Water Conservation in the City of Ramsey

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City of RAMSEY

Resilient Communities Project
University of Minnesota
Building community-university partnerships for sustainability

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Capstone Project

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Image Source: https://bit.ly/2H7XtgM

Executive Summary:

The city of Ramsey, MN exclusively draws its water from a series of ground wells leaving city leaders worried that as the population of the city grows, the community may exhaust its supply of groundwater. This issue becomes the most apparent during the summer months of June through September when city-wide water use often reaches levels three times greater than the levels seen during the rest of the year. Ramsey also sits on the Anoka Sand Plain meaning the soil drains very quickly and is not very absorbent, adding to the problem during the summer months when homeowners and businesses irrigate their lawns.

In an attempt to raise awareness and curb the growing water demand, the City of Ramsey has implemented a series of actions including an alternating watering schedule, new policies regarding smart irrigation systems for new developments, and a brochure that aims to educate the populace about different water conservation methods.

Here we aim to outline the current water supply system and projected future needs of the city, while also summarizing and detailing the effectiveness of the actions the City of Ramsey has taken along with other peer communities. A summary will be provided of the results of case studies and literature on this topic. We will provide recommendations of effective strategies the city could employ to curb its water demand.

These recommendations include a heightened tiered cost system during the summer which would raise water prices during seasons of high water demand, while also decreasing the billing period during summer months to monthly or bimonthly. Instead of the traditional quarterly system, shortening the billing period would allow residents to easily see how much water they use for lawn irrigation. We also looked at possible education campaigns aimed at raising water conservation awareness while offering day-to-day strategies residents can use.

However, due to a lack of dedicated staff, the feasibility of said campaigns came into question which caused us to focus our next recommendation on resilient landscaping and features such as rain barrels and gardens. Our last recommendation for Ramsey, if the city chooses to pursue it, could act as the financial backing for incentives and rebates towards resilient landscaping. Applying for the *Water Efficiency Grant Program*, run by the Metropolitan Council, would allow Ramsey to implement affordable energy efficient appliances for irrigation and in home utilities. Ramsey would also have the ability to use some of the grant money supplied by the Metropolitan Council to support the other two recommendations if they chose to implement those systems as well.

https://metrocouncil.org/Wastewater-Water/Planning/Water-Supply-Planning.aspx

Introduction:

"The city of Ramsey is a vibrant small town located at the confluence of the Mississippi and Rum Rivers, in southern Anoka County. The scenic environment, proximity to the urban centers of Minneapolis and St. Paul, and location along Highway 10 are contributing to strong growth in population" (City of Ramsey Website). According to Ramsey's water system website, the city uses a series of 8 groundwater wells that were established in 1985 above the Ironton-Galesville aquifer. An illustration of these water wells can be seen below in Figure 1. These

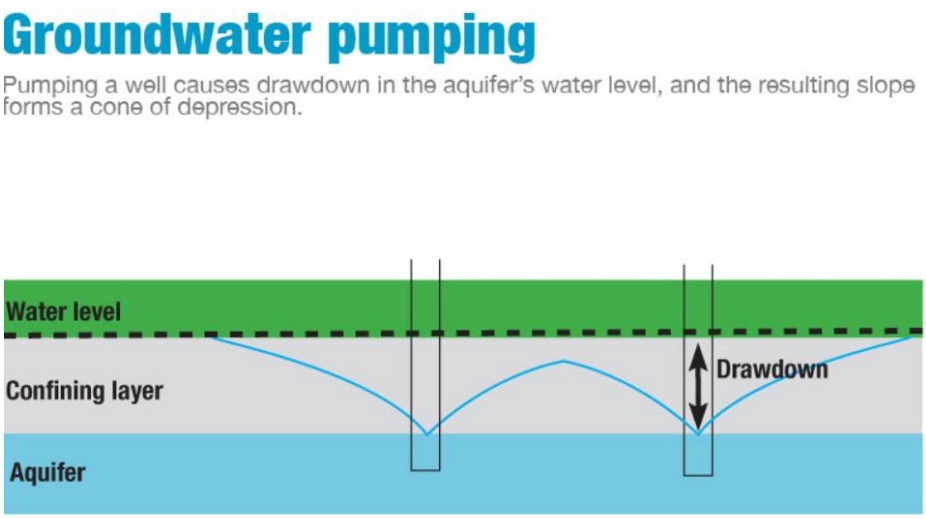


Figure 1: Effect of Ground Water Pumping

wells supply the entire city's water demand — averaging around 1.75 million gallons per day. However, during the summer months and on dry days the city's water demand can exceed 5 million gallons a day largely due to lawn watering and irrigation.

