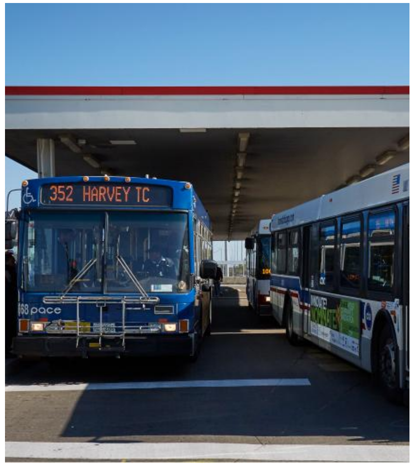
NWPA Water Supply Sustainability Plan

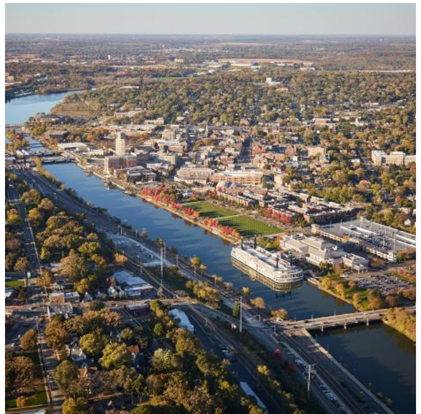
NWPA TAC Meeting

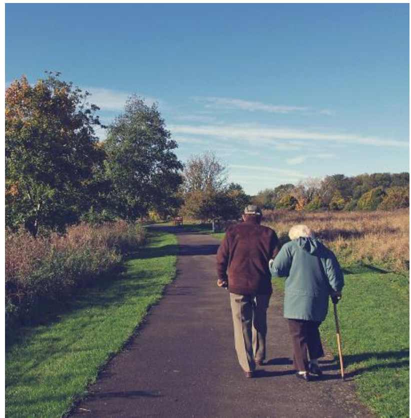
March 25, 2025











Plan review timeline

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- TAC to meet and consider plan approval (March 25) - *today!*
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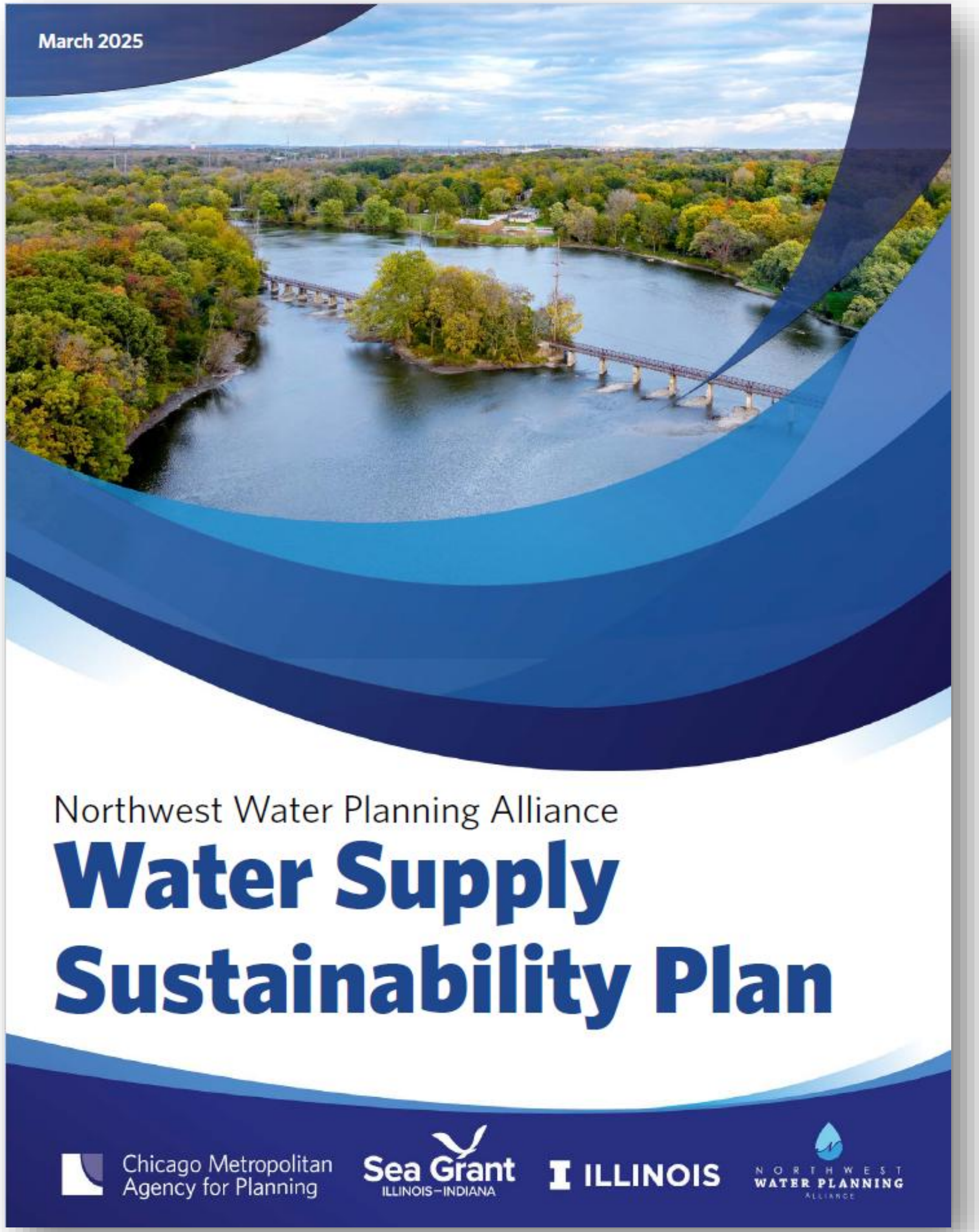
Water Supply Sustainability Plan is finished!



