SIGNIFICANT WATER ISSUES

Water Conservation and Water Use Efficiency

Next to the air we need to breathe, water is the most important resource that people need to support life. Up to 60% of the human body is water that must be replenished on a regular basis for people to remain alive and healthy. Water is also necessary to support economic development since people will not invest in homes or businesses unless they have access to safe, clean and affordable water. McHenry County relies solely on groundwater to meet all of its potable water needs and is very fortunate to have multiple sources of groundwater aquifers that may be able to provide water. The groundwater aquifers include:

- Shallow sand and gravel aquifers
- Shallow bedrock aquifers (limestone)
- Deep bedrock aquifers (sandstone)

The shallow sand and gravel aquifers are the main source of water in the county and are the most common aquifer used for private residential wells. Wells to these aquifers are generally between 0 to 300 feet deep. The sand and gravel aquifers are recharged locally from rainfall or snowmelt that infiltrates down through the permeable layers of sand and gravel, fills the pore spaces between the material, and creates a water table. Wells drilled below the water table can pump groundwater for people to use. The groundwater is in constant motion, not only infiltrating downward into the water table but also moving laterally to provide a baseflow of groundwater into lakes, rivers, streams and wetlands. This baseflow of cool, filtered groundwater is critical toward maintaining the health of these aquatic systems, but baseflow can be disrupted when the water table is excessively drawn down or when land is converted to impervious surfaces and causes water to flow overland rather than infiltrating into the ground. The capacity of sand and gravel aquifers to produce water can vary depending on factors such as where they are located, the size of their recharge area and the permeability of the geologic material. Because of their generally high permeability, sand and gravel aquifers are vulnerable to pollution that infiltrates downward, and are susceptible to overconsumption and drought because they need to be consistently recharged by rain and snowmelt.

The shallow bedrock aquifers consist predominantly of limestone that have cracks and fissures large enough to capture and hold water that infiltrates down through the sand and gravel. Wells to these aquifers are generally 200 to 500 feet deep. The cracks and fissures only occur in areas of limestone that had been sufficiently weathered in the past and need to be situated in low spots of the limestone so water infiltrating through sand and gravel is able to consistently accumulate large volumes of water in the cracks. Because shallow bedrock aquifers rely on such specific conditions, they can be particularly vulnerable to overconsumption and drought.

The deep bedrock aquifers are thick layers of sandstone that are covered by confining layers of shale or other impermeable material that prevents infiltration and recharge of water from above. Wells to these aquifers are generally 800 to 1,400 feet deep. The sandstone aquifers underlie vast areas and not only extend throughout northeast Illinois but also under several states. The upper layer of sandstone is called the St. Peter aquifer and it is recharged primarily in Boone County where deep bedrock valleys extend down to the aquifer. The deep bedrock valleys became filled with sand and gravel during periods of glaciation so are no longer visible, but still allow water to infiltrate from the ground surface down to the St. Peter aquifer. The deeper sandstone aquifer is called the Ironton-Galesville aquifer and it is the main

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deep aquifer used by municipalities in McHenry County. The Ironton-Galesville aquifer is recharged primarily in Central Wisconsin where that layer of sandstone rises up near the ground surface. The recharge rate of the Ironton-Galesville aquifer is very slow because of the long distance groundwater needs to travel and because the small pore size between the sandstone particles reduces the flow rate of the groundwater. It can take thousands of years for water infiltrating into the ground in central Wisconsin, to migrate through the sandstone aquifer and reach McHenry County. At about 2,000 feet below the ground surface, the Mount Simon aquifer is the deepest sandstone aquifer. The water in the Mount Simon is predominantly saline and historically has not been used for potable water in the region. However, there may be a layer of water at the top of the aquifer with water quality sufficient for use as drinking water. Further study would be needed to evaluate the potential of the Mount Simon aquifer as a source of drinking water for McHenry County.

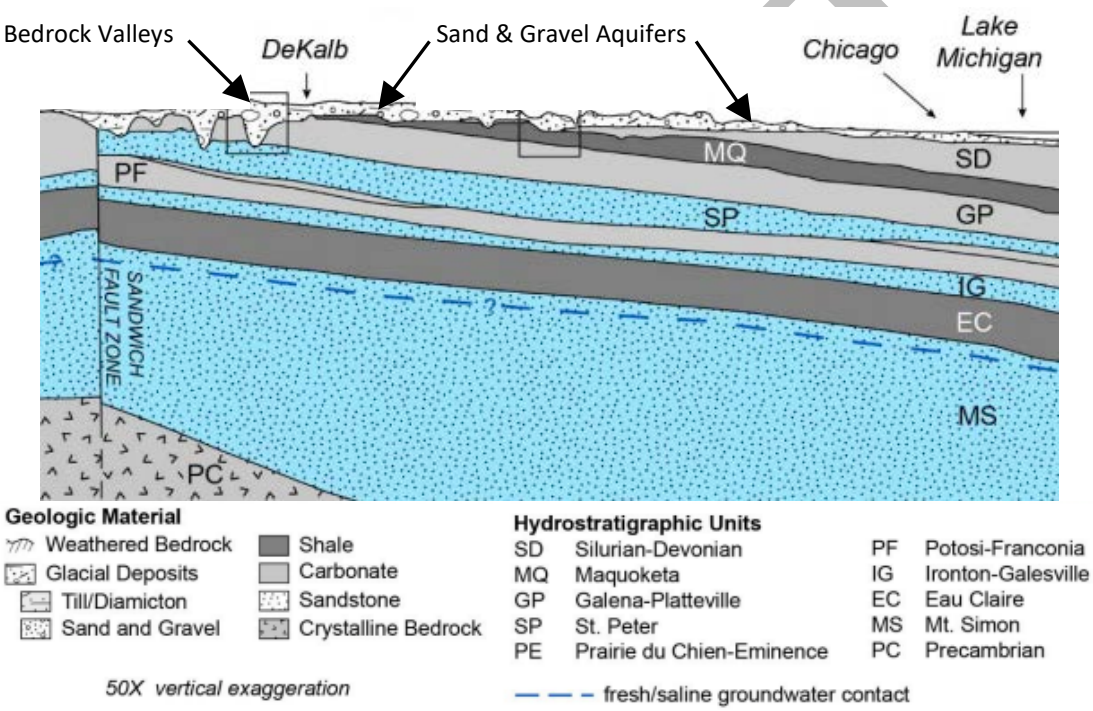
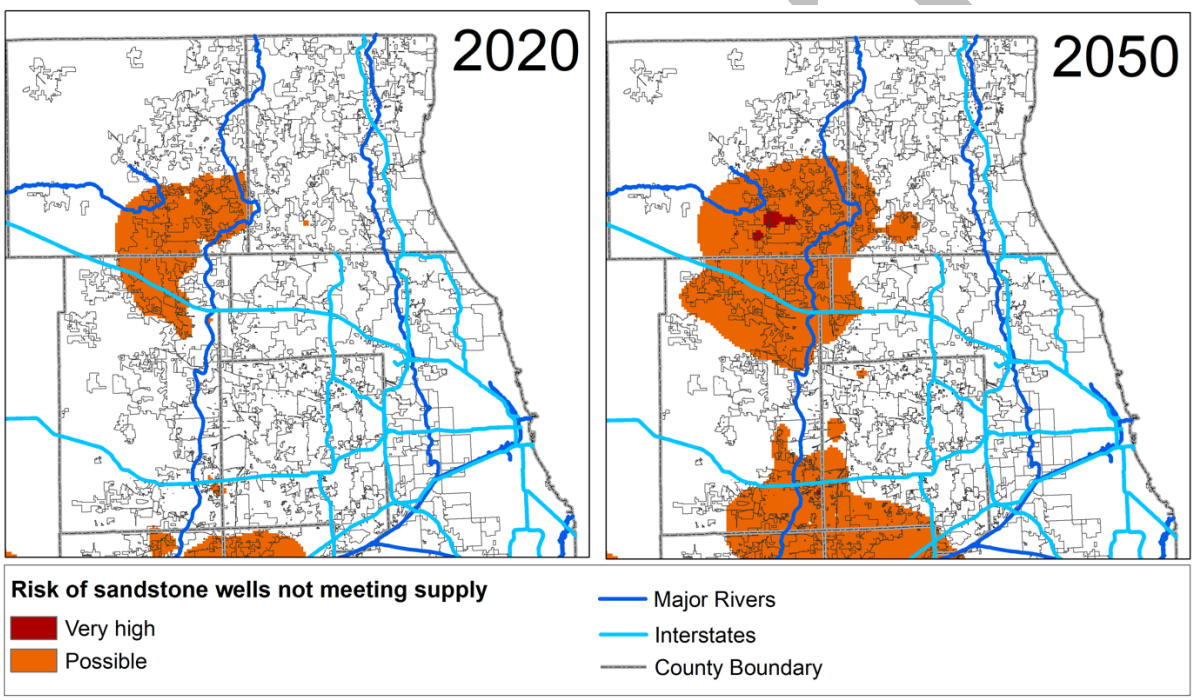