Groundwater is not a limitless resource and the recent growth of population in Ramsey has put pressure on the city to look for ways to conserve water and reduce demand—particularly during the summer months when factors such as dry sandy soil cause an up-tick in lawn irrigation. City officials worry that if the population continues to grow as predicted, the city's

supply of water is in danger of depletion threatening the town's residential and economic prosperity. Ramsey has already asked its residents to conserve water, while also exploring possibilities such as pulling water from the Mississippi. However, due to infrastructure and economic limitations, the city has switched their focus to more feasible courses of actions such as implementing policies requiring new developments to use smart irrigation systems. Recognizing that many existing homes aren't fit to install smart irrigation systems, another effort being pursued by the city is the re-evaluation of the current educational campaigns aimed at reducing water demand. This report aims to highlight potential opportunities for Ramsey's current water system while taking into account successful case studies from peer communities that provide the necessary information to make realistic recommendations for Ramsey. Ramsey can employ these recommendations to reduce the demand for water, and to conserve water now and in the future. The report will be organized according to the objectives of the project which are summarized as follows:

1. Current Water System and Future Needs
2. Current Conservation Actions in the Ramsey
3. Best Practices From Peer Communities
4. Recommendations for a Sustainable Future

One of the most intensive and consuming uses of water currently in the city of Ramsey is the use of potable water for lawns. At about 5 million gallons of water used each day, and with the growth of the city's population, the amount of groundwater left for the future City of Ramsey is becoming more limited. The city has already implemented lawn watering restrictions, which utilize odd/even day watering and limit the time of day of when homeowners can water their lawns. This tactic alone cannot relieve the increasing demand and stress on Ramsey's

groundwater supply, placing more importance on the implementation of new practices. The new tactics will be provided in Objective Four and in Conclusions and Recommendations—which will cover the possibility of revising the water pricing and billing, an increased focus on resilient landscaping, and the pursuit of a water conservation grant.

Project Goals:

The project goals can be broken down into four main categories—describing the City of Ramsey's current and future water needs, an analysis of Ramsey's past and present efforts to conserve groundwater, effectiveness of water conservation initiatives in peer communities, and recommendations for water conservation initiatives in the City of Ramsey. These four categories have an overarching theme of exploring potential actions the City of Ramsey could take in order to reduce current and future water demands. In addition to these goals, proposed projects should aim to create a balance between using surface waters and groundwater when possible.

The first objective of our project will aim to describe the City of Ramsey's current water supply system, and the city's future needs. We are able to describe the city's needs based off of what we have learned through the project, allowing us to determine pivotal aspects of the water system to be re-evaluated.

The second objective of our project will be a compilation and analysis of the different water conservation programs that have been implemented in the City of Ramsey. After analyzing these programs our group was able to determine what has worked and what hasn't worked—which is crucial in determining effective future programs the City of Ramsey can implement.

The third objective of our project will be a summary of effective practices peer communities have taken in order to reduce water demand. Studying other communities' water conservation practices allowed us to gain a better understanding of what has worked locally and potential courses of action the City of Ramsey could take.

The fourth and final objective will summarize all the previous objectives while presenting possible sustainable and resilient water supply systems the city could implement in the future. It will also recommend three different initiatives the city could take to achieve their objectives.

In addition to exploring ways to reduce demands for drinkable groundwater, we also looked at natural aspects of the water cycle and how things like soil composition fit into the system. The sandy soil composition of Ramsey and the surrounding areas relates directly to the natural rejuvenation of groundwater and is influenced by factors such as natural weathering, vegetation, nutrition uptake, and water retention.

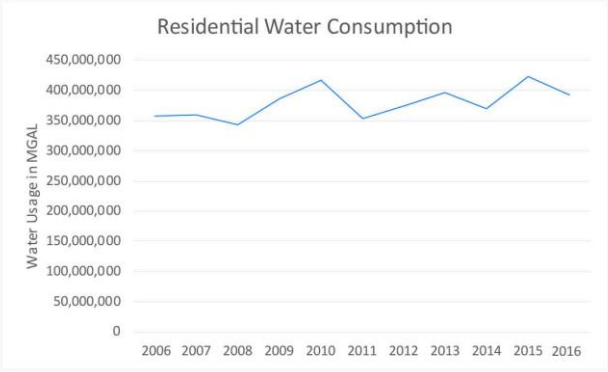
Approach:

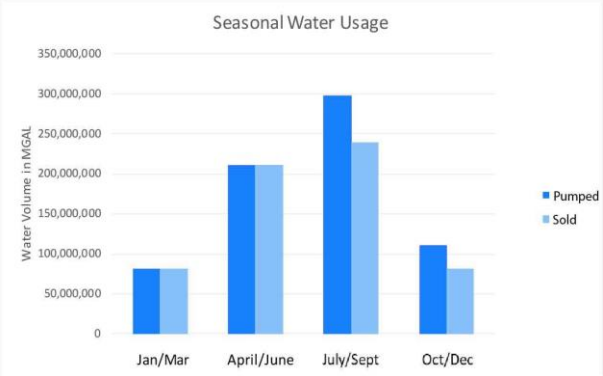
To achieve our goals, data was collected and analyzed from many different sources. We conducted research through online resources in combination with in-person interviews. The interviews and scholarly sources gave us immense insight into the concrete and abstract ideas, experiences, and recommendations for water conservation. Our team was able to gather all the necessary information for the project. We conducted interviews with people who have experience in the field of water conservation and/or the City of Ramsey. The interviewees included Todd Haas, Chris Anderson, John Letourneau, and Ali Elhassan. Todd Haas is a chair member in the Lower Rum River Watershed Management Organization. He currently works on implementing smart irrigation and educating those in the neighboring city of Andover. Chris Anderson is the city planner and environmental coordinator for the City of Ramsey. Ali Elhassan discussed waste water data as well as general water management via a phone interview. Ali Elhassan is the lead manager of Water Supply Planning at Metropolitan Council of the Twin Cities.

We chose our interviewees by recommendation of Bruce Westby. Our interviewees gave us an insider perspective of the current status of Ramsey's water system and allowed us to hear what locals believe could be effective strategies to implement.

Objective One: Current Water System and Future Needs

The groundwater use and demand for residents in Minnesota's Twin Cities metropolitan area, including the City of Ramsey, has been increasing it's consumption of water from natural reservoirs and aquifers during summer—specifically, the Ironton-Galesville aquifer that the City of Ramsey uses. The high levels of water consumption place the area at risk if the current trends do not change. The images below illustrate two important trends in water usage in the City of Ramsey—the first that water consumption is gradually increasing as the city's population grows. The second is that water usage spikes during the summer, particularly during April through September. The trends are in part due to lawn irrigation in residential and commercial





Figures 2 & 3: Water Usage in Ramsey (data from Bruce Westby)

areas—with residential water usage acting as the biggest contributor. It's effective to focus on specific actions Ramsey can take to reduce water use during the summer, as this is the primary stressor on the area's groundwater. Figures 4 and 5 illustrate the use of groundwater versus surface water in the metro area. Though at first glance the average daily water usage seems to be decreasing, the percentage of water that comes from groundwater sources is increasing.

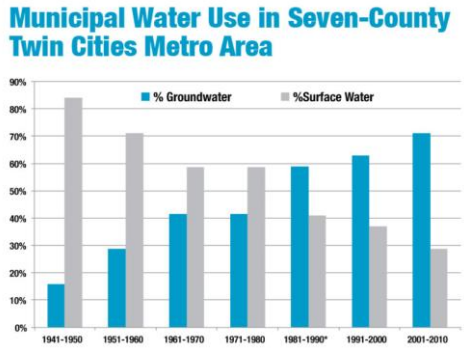


Figure 4: Twin Cities Water Supply Sources 1

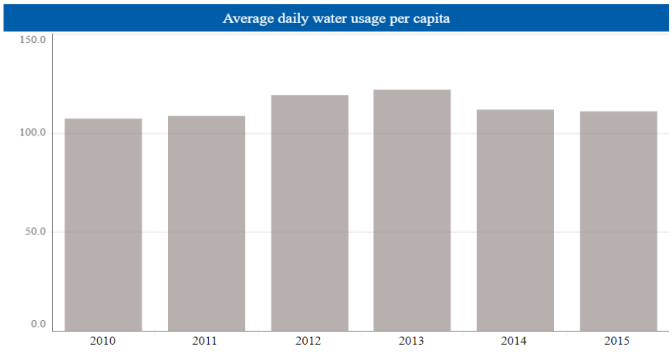


Figure 5: Per Capita Usage

The overuse of groundwater can have dire consequences on both the residential and commercial spheres, while also disrupting the natural ecosystem and water cycle. The Department of Natural Resources (DNR) defines sustainable use of groundwater as "the use of water to provide for the needs of society, now and in the future, without unacceptable social, economic, or environmental consequences" (DNR, 5). This definition closely matches the one found in *the Journal of Water Sustainability* (Ahuja, Satinder) and *Sustainability of Integrated Water Resources Management* (Donoso, C.). The neighboring City of Anoka's progress report found on the DNR's website states that the current demand of water, especially in the summer months of June-August, does not meet the criteria for sustainable groundwater use. The criteria is not met due to water demands exceeding the known rejuvenation rates of the ground aquifers in that time frame. This places the City of Ramsey's current water supply at risk along with endangering the needs of the city in the future. Figure 6, below, depicts the projected population growth of Ramsey and surrounding towns.