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of water use from northern Illinois' deep sandstone aquifers has led to declining water levels, with more water being withdrawn than naturally replaced.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:

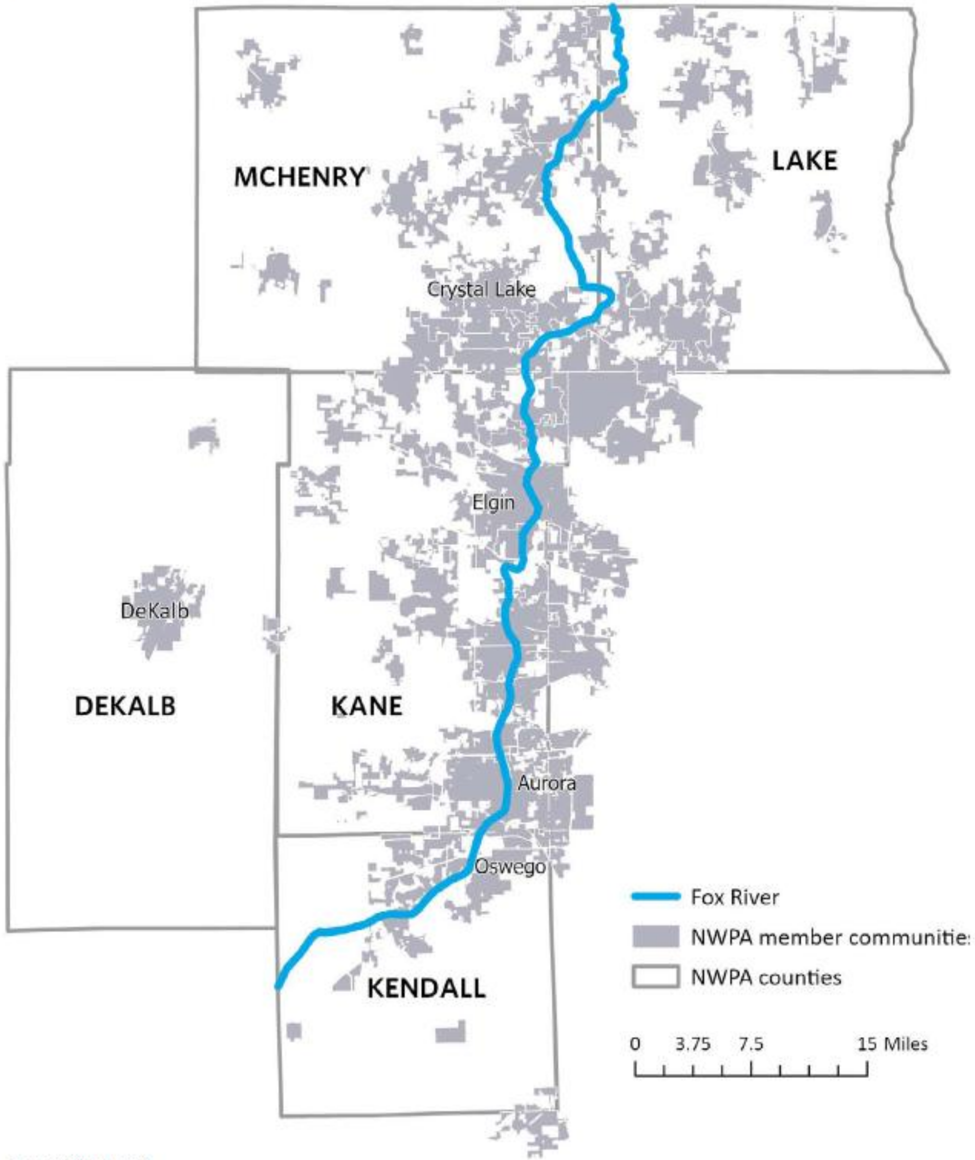
1. Develop and promote sustainable water policies and practices
2. Inform decision makers and the public on NWPA issues and best practices
3. Improve the scientific understanding of NWPA water supplies
4. Build organizational capacity to achieve its mission

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.

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.

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	12.6
Kendall	- *
Lake	0.1
McHenry	- *
NWPA region	**12.7**

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).