Figure ???: Illinois State Water Survey graphic showing a profile view of the subsurface geology and aquifers in northeast Illinois I24. The sand and gravel aquifers are at the surface, above the shallow bedrock/limestone aquifers (Silurian-Devonian). The layers shown in blue are the deep sandstone bedrock aquifers (St. Peter, Ironton-Galesville, Mount Simon). The dark layers between the aquifers consist of less permeable or impermeable material.

The deep aquifers can be the most vulnerable to overconsumption due to the slow recharge rate and large number of high capacity wells, throughout northeast Illinois and beyond, that are withdrawing water from the sandstone aquifers. Wells in some areas have pumped so much groundwater that water levels in parts of the aquifer have dropped over 800 feet. This over-pumping is accelerating regional desaturation of the sandstone aquifers. According to the Illinois State Water Survey (ISWS), withdrawals from the sandstone aquifers in northeast Illinois are occurring at twice the natural recharge rate I1. The combination of desaturation in the region and pumping of groundwater for local municipal wells is causing localized desaturation in the sandstone aquifers under McHenry County. This desaturation increases the risk to the supply of water in the future. Communities in the southeast part of the county that rely on deep aquifers are the most vulnerable to shortages in the future I12. The maps in Figure ??? illustrates approximate areas of the Ironton-Galesville aquifer under McHenry County at risk

for not meeting supply needs in 2020 and 2050 I12. Water conservation and efficiency programs can be particularly important for these communities in order to reduce the rate of desaturation, extend the availability of their existing water supplies, and prolong the life of their water infrastructure.

Although it is possible to temporarily pump water beyond the sustainable yield of the aquifer, this imbalance between withdrawals and recharge cannot be sustained indefinitely. The maps in Figure ??? are based on regional studies conducted by the ISWS and demonstrate that the long-term viability of water supplies is a concern, especially for the southeast part of the county. Because of the complexity of groundwater systems, more localized studies should be conducted to develop a more complete understanding of the potential water supplies in these aquifers. The localized studies would help municipalities develop sustainable long-term plans and better maintain the balance between supply and demand for water into the future.



*** Figure ?? Illinois State Water Survey (ISWS) map illustrating approximate zones within the Ironton-Galesville aquifer under McHenry County that are experiencing desaturation and may face challenges to pumping and water supplies I12. ***

The Chicago Metropolitan Agency for Planning (CMAP) projects that between 2011 and 2050 water demands in McHenry County will increase by 30 percent in the shallow sand and gravel aquifers and by 24 percent in the deep sandstone aquifers I10. The increased demand will place additional stress on the sandstone aquifers that are already being pumped beyond their natural recharge rate I12. Based on this information, the projected increases in water demand will not be sustainable. The CMAP projections are conservative estimates based on the assumption that the steady improvements that have been made in water conservation and efficiency over past decades will continue through 2050. Therefore, if improved conservation and efficiency practices do not continue, or if they decline in the future, the increase in water demands will likely be substantially greater. The CMAP projections indicate that most of the increased demand will occur in municipalities that have expanding populations and are building out infrastructure. Communities that are already built out and increasingly implementing conservation and efficiency are projected to experience decreases in demand I2.

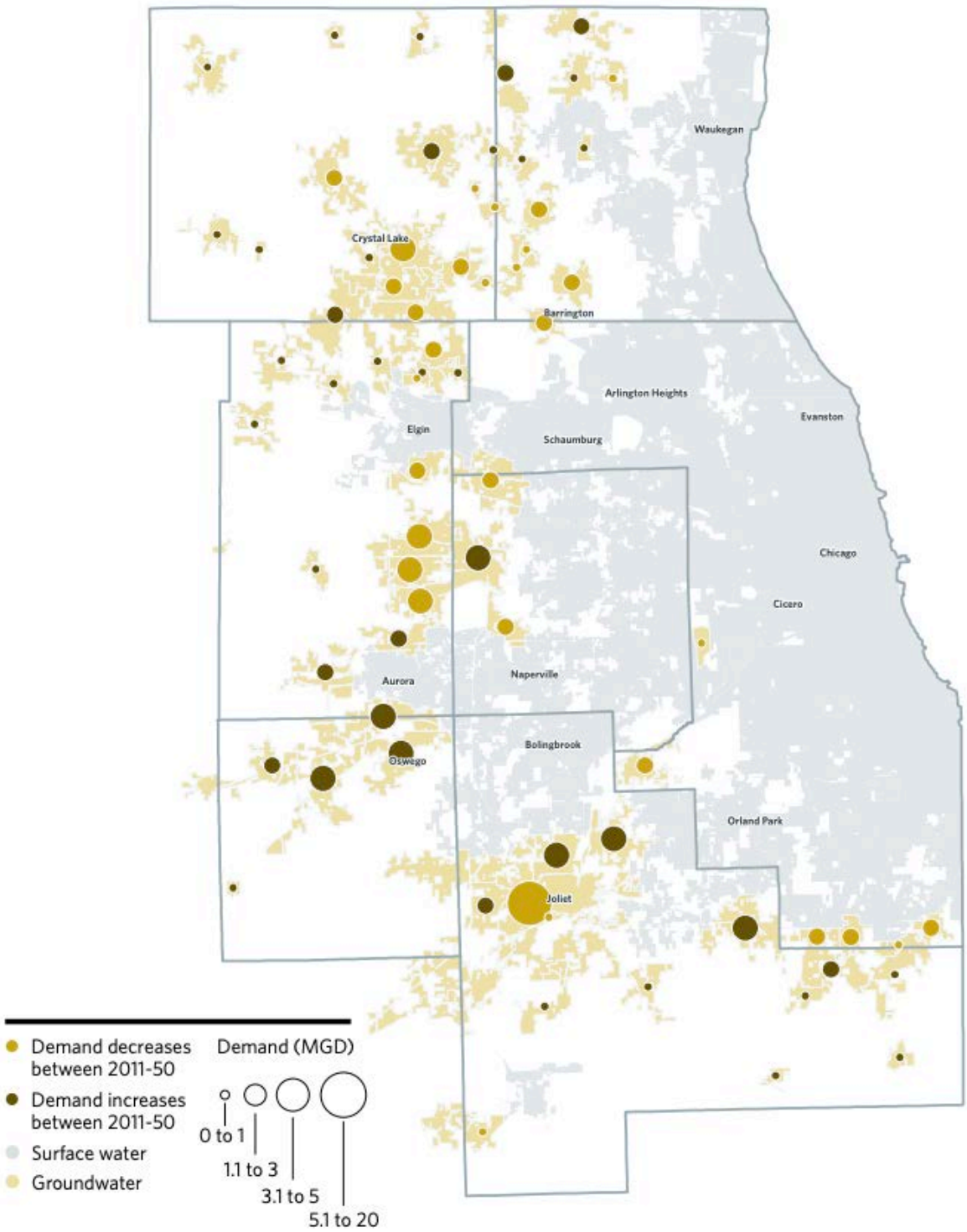


Figure ???: Projected change in demand for groundwater dependent municipalities, 2011 to 2050 based on millions of gallons per day (MGD). The map uses color coding to indicate increases or decreases, and sizes to indicate scale of change. From CMAP Changing Water Demand: Projecting Water Use in the Chicago Region to 2050 I2.