[1] Figures 4 & 5 source: https://metrocouncil.org/Wastewater-Water/Planning/Water-Supply-Planning.aspx

ANOKA COUNTY	Population 2010	2020	2030	2040
Andover	30,598	34,000	38,200	41,900
Anoka	17,142	18,700	20,000	21,200
Bethel	466	480	520	550
Blaine (pt)	57,186	66,300	76,700	87,300
Centerville	3,792	3,840	3,930	4,060
Circle Pines	4,918	5,000	5,200	5,300
Columbia Heights	19,496	20,500	21,800	23,100
Columbus	3,914	4,220	4,950	5,500
Coon Rapids	61,476	64,800	68,400	72,100
East Bethel	11,626	12,400	15,400	18,400
Fridley **	27,208	29,300	31,600	32,500
Ham Lake	15,296	16,200	17,700	18,700
Hilltop	744	840	960	1,090
Lexington	2,049	2,100	2,270	2,430
Lino Lakes	20,216	22,800	26,900	31,100
Linwood Township	5,123	5,100	4,930	4,820
Nowthen	4,443	4,590	5,100	5,500
Oak Grove	8,031	8,600	9,500	10,400
Ramsey ***	23,668	26,400	30,700	34,700
St. Francis	7,218	8,200	10,400	12,600
Spring Lake Park (pt)**	6,234	6,510	6,790	7,170
Anoka County Total	**330,844**	**360,880**	**401,950**	**440,420**

Figure 6: Population Forecast[2]

As Figure 6 shows, the projected population of Ramsey is expected to steadily increase. As a result, water usage is also going to increase which means more water will be pulled from ground aquifers; placing an increasing stress on the aquifers, but also on Ramsey's overall prosperity. Often times cones of depressions form around groundwater well sites. This may cause shallow water wells to dry up, forcing either new deeper wells to be drilled, or increased use of existing deep wells. Figure 7, below, illustrates this concept.

[2] Image source: https://metrocouncil.org/Data-and-Maps/Publications-And-Resources/Files-and-reports/Thrive-MSP-2040-Local-Forecasts-(January-2018)-(1).aspx

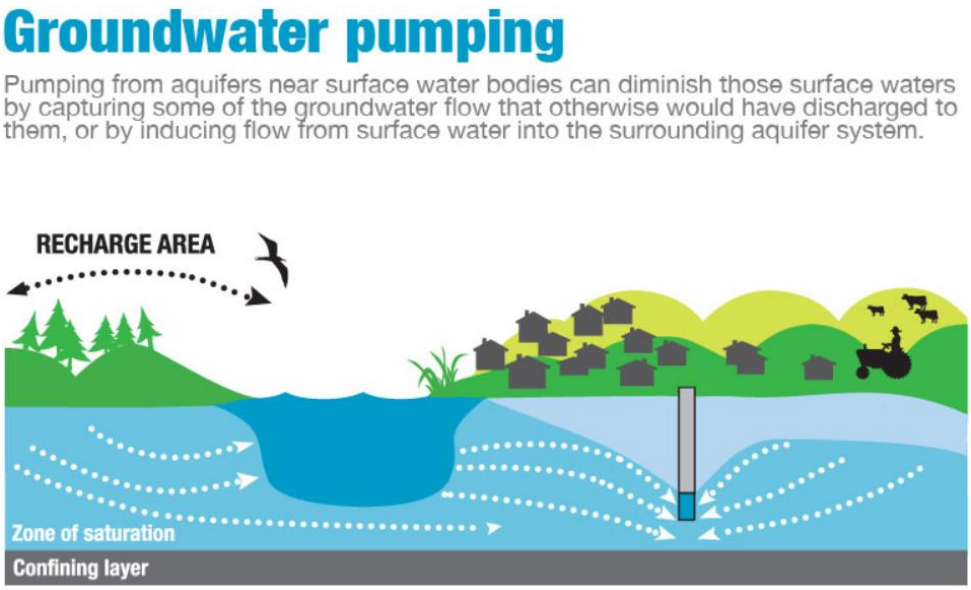


Figure 7: Groundwater pumping

According to Blanco-Canqui, Humberto and the journal *Principles of Soil Conservation and Management,* "Soil is the most fundamental and basic resource because it is the basis of all terrestrial life." Terrestrial life relies on water as a basic resource, demonstrating the relationship between organisms, soil composition, and water conservation. Soil is a necessity and its water retention characteristics differs based on its composition. Ramsey's soil composition is different from other cities in the metro area. The soil in Ramsey is composed of more permeable materials, like sand and silt. According to the *Journal of Soil and Water Conservation*, soil from farmland is more likely to have more soil degradation than non-farming areas. With it's different composition, Ramsey already has soil with lower water retention levels than the surrounding farming communities. If the City of Ramsey does not curb its water usage, the impacts on the local soil may cause their consumption of water to increase further.