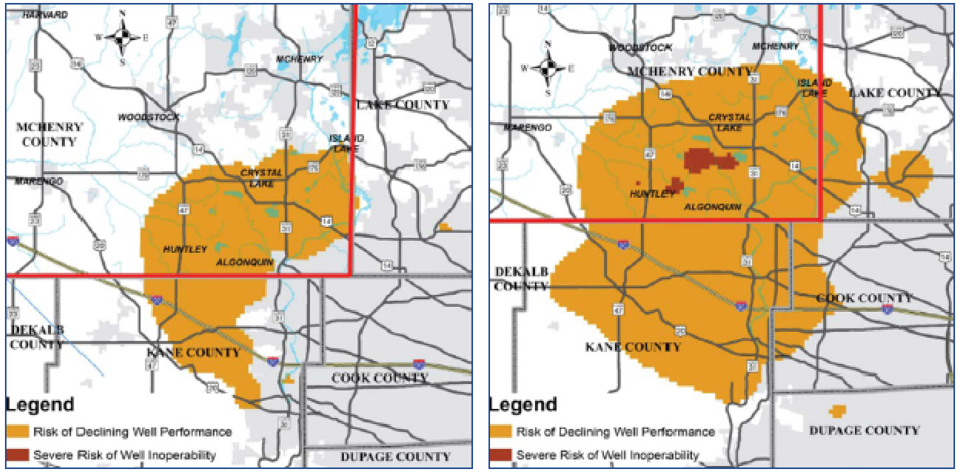
Even in counties where overall demand remains within the sustainable water supply estimates, localized challenges may arise. Specific areas in DeKalb, Kendall, and McHenry counties face risks of water stress due to concentrated demand or unique geological conditions.

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.

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

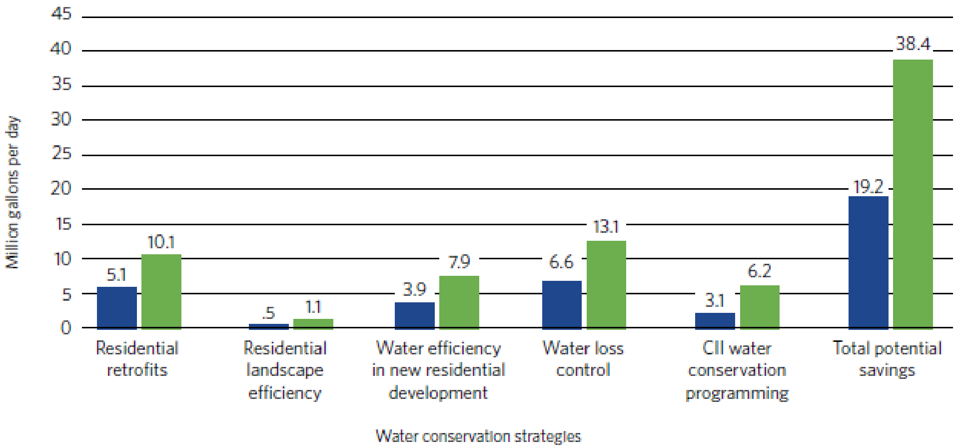
Water conservation strategy	Water uses (subsectors)
Residential retrofits	Single-family residential customers
Outdoor landscape efficiency	Single-family residential customers
Water efficiency in new development	Single-family residential customers
Water loss control	Water loss within system supply and 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 million gallons per day (MGD). When looking at these withdrawals by source, 39 MGD came from shallow groundwater sources, 35 MGD from deep groundwater sources, 11 MGD from river sources, and 46 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.

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

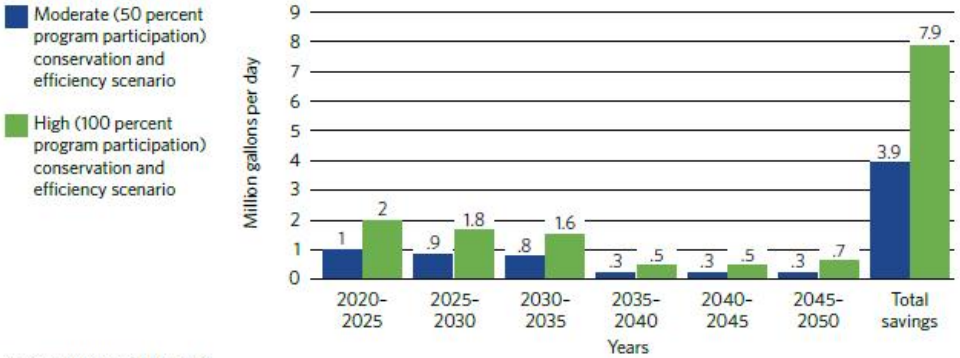
Item	Requirement
Leaks	Pressure-loss test on all water supplies detects no leaks
	Free of visible leaks from toilets
	Free of visible leaks from bathroom faucets
	Free of visible leaks from showerheads
	Free of visible leaks from bathroom tub faucets (tub spouts) when showerheads are active
	Free of 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)



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Questions?

Chicago Metropolitan Agency for Planning

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Thank you

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