While the terms water conservation and water efficiency are often used interchangeably, they can have slightly different meanings. Water conservation often refers to changes in behavior, policy or technology that use less water or prevent waste. Examples of water conservation practices may include turning off water when brushing teeth or shaving, only running full loads of laundry in the washing machine, only allowing lawn watering at optimal times of the day, converting lawns to native plants that do not require watering, or repairing leaks to prevent waste. On the other hand, water efficiency means minimizing the amount of water needed to complete tasks such as washing dishes, flushing toilets, cleaning cars, or performing an operation on an assembly line. Water efficiency normally relies on technology and good engineering to use the least amount of water to perform specific tasks. Both terms, however, share the goal of using less water and should be implemented together to protect water supplies.

Although the motivations to practice water conservation and water efficiency may vary depending on the stakeholder, there are many reasons to use and waste less water. Reasons may include:

- Extend water supplies: Water in McHenry County's aquifers is finite, so conservation can stretch existing supplies and reduce or eliminate the need for municipalities to develop expensive new water sources and individual well owners to drill existing wells deeper.
- Cost savings: Lowering water production and/or distribution costs will save the utility and its customers (ratepayers) money in reduced operating costs.
- Defer or reduce costs: Conservation and reducing demand can help defer capital costs by delaying when new expansion is needed and/or reduce the size of the infrastructure when replacement or expansion becomes necessary.
- Wastewater treatment and disposal benefits: Reducing the volume of water used indoors also reduces the volume of wastewater that needs to be treated, resulting in cost savings, lower energy use, and lessened environmental impacts of treated wastewater disposal.
- Environmental benefits: Water pumped from aquifers can reduce the level of baseflow available for lakes, rivers, streams, and wetlands. The reduced baseflow can adversely impact sensitive aquatic habitats including fisheries. Therefore, practicing water conservation can reduce groundwater withdrawals and help protect aquatic resources.
- Utility stewardship and sustainability: Utilities that conserve water demonstrate leadership in resource management and help communities work toward a goal of sustainable development.
- Energy savings and emissions reduction: Reducing water production will save energy at every phase of production and treatment while also reducing greenhouse gas emissions.
- Customer benefits: Customers who conserve water may enjoy lower water bills and possibly lower wastewater and energy bills.
- Public perception: Environmental benefits and cost savings from water conservation efforts can help develop public support for public works projects when they are necessary.

The implementation of water conservation and efficiency practices can help reduce stress on the county's aquifers, protect and preserve water supplies, strengthen the resilience of communities, and save money. Therefore, water conservation and efficiency should be a priority whether it is at a municipal, industrial, commercial, agricultural, or residential scale.

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MUNICIPAL WATER SUPPLY

McHenry County and all municipalities in the county should coordinate with the Illinois State Water Survey, the Illinois State Geological Survey, the United States Geological Survey, and other agencies to better understand the viability of their specific groundwater aquifers and develop long range plans to maintain water supplies for their residents and businesses.

McHenry County has long been, and continues to be, a leader in studying its sand and gravel aquifers. Through collaboration with the United States Geological Survey (USGS), Illinois State Geological Survey (ISGS) and Illinois State Water Survey (ISWS), McHenry County has tools and data to make informed decisions for the long-term care and management of its shallow aquifer systems. However, as municipalities continue to expand their reliance on the deep sandstone aquifers and the extent of desaturation is becoming better understood, it is clear that additional study of the deep aquifers is also needed to ensure adequate water supplies into the future.

Regional study of the deep sandstone aquifers has expanded in recent years because communities in Will and Kendall counties are facing dire circumstances after unregulated pumping in the area has lowered the water table and desaturated the sandstone aquifers by over 800 feet I29. These impacts have contributed to regional desaturation that is affecting northeastern Illinois, including McHenry County I30. After years of pumping groundwater water beyond its sustainable yield, the deep aquifer that served the City of Joliet and its surrounding communities will be unusable by 2030. Therefore they must pursue very expensive capital projects to obtain alternative sources to meet their water needs I32. By taking action now, McHenry County and its own communities may be able to avoid similar problems and can have a much broader range of options to implement. The longer communities wait to address the desaturation of the sandstone aquifers, the fewer options will be available and the more expensive they are likely to be.

The ISWS has been a lead agency in studying the sandstone aquifers and developing models to help prepare projections and plans. The ISGS and USGS, along with other planning organizations, have been instrumental in conducting studies and evaluating options. By coordinating with these agencies and organizations, McHenry County and its communities can build off the work that has already been conducted in order to keep costs down and obtain the most reliable information. Just because municipalities currently have water does not mean it will be available at the same level in the future. How much water can be sustainably extracted and how long will it last are important questions to ask. The water resource agencies are best capable of providing answers.

MUNICIPAL WATER CONSERVATION AND EFFICIENCY

Municipal water utilities, private water utilities, and facilities with non-community public wells in McHenry County should implement water conservation and water efficiency programs to maintain a balance between supply and demand of water, protect water supplies, reduce energy use, minimize peak demand for water, and extend the life of infrastructure.

Municipal and private water utilities in McHenry County consist of many components of infrastructure, starting with a high capacity well (or wells) that pumps raw water from groundwater aquifers. The raw water is then pumped to a water treatment plant where it is cleaned, filtered and disinfected to meet drinking water standards. The drinking water is then pumped up to water storage towers and tanks that use gravity to help distribute the drinking water to homes or buildings through a network of pipes called

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water mains. The drinking water is used for washing, cooking, cleaning, flushing, or other purposes. The used water then flows as wastewater through sanitary sewers to wastewater treatment plants where it is run through a series of treatment stages that break down and remove pollutants. The treated wastewater is then discharged into the Fox River, the Kishwaukee River, or tributaries that lead to them. The Fox and Kishwaukee Rivers connect with other rivers that eventually lead to the Mississippi River that discharges into the Gulf of Mexico.

Non-community public water systems in McHenry County include facilities such as schools, churches, restaurants, or factories that have their own wells and supply their own water. While the scale of infrastructure for these systems are not as extensive as municipal systems, water systems at any scale can benefit from water conservation and efficiency. These facilities, along with municipal and private water systems, are required to provide a safe and adequate supply of water under the federal Safe Drinking Water Act (SWDA).

*** Photo of hand pump and water tower ***

Many points in the municipal water system provide opportunities for overuse or waste that can be corrected through improved water conservation and efficiency. For instance, leaks and breaks in water mains can be enormous sources of waste. The water mains are part of the infrastructure that distributes water, which has been treated to drinking water standards, under pressure throughout the municipality. But not all of this water makes it to the homes or businesses. As infrastructure such as water mains age, they become increasingly susceptible to leaks and breaks. The American Water Works Association (AWWA) estimates that nationwide over 6 billion gallons of water per day, or 2 trillion gallons of water each year, is lost due to leaks and breaks in water mains I7 This equates to about 14 to 18 percent of all the water treated in the U.S. I7. In some cases this water may seep back into the ground and recharge the same aquifer it was drawn from. However, far more often there are layers of impermeable clay or rock between the source of the leak and the aquifer the municipal water was drawn from, thereby preventing local recharge. Under these circumstances, aquifer desaturation may be accelerated as more water is pumped to make up for the water being wasted from the leaks. The water lost before it reaches customers also represents lost revenue for the water utility. Additionally, all of the energy that was used to pump water from the ground, treat the water to drinking water standards, and then pump it into water mains is wasted as well. The lost revenue and energy costs must be absorbed by the water utility, and ultimately the ratepayers.