The theme of soil composition and its effect on water conservation gives us insight into non-human water conservation activity. The theme gives us background knowledge on how

different soils have different water retention rates; which we can apply to Ramsey and the surrounding area. The theme allows us to narrow down the best practices to curb water loss within the water cycle. The situation Ramsey is going to be dealing with the water usage challenges within the next decade: population growth is a massive contributor. It is important that the City of Ramsey look into more resilient and efficient ways of reducing their water usage. In order for the Ironton-Galesville aquifer to remain usable, we must look at possible sustainable actions Ramsey can take to supply the demand of water for the growing population.

Objective Two: Water Conservation Actions the City has Implemented

The City of Ramsey has produced a few examples of community outreach programs focused on sustainable development. Ramsey currently sends out bulletins in the local paper detailing how to lower the water main settings and being conscious about irrigating lawns. However, Ramsey has found that it has not made much of an impact on water consumption with their current initiatives. The City of Ramsey must give their residents the context for water conservation in their own living space, along with providing actual data from the community, allowing the residents to become aware of their impact and understand their role. Stated in the journal *Potable Water Use and Wastewater Reduction*, "a leaky faucet can waste over 10,000 litres of water a year, a leaky toilet over 40,000 litres." A lot of the nation is not aware of how large of an impact a leaky utility can have; which is exactly why community engagement is an important aspect of a great community. In general people will look over smaller problems and not worry about larger issues, such as their water consumption, outside of how much they have to pay. Once individuals are educated on how big of an impact they could have, it would help shed light on water conservation and show that people's actions actually do matter.

When educating the public, the educator must make sure that they are instructing the community in a way that they can successfully improve, rather than placing the blame on the residents. Educating for improvements allows the residents to absorb the information given without becoming protective of their current routines. Ramsey's community outreach programs could incorporate these concepts further. Though even with an efficient approach, it is nearly impossible to have everyone believe in or to follow through with what they are being told. A study done in the article *Revealing the Determinants of Shower Water End Use Consumption* states, "as a present study shows the potential impact of a low-cost strategy for a water utility

involving limited additional interactions with the participants". This study included phone calls, monitored consumption, and local community engagement events. This led to a more interactive process of proactively engaging with the community, rather than having the citizens come to you.

Another action taken by the City of Ramsey was to partner with the Board of Water and Soil Resources (BWSR). BWSR has, "awarded matching grants of $15,600 to the six metropolitan counties preparing plans". The City of Ramsey used the awarded money to create an official groundwater management plan found on the DNR and BWSR websites in hopes of developing new plans that will get the city off of using groundwater as the primary source of water.

A set of standards put into place by the City of Ramsey enforces an odd/even watering schedule for irrigating lawns from times between 10:00 am till 8:00 pm, which has provided limited results for conserving water in Ramsey. An issue Ramsey faces is enforcement of their policies. People may follow the watering schedule, but with limited enforcement, the odd/even scheduling has not significantly lowered Ramsey's average water usage.

As an effort to help lower water consumption, Ramsey has implemented SMART irrigation systems into newer developments, along with topsoil requirements that contain set percentages of organic material needed in the topsoil. The soil can absorb over double its weight in water with the addition of organic materials. These policies only apply to new developments and therefore do not affect older areas in town. Ramsey does provide information on how to remodel an older building to the same standards as new developments. They also provide several ways of reducing residential irrigation water use; found on the Ramsey

website illustrating efficient ways of irrigating lawns and implementing monitoring systems (City of Ramsey).

As found on the City of Ramsey website, turfgrass educator Sam Bauer, describes different systems that can be used in residential and commercial lawns for reducing water consumption. He includes smaller scale projects that do not cost extra money for customers that deal with watching and predicting the weather to only use water during an extended drought. The systems achieve this by changing the watering schedule to water once a week or less, and by using only an inch of water to water the lawn. There are also examples of water recycling programs, smart irrigation systems/water sensors, and installing a resilient yard. The resilient yard can be specially designed for a specific homeowner's layout. Though these are currently suggestions, an incentive based pricing system for installing these systems has yet to be put in place (City of Ramsey, 277).

Objective Three: Best Practices from Peer Communities

According to *The Journal of Water Sustainability* (JWS, 2) any system that solely relies on groundwater will most likely use up that resource in some amount of time due to the limited nature of groundwater. Therefore, to create a sustainable water system multiple methods of water supply, water recycling, and water planning need to be taken into account and implemented. The journal *Milestones in Water Reuse* details the effectiveness of implementing rainwater recycling programs; such as the use of rain barrels, rain gardens, cost sharing, and wastewater treatment.

Based off past studies on water conservation plans across the country a majority of plans disregard holistic approaches to water systems and its interconnectedness, as stated in *Case Studies in Integrated Water Resources Management: From Local Stewardship to National Vision.* Instead, the majority of plans place their primary focus on water supply development. Water is the essence of life and every living thing/system is dependant on water, so to quantify water as an independent variable is a wrong approach. In *Integrated Water Resources Management* (IWRM) water is integrated in the conservation process along with land and related resources in order to "maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems". To shift the reliance of supply side infrastructure—that traditional water management uses—it is necessary for suppliers to work with communities. It is also necessary for communities to work with their local environment and to understand their situation. Case studies that have implemented IWRM have shown positive results. Especially effective results where seen when the program was implemented in Seattle, Washington. Step one to conserving water is to not use water in the first place, or to use water in a sustainable/sparing way. In Seattle, the soil's capacity to store water

long term is poor. Due to their intense summers the water that melts into the ground from the previous winter—that they depend on—quickly evaporates and creates water shortages. In order to combat this problem, the City of Seattle implemented a holistic plan focused on giving the suppliers a choice in managing the situation scientifically while also aiming to raise awareness commercially. They provided free water saving devices to households and created public incentive programs to encourage the use of resource-efficient technology which helped increase water savings by 14% (Cary). This multifaceted approach illustrates that shared understanding and effective collaboration between the consumers and suppliers can lead to water conservation.

Locally, the City of Shoreview, MN has also taken a multifaceted approach in finding ways to increase groundwater by implementing new programs. These programs include public outreach, incentives, and rebates. Unlike the approach of reducing groundwater usage, Shoreview is finding ways to increase the amount of groundwater available. Like Ramsey, Shoreview relies primarily on groundwater and has implemented steps to increase the available groundwater. Some of the strategies Shoreview has implemented are to reduce the amount of water going into drains by creating plans for water to drain into aquifers instead. Shoreview has created more porous roads that are narrower to allow for more green space and water infiltration (GreenStep). They have also implemented a rainwater storage strategy which shifts the focus from using potable water for practices such as irrigation to more essential needs. Rainwater storage has now become a common practice in Shoreview.

Though landscaping can affect aesthetics, it can be rewarding. Using more native and drought-resistant plants, Shoreview has captured roughly 5-6% more more rainwater, effectively

saving that much groundwater through their selective landscaping strategy.

As important as it is to reduce groundwater usage, it is equally important to track where the water is going and ensuring that it is being used efficiently. Locally, the City of Chanhassen has implemented strategies to reduce groundwater usage through city conservation activities for locals, which engages in the reuse of potable water. Chanhassen's strategy to reduce their groundwater use targeted the primary culprit—lawns. With about 43% of household water used for lawns—not accounting for peak demands during the summer—Chanhassen recognized the situation and implemented their WaterWise program to inform their community about the stresses of water demand (Chanhassen). The WaterWise program primarily focused on how the City of Chanhassen could reduce their water usage within the residential sector by offering rebates to those who managed their lawns in less water intensive landscapes and by informing residents about the benefits of efficient irrigation fixtures. However, the landscaping rebate program proved to be ineffective and was discontinued due to the variety of preferences in lawn aesthetics.[3] A successful strategy implemented by the City of Chanhassen's WaterWise program was the creation of a step-by-step irrigation audit tutorial for homeowners. This portion of their program aided in increasing awareness of the water conservation issue and helped alleviate pressure of city staffing/funds as it worked directly with the residents. With the kickoff of this program Chanhassen has seen a substantial drop in its groundwater usage. However, the program is still in its early stages, and the results cannot be conclusive.