*** Photo of Crystal Lake repairing infrastructure in road with water tower in background ***

Historically, as the population of municipalities grew so did their demand for water supplies, thereby prompting increasing numbers of wells and a larger infrastructure. The infrastructure also needed to be large enough to manage the peak water demands that occur during the summer months. To meet the growing demands, municipalities would try to find additional sources of water by drilling additional wells, often into deeper aquifers. However, this solution is not sustainable since there are only a limited number of aquifers, the amount of water available in the aquifers is finite, and some aquifers already are experiencing drawdown or desaturation. Drilling new utility-scale wells can be very costly, especially if it requires additional infrastructure such as treatment plants and water mains. The costs have to be absorbed by the utility, and ultimately the ratepayers. Over time, they will also have to bear the costs of ongoing maintenance and eventual replacement. For many growing communities, the most effective and least costly approach to balance the supply and demand for water is to implement water conservation and efficiency programs. With proper implementation of water conservation and

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efficiency programs, it may be possible for growing communities to increase their population and support new businesses without increasing their need for new water sources.

*** Photo of 2 water towers side by side ***

In CMAP's *Water 2050* publication, the agency promoted water conservation as the most cost-effective means of increasing the effective water supply without creating or tapping additional resources I13. This approach is also widely advocated by the Alliance for Water Efficiency and other water resource organizations. In addition to reducing stress on limited aquifers and water resources, water conservation can provide a multitude of economic benefits. Since each of the steps in a water system requires capital investment for infrastructure and uses large amounts of energy to operate, water conservation and efficiency can result in lower energy costs and reduced wear and tear on infrastructure. Reducing water demand through conservation and efficiency can provide additional economic benefits by delaying when new water capacity would be needed and downsizing the size of infrastructure when expansion is necessary. These concepts are illustrated in the cost-benefit analysis diagram (Figure ???) included in the American Water Works Association (AWWA) *Manual of Water Supply Practices (M52)* I14.

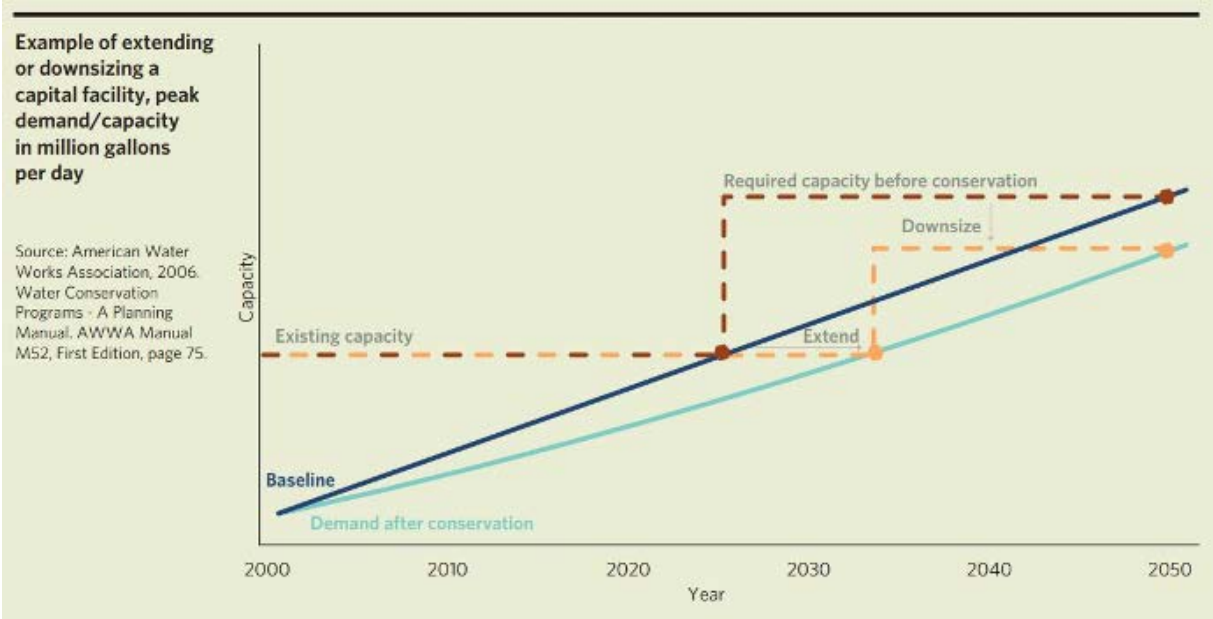

Figure ???: The diagram illustrates economic benefits from water conservation by delaying when capital investment to expand a utility's capacity is needed and reducing the size of infrastructure when expansion becomes necessary.

*** AWE Net Blue sidebar ***

There are many actions available to municipalities to conserve water, use water more efficiently, reduce energy consumption, and save money. These actions may include the following options:

Water Loss Prevention: *Municipal water utilities, private water utilities, and facilities with non-community public wells in McHenry County should implement water loss prevention to eliminate waste, protect water supplies and save money.*

All water systems experience some level of water loss. Water that is used by known customers is referred to as "authorized consumption" and may consist of billed authorized consumption or unbilled authorized consumption. Water that is produced but not accounted for as authorized consumption represent water losses. Water losses in utilities may include the physical release of water from pressurized pipes as leakage, commonly referred to as "real losses". Losses can also occur due to inaccurate metering of customers' water usage, theft of service, or the utility's own billing and accounting practices. These are collectively known as "apparent losses". A water loss control program can help a utility identify authorized consumption as well as their real and apparent losses. Once a utility identifies the real and apparent losses, it can implement controls to reduce the losses. By reducing the amount of water lost, revenues can be increased and the need for costly upgrades can be reduced or postponed.

The IWA/AWWA Water Balance						
Volume From Own Sources (corrected for known errors)	System Input Volume	Water Exported (corrected for known errors)	Billed Water Exported			Revenue Water
		Water Supplied	Authorized Consumption	Billed Authorized Consumption	Billed Metered Consumption	Revenue Water
					Billed Unmetered Consumption	
				Unbilled Authorized Consumption	Unbilled Metered Consumption	Non-revenue Water
					Unbilled Unmetered Consumption	
			Water Losses	Apparent Losses	Customer Metering Inaccuracies	
					Unauthorized Consumption	
					Systematic Data Handling Errors	
				Real Losses	Leakage on Transmission and Distribution Mains	
Water Imported (corrected for known errors)					Leakage and Overflows at Utility's Storage Tanks	
					Leakage on Service Connections up to the Point of Customer Metering	
NOTE: All data in volume for the period of reference, typically one year.						

Figure ??? AWWA Audit Water Balance Methodology: The water balance tracks – from left to right – how a water utility supplies water volumes from source to customer, and provides a process for the water utility to quantify the amounts of water billed for, unbilled or lost.

A water loss control program consists of three principle steps:

1. Water Audit – A water audit identifies and quantifies the water uses and losses in a water system.
2. Intervention – The intervention process addresses the findings of the water audit by implementing controls to reduce or eliminate the losses.
3. Evaluation – The evaluation step uses performance indicators to determine the success of the chosen intervention actions.

The foundation of a water loss control program is the annual water audit. Water audits provide a way for utilities to inventory all water uses in a facility, evaluate ways to improve efficiency, and identify potential opportunities to improve revenues. The International Water Association (IWA) and American Water Works Association (AWWA) have a reliable water audit methodology that is described in the

AWWA *M36 Manual I28*. The AWWA methodology shows schematically the various components of a utility and compares the volumes of water that are treated and dispersed to the volumes of water consumed by customers and other users. This form of audit will ultimately help identify sources of Revenue Water and Non-Revenue Water. The Non-Revenue Water comprises the volume utilities lose from their water supply infrastructure and the unbilled volumes associated with lost revenue from a portion of the supply that reaches the customer, plus the authorized unbilled usage. The AWWA auditing resources include free water audit software that can be found on the AWWA website at: www.awwa.org/Resources-Tools/water-knowledge/water-loss-control.

The audit is followed by an Intervention phase when water systems take actions to identify specific sources of water loss and implement solutions to correct them. These actions may include:

- Preventive measures such as improved design and construction standards to allow for greater structural integrity; and effective maintenance practices to help ensure the water system operates at optimal performance.
- Installation of accurate meters to record usage, monitor demand, encourage conservation, identify leaks more quickly, and make it possible to charge customers for what is actually used.
- Implementing leakage management to detect, pinpoint and repair leaks; and collecting data that refines and confirms water losses identified during the water audit.
- Pipe repair and replacement after the leaks have been detected and located.

The Evaluation phase is important to track progress and ensure the water loss control program is working efficiently and effectively. Evaluations are intended to answer questions such as:

- Were the goals of the intervention met? If not, why not?
- Where is additional information needed?
- How often should the Audit, Intervention and Evaluation process be repeated?
- Is there another performance indicator that should be considered?
- How did the current year compare to the last Audit, Intervention and Evaluation process?
- How can performance be improved?

Water Metering: *Municipal and private utilities should continue to expand and update water metering programs and consider adding smart meters and advanced metering infrastructure to help improve water conservation and efficiency for both providers and consumers.*

Water meters are devises used to measure the amount of water consumed. Water meters are usually connected to water lines inside homes or buildings. Historically, utility staff would have to manually read the meter by physically entering homes or businesses. Recent upgrades to these systems allowed the meters to be read outside of the homes or buildings. Modern smart meters, or Advanced Metering Infrastructure (AMI) goes even further by using two-way communication between the meter and utility. This allows meters to be read remotely, thereby reducing manpower costs. The smart meters can be powerful tools to improve water conservation and efficiency. The smart meters provide customers with real time data to help track water usage and identify and correct leaks. Smart meters also provide multiple benefits to utilities including leak detection, energy reduction, demand forecasting, enhanced awareness campaigns, promotion of efficient appliances, and performance indicators. When it is time for utilities to upgrade or replace water meters, smart meters and AMI systems should be considered.

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Full Cost Pricing: *Municipalities and private utilities should consider implementing full-cost pricing to ensure adequate funding to maintain the long-term viability of water infrastructure and resources.*

Utilities add value to drinking water through pumping, testing, treatment, storage, and distribution directly to their customers. Each of these services requires capital and operating expenditures. Setting appropriate pricing for these services is necessary to maintain the long-term viability of the drinking water infrastructure and sustainability of the water resources. Revenues generated from water rates are the primary source of funding for drinking water utilities. As such, rates should be set to recover the full cost of operations, maintenance, and capital costs. Rates should also account for resource depletion and environmental costs.

In their publication *Drinking Water 1-2-3*, the Metropolitan Planning Council recommends that each utility and community should consider the following key points throughout the rate-setting process I26:

- Rates must be set at a level that covers all of the costs to finance, produce, treat, store and distribute water to customers as well as provide capital for investment in the water system
- Rates must be fair and equitable
- A water system's revenues should not be used to pay for other municipal services or needs
- Customers should easily understand their water rate
- The rate structure should be easy to administer and be reviewed once a year
- Good rate structures are based on accurate financial information and customer records
- Affordability programs for economically disadvantaged customers need to be established

For more information refer to the *Full-Cost Water Pricing Handbook* that was collaboratively prepared by CMAP, Sea Grant Illinois-Indiana, and the University of Illinois Extension I27.

Conservation Pricing: *Municipalities and private utilities should adopt and implement water rates that promote conservation and efficiency of finite water resources rather than reward over-consumption of potable water.*

Water conservation pricing is the use of rate structures that discourage the inefficient use or waste of water. In the past, utilities would commonly charge block rates where pricing would decrease as consumption increased, thereby potentially incentivizing waste. On the other hand, conservation pricing structures may include seasonal rates with higher per-unit water fees during peak summer months, or increasing block rates where the per-unit price increases as the quantity of water used increases. For instance, the Village of Orland Park established water conservation pricing following an increasing block rate structure based on three levels, with Level 1 being the lowest and Level 3 being the highest I3. Level 1 refers to usage of less than 9,000 gallons, Level 2 from 9,000 gallons to less than 18,000 gallons, and Level 3 includes usage of 18,000 or more gallons. The Village of Algonquin has a flat rate and monthly fees for water and sewer but rates are tripled for usage over 20,000 gallons per month I31.

Seasonal water pricing is often used to target residential outdoor water use during the summer months when water demand is typically at the highest yearly levels. The rates for water are higher during the peak season and lower during the off-peak season to reflect the varying costs of providing water during those time periods. A benefit of seasonal rates is that conservation is encouraged during the peak season when the greatest stress is being placed on aquifers and infrastructure. This may also reduce capital costs if storage capacity does not need to be expanded to handle excessive peak demands.

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Potential disadvantages are that the variable rates are more difficult to administer and there can be increased revenue variability.

Conservation pricing can be most effective when used in conjunction with timely billing based on actual metered usage. When water bills are sent out quarterly, the wide gap in time makes it difficult for the customer to correlate their water use with the bill. On the other hand, monthly billing provides more immediate feedback, making it easier for customers to recognize how their practices can influence water consumption and billing costs. Therefore, such immediate feedback is more likely to influence future behavior, such as water conservation, in customers.

Outdoor Water Use Restrictions: *To minimize waste that commonly occurs from outdoor water use, municipalities should adopt, enforce, and advertise policies to restrict outdoor water use in their communities.*

The average American family uses around 300 gallons of water per day, with about 30 to 70 percent devoted to outdoor uses I8. Nationwide, water used for landscape irrigation totals nearly 9 billion gallons per day I4. Approximately 50 percent of the water used outdoors goes to waste from evaporation, wind, or runoff due to overwatering I5. While the actual water use may vary greatly depending on geographic location and type of vegetation, it is clear that large volumes of water produced by utilities and treated to drinking water standards are used to water lawns and landscaping. During the summer months, many communities experience increased peak demand for water due largely to watering lawns. Since these peak demands can be 1.5 to 4 times the water utilities' average day demands, the utilities are forced to increase capacity I6. This often involves large capital expenditures to build out water infrastructure that can meet peak demands from watering lawns during summer months while having excess capacity the rest of the year. By reducing non-essential water use to lower peak water demands, residents and businesses can help reduce their costs and delay or eliminate the need for utilities to invest in costly expansions.

To minimize excessive use and waste, especially during peak usage periods in the heat of summer, many municipalities institute outdoor water use restrictions that limit water usage to specific days and/or times. For instance, a common practice for municipalities is to allow even numbered addresses to water landscaping on even numbered days and odd numbered addresses to water on odd numbered days. While simple to understand and enforce, this approach can have the unintended consequence of making people think they have to water every other day, thereby motivating people to water more often than they would have without the ordinance. Therefore, this practice should be accompanied by educational outreach with frequent messaging through a variety of mediums to prevent overwatering. Another approach that is recommended by CMAP and could reduce the potential for overwatering is to allow landscape irrigation at even numbered addresses only on Wednesdays or Saturdays. Odd numbered addresses would only be allowed to irrigate on Thursdays or Sundays I3.

The best time of day to water lawns and landscaping is in the early morning or early evening when wind and heat are usually at their lowest and the majority of water can be taken up by the vegetation. During the heat of the day much of the water evaporates and may not be available for plants. Additionally, watering at night is not suggested because lawns and vegetation may remain wet for long periods of time making them vulnerable to disease. To avoid wasting water, municipalities may restrict the time of landscape watering to early morning and evening hours such as 6 a.m. to 9 a.m. and 6 p.m. and 9 p.m. with no watering between 9 p.m. and 6 a.m. Because establishing sod or other vegetation may require special care, including additional watering over established plants, municipalities implementing these

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restrictions should provide residents and businesses the ability to obtain permits or variances to the restrictions.