Another case study in which reducing water usage has worked is in Washington county. Washington County's approach to reducing groundwater demands was unique as it focused on

[3] As of the time of this report, the city of Chanshassen website indicates, "the City of Chanhassen offers landscape rebates to residents, organizations, and businesses in Chanhassen who replace a minimum of 200 square feet of irrigated/watered lawn or landscape with a WaterWise landscape."

using existing water systems and recycling existing wastewater. In this case study the county proposed two alternatives, one in which wastewater could be used in potable water and the other where the wastewater would be treated just enough for non-essential uses. In the situation of using wastewater as potable water, the overall benefits would outweigh that of irrigation water. However, upon examination of the costs, it would be extremely expensive for Ramsey to produce. Washington County splits the total capital costs for three cities, and the total cost would add up to 90 million dollars (Met Council Washington). Therefore, the best choice for Washington County was to use contaminated water from 3M's wastewater facility and have it be treated for non-essential applications. Analysis done on the situation estimated that if treated wastewater was used for non-essential uses, the wastewater could potentially save up to 4 million gallons per day of groundwater. The potential amount of saved water is equivalent to a 30% savings in groundwater usage (Met Council Washing County). Though not as expensive as treating the wastewater for essential purposes, such as drinking and cleaning, the estimated costs of treating wastewater for the purpose of lawn irrigation for golf courses would equate to 32 million dollars. Much of the cost proposed in this case study was for treating the wastewater where granulated activated carbon would be primarily used to remove most harmful contaminants from the water. In addition, the county planned on implementing current water systems as bodies to store and transport the treated wastewater. The water would end up in the Mississippi where it would be further treated and then be continually be recycled for other uses. This strategy proposed by Washington County highlights that by recycling what would be wastewater for irrigation purpose, we could potentially save our groundwater for more essential purposes. In addition, treated wastewater could be further treated by the natural filtration systems of the soil and thus add to increasing the overall capacity of the groundwater system.

Objective Four: A Sustainable Future

The City of Ramsey should look to revitalize its existing groundwater systems and implement new systems that promote the welfare and future needs of the city. In order for Ramsey to keep up with the expected growth of population while achieving its goals of reducing water demand, core components of Ramsey's water system will need to change. This report determined that lawn irrigation—particularly residential homes in the summer—was the leading cause of water consumption in Ramsey. Therefore, Ramsey should target the factors that play into why irrigation demand is so high. As previously discussed, the soil composition in Ramsey is suboptimal for the retention of water making residents have to irrigate their lawns more frequently. Additionally, many older homes are equipped with water mains that have multiple water pressure settings. Bruce Westby noted that its likely most of these water mains are not set to their lowest, most efficient setting. Furthermore, most people do not even know these settings exist. The City of Ramsey could incorporate an instructional piece on how to change the settings on a water main into their brochure or website. The instructions would decrease the total amount of water used when residents irrigate their lawns.

Our first recommendation for the City of Ramsey is altering of the current water payment system. Currently Ramsey uses a seven tiered price system, which determines the cost residents pay for water depending on what tier they fall into. The more water used, the higher the tier, the more expensive it gets. This is a common and sound payment system, but knowing that most people only take action when their checkbooks are affected, we encourage Ramsey to change their system to increase water prices during the months of peak water use. Also, we recommend changing the billing period to monthly or bi-monthly during the same months

as the price increase. These changes will both discourage the overuse of water while allowing residents to view how much they are spending on water on a more consistent basis. This will help residents see the direct impact their irrigation habits have on their monthly bills, allowing them enough time to change their habits before the next bill. Under Ramsey's current billing system residents cannot see how much they are spending on water until the end of the summer. As found on the DNR *Demand Reduction Measures*, increasing the price of water during the summer is valid water conservation method: "The cost per gallon increases in the summer to encourage the efficient use of water during peak demand periods—caused by outdoor water use. Seasonal rates can take the form of a surcharge added to the normal rate or a separate fee schedule for winter and summer periods" (DNR, Demand). Additionally, these changes would require minimal costs from the city without the need of establishing partners or potential funders. The impacts would be city-wide as all residents of the city pays bills, creating a large potential for water use reduction. Additionally, the price change could happen in a tiered manner as well. Residents who fall into the lowest tiers of water consumption see minimal price differences, but residents and businesses that fall into higher tiers get charged increasingly steeper rates.

Our next recommendation for the City of Ramsey is to reduce the need for irrigating lawns in the city. We suggest doing this through the promotion of rainwater collection and resilient landscaping. Rainwater collectors can take the form of rain gardens of rain barrels. Rain-barrels are placed at the bottom of downspouts, or independent containers located in areas that see heavy rainfall. Rain gardens and rain barrels both capture rainwater that can later be used to water lawns or gardens. They have minimals upkeep and low initial investments.