*** Sidebar with NWPA Recommended Lawn Watering Ordinance or Village's regulations ***

**** Photo of Algonquin water conservation sign with Water Tower in background ***

Promote Landscaping with Native Plants: *The County, municipalities, park districts, institutions, and organizations should promote the use of native vegetation for landscaping and as an alternative to turfgrass to reduce water consumption for watering conventional vegetation that is not adapted to local climate.*

Vegetation native to McHenry County evolved to survive our local conditions and, therefore, is best adapted to local climate, soils, and weather patterns. Many of the native plant species have deep root systems that enable them draw moisture from a larger portion of the soil profile and withstand drought conditions. These adaptations mean that native vegetation does not need additional watering once they are properly established. On the other hand, the roots of turfgrass only extend about 1 inch into the soil and require additional watering because they are not adapted to local conditions. Many of the ornamental plants and shrubs used for landscaping have been imported from different climates and also require constant watering to survive.

Since native vegetation does not require additional watering once it is established, municipalities can help implement water conservation by promoting the use of native vegetation for landscaping in their communities. Native vegetation can be particularly useful for improving the conservation of water when areas of turfgrass are converted to naturalized plantings, thereby reducing or eliminating the need for irrigation over large areas. In addition to conserving water, the establishment of native plants can aid in reducing flooding because their root systems and surrounding soils are able to absorb larger volumes of rainfall and help promote infiltration into the ground.

When establishing native plant species, it is important to understand the life cycle of the vegetation. Because many native plants have deep root systems, their energy is focused on establishing roots below ground during the first year or two. Therefore, the plants may not start to flower and look like an established habitat until the third or fourth growing season. However, once established, the deep root systems allow native plants to access moisture deep in the soil, thriving without additional watering and surviving periods of drought.

Native vegetation can be established by seed or by planting live plugs. Establishing the vegetation by seed is the most cost-effective option, especially for covering large areas. Planting live plugs provides a more immediate visual appeal and is often preferred for areas with high visibility, but is typically more expensive than seed.

Native plantings need to be maintained. The level of effort depends, in part, on how manicured of an appearance is desired. Native plants incorporated into landscaping around a home or business should not require any more maintenance than conventional plantings, and may require less effort since watering is not needed. Maintenance for larger native plantings that have been properly installed may include annual mowing in the spring and at least two or more site visits in the late spring and summer to make sure the presence of invasive species is identified and controlled before they can get established.

*** Photo of native garden at Co Admin Bldg ***

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Promote Rainwater Harvesting/Rain Catchment Systems: *In order to use collected rainwater as a resource and offset the use of treated drinking water for non-potable uses, County and municipal staff should coordinate with the Illinois EPA, the Illinois Department of Public Health, and the County Department of Health to establish clear guidelines that help promote the safe use of rainwater as a source of non-potable water in McHenry County, which can offset the use of treated drinking water.*

Rainwater harvesting or rain catchment systems refer to collecting rainwater from an impervious surface and storing it for later use. This typically involves directing rainwater from a roof into a storage vessel, otherwise referred to as a rain catchment system. Rainwater collection systems can be as simple as a rain barrel under a downspout or as complex as underground cisterns. Both systems are made from impervious vessels capable of holding water and have screening or other protection to prevent mosquitoes and debris from clogging and accumulating in the vessel. Rain barrels are typically small enough to fit under the downspout of a residential home and are intended to capture runoff from a portion of the homes roof. Cisterns are larger storage tanks that can be above ground or below ground and can be designed for use on homes or buildings to capture and store greater volumes of water than rain barrels.

*** Provide images of rainwater catchment systems. gather on-line or community garden photo ***

The collected rainwater is most commonly used for landscaping or indoor non-potable use. The use of harvested rainwater can reduce the amount of groundwater that needs to be pumped from aquifers and treated in municipal plants. Rain barrels and cisterns help homes and buildings be more self-sufficient and promotes an appreciation for water conservation. After the rain catchment system is designed and installed, the water is a free resource and can help to lower the building's water costs. Harvesting rainwater may also reduce the volume of runoff that needs to be managed as stormwater. Therefore, rainwater that had historically been considered a problem is an asset when it is harvested for productive uses.

Wastewater Re-Use: *County and municipal staff should coordinate with the Illinois EPA, the Illinois Department of Public Health, and the County Department of Health to establish clear guidelines that help promote the safe reuse of wastewater as a source of non-potable water in McHenry County, which can offset the use of treated drinking water.*

Wastewater reuse generally refers to the use of treated municipal wastewater as a source of non-potable water for beneficial purposes rather than discharging it as waste into a sanitary sewer system. The wastewater consists of water that was pumped from groundwater aquifers, treated to drinking water standards and pumped around the municipality, used by people and then pumped to wastewater treatment plants where the wastewater is treated, cleaned and filtered. At the end of all this investment, the treated wastewater has traditionally been discharged as a waste product into streams and rivers. With wastewater reuse, some of the treated wastewater is diverted and once again put to practical use. Wastewater reuse follows the principles of a circular economy by valuing the treated wastewater as an asset rather than a liability.

Wastewater reuse is often used synonymously with the terms wastewater recycling and wastewater reclamation. Some of the primary reasons for reusing wastewater include providing a source to meet increasing demands for water and offsetting water that would otherwise need to be pumped from an aquifer. Wastewater reuse is commonly grouped into the following categories:

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- Urban Reuse – Irrigation for golf courses, commercial property, public parks, school yards, highway medians, and residential landscapes. The water can also be used for fire protection, toilet flushing in commercial and industrial buildings, and commercial car washes.
- Agricultural Reuse – Irrigation of nonfood crops, commercial nurseries, and pastureland. High-quality reclaimed water has also been used to irrigate food crops.
- Landscape and Recreational Impoundments – Ponds, lakes or other ornamental water features.
- Environmental Reuse – Creating artificial wetlands, enhancing natural wetlands, and sustaining stream flows.
- Industrial Reuse – Process or makeup water and cooling tower water.

The U.S. EPA does not have specific regulations or guidance on water reuse. The State of Illinois has regulations that can apply directly and indirectly to water reuse but does not provide clear guidance. In order to effectively promote the safe application of water reuse, County and municipal staff should coordinate with the Illinois EPA, the Illinois Department of Public Health, and the County Department of Health to establish clear guidelines to help promote the safe reuse of water in McHenry County.

Promote Green Building: *The County and municipalities should promote green buildings that protect health, water and the environment by updating codes and ordinances to ensure they are compatible with green building strategies and having staff familiar with green building methods so reviews can be processed efficiently.*

Green buildings are structures built with the goal of being healthy for occupants, environmentally responsible, and resource efficient throughout its life-cycle from site selection to design, construction, operation, maintenance, and deconstruction. Green buildings are designed to reduce the impact of the built environment on human health and the natural environment by:

- Efficiently using energy, water, and other resources
- Protecting occupant health and improving employee productivity
- Reducing waste, pollution and environmental degradation

*** Sidebar of MCC LEED Certified Science Building ***

The efficient use of water resources is a fundamental component of green building. For instance, the Leadership in Energy and Environmental Design (LEED) program developed by the U.S. Green Building Council (USGBC) is the most prominent green building certification program in the country. The LEED program focuses on several categories of health and environmental responsibility including I33:

- Location and Transportation
- Sustainable Sites
- Water Efficiency
- Energy and Atmosphere
- Materials and resources
- Indoor Environmental Quality

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Applicants for LEED certification must meet specific prerequisites in each of the categories. After the prerequisites are met, the applicants are able to pursue points by implementing green building techniques for each category. After the prerequisites and green building techniques have been verified, projects can be awarded LEED Bronze, Silver, Gold, and Platinum based on the total number of points achieved. The water efficiency category includes prerequisites that require projects to use less water, indoors and outdoors, than a comparable building built conventionally. Another prerequisite is that projects must also provide water metering at the building scale. Additional points can be earned for projects that provide water conservation at levels beyond the prerequisite requirements or incorporate non-potable or alternative sources of water as strategies to further reduce the buildings demand for potable water.

*** Provide LEED V4 checklist ***

Because the standards, verification, and certification processes are rigorous, the LEED program can be used to help municipalities promote green building and water conservation or streamline the review process. For instance, the City of Chicago has been a world leader in promoting green building and the City itself has earned LEED Certification from the USGBC under their LEED for Cities program due to the cities commitment to green building and sustainability. One of Chicago's initiatives is the Green Permit Benefit Tier Program that provides expedited review of building permits and possible reductions of permit fees for qualified green building projects. To qualify for the Program, projects must meet the following criteria:

- Commercial projects must earn certification within the *LEED* or *Green Globes* rating systems.
- Residential projects must earn certification under *LEED for Homes* or *Green Globes* rating systems.
- All projects must implement green strategies or green technologies to receive incentives.

Other green building programs include Green Globes, Net Zero Energy Building, WELL Building, the Living Building Challenge, National Green Building Standard and others. These programs may have different areas of focus or approaches. For instance, Net Zero Energy Building is focused on buildings that have 100 percent of their energy needs supplied by on-site renewable energy on a net annual basis. The Living Building Challenge also addresses a range of categories but is focused on "regenerative" design that strives to improve environmental health rather just reducing impacts. Builders will usually pursue these third-party certification programs in order to demonstrate they have met green building standards and to be able to market their project as a green building. This certification can be particularly important on government projects or other public buildings to verify to their constituents that the buildings have been built to be environmentally responsible and are performing as designed. However, most projects that call themselves green buildings will likely incorporate green building elements into the design without going through these third-party certification programs.

*** Sidebar of Kane County LEED Green Communities Grant ***

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RESIDENTIAL, BUSINESS and INDUSTRY

Residents, businesses and industries should regularly practice water conservation and efficiency inside and outside of their homes and buildings to protect water resources, preserve property values, and save money.

Water use in homes or businesses is prone to high levels of waste or water loss that can be addressed through greater water conservation and efficiency. The average family uses more than 300 gallons of water per day with about 70 percent being used indoors and 30 percent outdoors I8. Leaks in an average household can add up to around 10,000 gallons of water wasted every year I15. The EPA estimates that household leaks in the nation add up to 1 trillion gallons of water wasted every year I15. Common types of leaks found in homes include worn toilet flappers, dripping faucets, and other leaking valves. These types of leaks are often easy to fix with standard tools and hardware. It is more difficult to calculate an average water use for businesses because of the wide variation in water use between different types of industries. For instance, a hotel would likely utilize a large volume of water for its operations while a self-storage facility may not require any water at all. However, the same principles regarding water conservation and efficiency in homes would apply to both homes and businesses. Leaks in homes and businesses that get water from municipal or private utilities not only waste water from the aquifers, but the consumers also waste money by paying for a product they are not deriving any benefit from. Although homes and businesses on private wells may not pay fees to utilities for water being wasted, they are paying by unnecessarily adding wear and tear to their well and septic systems and possibly even their water heaters and water softeners.

The EPA estimates that most homes in America could reduce their water use up to 20 percent by installing water-efficient fixtures and appliances I16. Families could also save an average of approximately $380 dollars per year by installing WaterSense labeled fixtures and ENERGY STAR certified appliances I16. WaterSense and Energy Star are U.S. EPA sponsored certification and labeling programs that work in conjunction with manufacturers to produce products that use water and energy efficiently while maintaining or improving the product's performance. For instance, household toilets have seen increasing efficiency in the past. Prior to 1980, the amount of water the average person used to flush household toilets ranged from 5 to 8 gallons per flush (GPF) resulting in 48 gallons of water being flushed, per person, each day (GPD). Toilets manufactured between 1980 and 1992 used between 2.5 to 3.6 GPF or about 18.8 GPD per person. For toilets made after 1992, water use decreased to 1.6 GPF or 9.1 GPD per person I9. WaterSense toilets use only 1.28 GPF or less, representing another 20 percent reduction below 1992 standards. By switching out a toilet made before 1992 with a WaterSense toilet, an average family could save approximately 16,000 gallons of water per year I14. Installing WaterSense faucets and showerheads could save another 3,500 gallons of water per year over older inefficient fixtures I14.

Bill Christiansen of the Alliance for Water Efficiency conservatively estimated that there were likely at least 44,000 inefficient old toilets that could be replaced in McHenry County I11. If families replaced those inefficient toilets with high efficiency WaterSense toilets, approximately 704,000,000 gallons of water could be saved per year. This would also reduce the amount of water that would need to be processed by wastewater treatment plants; save communities on energy costs from not having to produce, treat, transport and clean as much water; and minimize strain on infrastructure by reducing peak demand.

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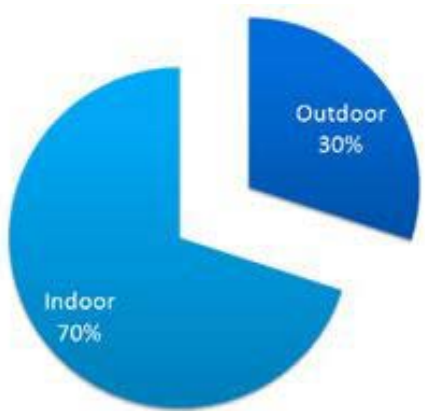
Outdoor VS. Indoor Water Use



Source: City of Madison Wisconsin from EPA data

Figure ???: Breakdown of average indoor and outdoor water usage for single-family residences.

Indoor Water Use

Source: Water Research Foundation, Residential End Uses of Water, Version 2. 2016

Figure ???: Breakdown of average water usage for single-family residences.

Since outdoor water use accounts for approximately 30 percent of household water consumption I8, this also provides opportunities to implement water conservation and efficiency. Conservation practices include changes to how people manage lawns, wash vehicles, or clean paved surfaces. Watering individual lawns may not seem significant to some people, but turfgrass makes up approximately 25 percent of land use in urban and suburban landscapes, and is the largest irrigated crop by area in the U.S. I22. Therefore, the amount of land dedicated to lawns and how those lawns are managed can impact water resources. For instance, watering lawns in the morning or late afternoon instead of the middle of the day can lead to less water use because less water is lost to evaporation and it provides better conditions for water to be taken up by plants. Water efficiency practices may include the installation of sensors for irrigation systems that only provide irrigation when soil moisture is low and when lawns really need to be watered. Another option may be to install native plant species that do not require additional watering instead of turfgrass.

There are a large number of actions that can be taken by residents and businesses to practice water conservation and efficiency inside and outside of homes and buildings. These actions include:

Homes and Buildings

Check for Leaks:

- Water Meter – Use the water meter to check for hidden leaks. Read the water meter before and after a two-hour period when no water is being used. If the meter readings are not identical, then there is likely a leak.

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Bathrooms:

- Toilets – Even with the improvements in water efficiency over the years, toilets are still the largest use of water in the house.
- Toilet Leaks – About 20 percent of traditional gravity-flush toilets leak and can waste up to 5 gallons per minute I17. Worn out flappers are the most common cause for leaks. Flappers are relatively inexpensive and should be replaced every 3 to 5 years. Leaking toilets often go unnoticed for years, wasting water, energy and money. To test for a leak, simply place a few drops of food coloring in the toilet's tank and wait a few minutes. If the water in the bowl turns color, then there is a leak that should be corrected immediately.
- High Efficiency Toilets - When replacing outdated, inefficient toilets in buildings or houses , select high efficiency WaterSense rated toilets that use 1.28 gallons per flush (GPF) or less.
- Dual Flush Toilets - Although most commonly used for commercial projects, dual flush toilets are increasingly becoming an option for homes. Dual flush toilets have one setting to dispose of solids and another setting to dispose of liquids only. The amount of water used per flush will vary depending on the model and technology being used. For instance, some models will use 1.6 gallons for a regular flush and 1.1 gallons when only liquids need to be flushed.
- Reduce Volume in Existing Toilets – If replacing a toilet is not an option, the volume used per flush can be reduced by putting a plastic bottle (filled with sand or rocks to weight it down) into the toilet tank. Experiment with different sized bottles to find one that fits in the tank and reduces the maximum volume while still flushing properly. Do not use bricks to reduce volume as these can disintegrate in the toilet tank over time and affect the flush mechanism.
- Toilet Usage - Do not use the toilet as a garbage can or ash tray. Flushing a toilet to dispose of a tissue not only wastes large amounts of water, it also wastes a lot of money.

Sinks and Showers:

- Faucet Leaks – A faucet or showerhead that leaks 60 drips per minute will waste about 7 gallons per day, or 2,777 gallons per year I18. Some leaks in bathrooms are easily identified while others may take more effort to locate. Dry sinks and tubs thoroughly and let sit for an hour. If there is wetness, then there is most likely a leak. Typical causes for leaky faucets include corrosion, mineral deposits on internal parts, or defective gaskets, o-rings, or washers. Most faucets can be repaired by homeowners if they have the right tools and some basic knowledge of plumbing.
- Efficient Showerheads - Consider getting water efficient WaterSense rated showerheads to reduce water use without sacrificing performance. Replacing old showerheads with WaterSense labeled models can reduce an average family's water and electricity costs by $70 and save more than 2,700 gallons of water per year I19.
- Shorter Showers – Even with more efficient showerheads, showers use large amounts of water. To cut down on water use, limit showers to 5 minutes or less. Another conservation measure is to turn the shower off after soaping up, then turn the water back on to rinse.

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- Efficient Faucets – An easy and inexpensive option to improve the water efficiency is to install a simple low-flow aerator to the existing faucet. When it is time to purchase new faucets, select an efficient WaterSense labeled model.
- Shut off Faucet – Do not leave water running while brushing teeth or shaving. Turning off the faucet while brushing teeth can save 8 gallons of water per day and while shaving can save 10 gallons per shave I19.
- Collect Bath/Shower Water – Every day a lot of water is wasted while waiting for hot water to reach a faucet or shower. In a large house it is not unusual for 50 feet of pipe to extend from the hot water heater to the most distant fixtures, so it can take a long time to get the hot water. In most homes it is possible to collect at least some of this water in a bucket and use that water for other purposes such as watering plants.

Kitchens:

- Efficient Faucets – An easy and inexpensive option to improve water efficiency is to install a simple low-flow aerator to the existing faucet. Aerators with a swivel are particularly useful for kitchen faucets. When it is time to purchase new faucets, select an efficient WaterSense labeled model.
- Dishwashing – The most efficient way to wash dishes is by using an EnergyStar rated dishwasher that uses less than 5 gallons of water per load. Most of the new efficient dishwashers save even more water because dishware does not need to be pre-rinsed before washing. Only run full loads with any dishwasher. When washing by hand, do not leave the water running to wash or rinse. Fill one sink or a bucket with soapy water to wash the dishes and fill the other sink or tub with fresh water for rinsing. Only use the minimum amount of detergent needed to get dishware clean which will also minimize suds and make it easier to rinse.
- Defrosting Food - Do not defrost frozen foods with running water. Prepare foods in advance by defrosting in the refrigerator overnight.

Laundry:

- Washing Machines - Nearly 22 percent of indoor water use traditionally comes from doing laundry I20. Always run full loads or make sure to adjust settings for smaller loads. When it is time to buy a new washing machine, select a High Efficiency (HE) model. The HE clothes washers are designed to use less water, less energy and less detergent than older traditional models. For instance, front loading HE models can use as little as 7 gallons for a full load, while newer top loaders typically use under 30 gallons per load, and older top loaders can use around 40 gallons of water per load I21. HE washers are available as front loaders that use the least amount of water or as top loaders similar to older conventional models but without a central agitator.

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Outdoor Water Use

Lawns:

- Minimize Lawn Watering – Only water lawns when they need it. Most lawns only need 1 inch of water per week. A general rule of thumb to see if a lawn needs water is to step on the grass. If the grass springs back after stepping away, then the lawn does not need watering, if it lays flat then it is ready for water. Relatively inexpensive moisture sensors are also available for more accurate readings.

  During dry spells, all watering can stop and allow the lawn to go brown and dormant. This may result in a brown colored lawn during summer but will save a tremendous amount of water during periods of water deficit. When cooler temperatures and moisture return, the lawn will emerge from dormancy and regain its normal vigor.

- Let the Grass Grow – Letting the grass grow to 3" will help promote water retention.

- Lawn Watering - When watering is needed, it is best to water lawns in the morning (e.g. 6:00 A.M. to 9:00 A.M.) when conditions are cooler. This will prevent the water from evaporating quickly, allow the lawn to take up the moisture, and result in the need for less watering. Watering lawns at night reduces evaporation but allows lawns to remain wet for long periods which can increase lawn disease.

- Grass Species - Convert lawns from Kentucky bluegrass to grass species that require less water. The Northwest Water Planning Alliance (NWPA) suggests Tall Fescue as an alternative cool season grass or Buffalo Grass as an alternative warm season grass I23.

- Native Vegetation – Convert portions of lawns to native plants and incorporate native plant species into landscaping around homes or businesses. Native plants have deep root systems that help them absorb moisture more efficiently from the ground than turfgrass and other non-native plants. Once established, native plants do not require additional watering.

*** Provide sidebar of the NWPA Water Conservation Manual ***

Pools:

- Pool Covers - Outdoor pools should utilize pool covers to reduce evaporation. A typical uncovered pool can lose between 12,000 and 31,000 gallons of pool water to evaporation every year. Using a pool cover can prevent up to 95 percent of pool water evaporation I25.
- Monitor for, identify, and repair any leaks.

Other Outdoor Uses:

- Harvest Rainwater – Reduce groundwater consumption by using rainbarrels or cisterns to capture and hold rainwater for watering landscapes or other outdoor purposes.

- Sweep Instead of Spray – As a general rule, use brooms to clean paved surfaces instead of spraying them down with water. Use a high pressure nozzle when spraying is necessary.

- Washing Vehicles – The most efficient way to wash vehicles is at car wash facilities that recycle their water or use reclaimed wastewater. When washing vehicles by hand, do not leave the water running. Use a bucket for soap water and make sure the hose is equipped with a working spray nozzle that can shut of water between steps. High pressure nozzles can remove grime and soap more efficiently than ones that operate under low pressure.

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Additional Conservation and Efficiency Recommendations for Businesses

Building Operations:

- Meter all water uses separately.
- Regularly check water meters to track potential leaks or excessive use.
- Shut off water to unused areas.
- Install metered or sensor faucets in restrooms.
- Maintain employee education and training.
- Install moisture sensors on irrigation systems.
- Use native plants for landscaping.
- Educate and train staff on businesses water conservation and efficiency programs.

Food Services:

- Only provide water on request.
- Scrape dishes instead of rinsing.
- Install high-pressure, low-volume spray washers.
- Wash full loads only.
- Reuse final rinse water for prewash or garbage disposal.
- Install washers equipped with automatic shut off valves.

Hotels:

- Install meters to measure water consumption targeting areas of greatest use.
- Conduct an audit and develop a water management plan.
- Routinely inspect for leaks of all fixtures/toilets and repair leaks immediately.
- Install efficient, WaterSense rated fixtures/toilets.
- Establish policy limiting washing of linens only upon request and clearly post policy for guests.

Cooling and Heating Systems:

- Install a recirculating system.
- Reuse condensate and blowdown.
- Reuse treated water for makeup water.
- Consider evaporative cooling or hybrid cooling towers.
- Check and replace steam traps regularly.

*** ADD Recommendation and Discussion on AGRICULTURAL WATER CONSERVATION ***

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ENDNOTES

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I12 Maps provided by Dan Abrams of the Illinois State Water Survey (ISWS) depicting areas of the Ironton-Galesville aquifer at risk for water supplies in 2020 and 2050
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USEFUL WEBSITES AND RESOURCES

CMAP Model Water Conservation Ordinance
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CMAP Changing Water Demand: Projecting Water Use in the Chicago Region to 2050
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WaterSense
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