In addition to Ramsey's requirements for new developments on smart irrigation and topsoil

requirements, we recommend including a policy that new developments must include rainwater collection—as either rain gardens or rain barrels—that can later be used in place of city water to irrigate their property. With older developments, the city could provide incentives for residents who choose to install either rain gardens or rain barrels. The incentives would encourage participants as the city would see a decrease in water use while residents would see a decrease in the amount of money spent on irrigation. Ramsey could aim to implement rain barrels on a small or large scale. Neighborhoods could implement community-wide rain gardens or rain barrels that could be shared among residents. If Ramsey and their residents wanted to pursue a more aggressive approach they could require the installation of rain barrels or rain gardens for all properties that exceed a certain size or amount of water consumption. This would require a large initial investment by the city if they chose to fund the installation of rain barrels and rain gardens. Otherwise, Ramsey could encourage their residents to fund and create their own rain barrels and rain gardens by offering rebates to go along with the proposed incentives to increase participation. The potential impact of instituting rain barrels and rain gardens could be significant though it depends on the scale at which the rain barrels and rain gardens are implemented. Realistically, it's unlikely for the city to require every resident to install rain barrels or rain gardens, and it's unlikely every resident would choose to install one of these options on their own even if incentives are offered. Therefore, we propose targeting specific neighborhoods with records of high water usage. The benefits from our recommendations are not limited to water conservation alone. Rain gardens can promote natural wildlife and plants while also restoring important nutrients to the soil. The natural water cycle benefits from resilient landscaping as the rain gardens capture water, absorbing it back into the ground, instead of diverting runoff into streets and sewers, polluting local reservoirs.

Our final recommendation is for the City of Ramsey to apply for the *Water Efficiency Grant Program* run by the Metropolitan Council. In 2015 the Metropolitan Council received $500,000 from the Minnesota Clean Water, Land and Legacy Amendment Funds. These funds are awarded on a competitive basis to Twin Cities metro area communities that manage their municipal water systems excellently. Outcomes of obtaining this grant included the replacement of toilets, irrigation controllers, clothes washers, and irrigation system audits as shown below.

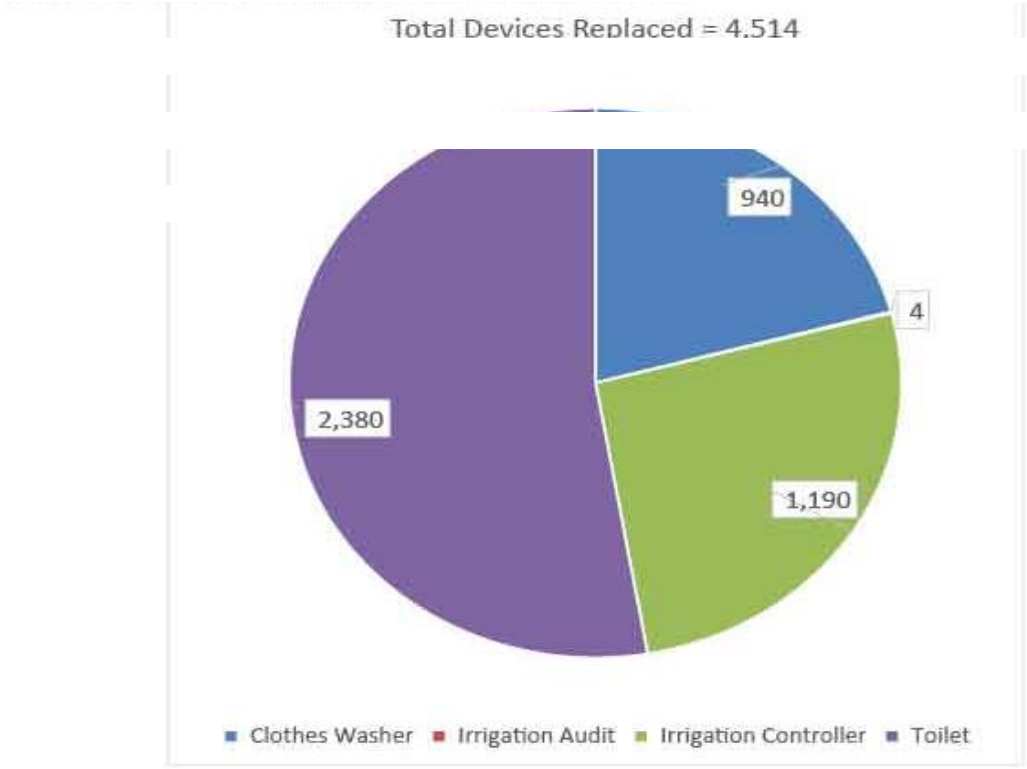


Figure 8: Water Efficiency Grant Summary of Devices Replaced

The Metropolitan Council covers, "75% of the program cost—each participating municipality provides the remaining 25% as a match" (Metro Groundwater).

Total program expenditures for each category of replacements can be found below in Figure 9. Figure 10 illustrates each participating city's expenditures for clothes washers, irrigation audits, irrigation controllers, and toilets.

With most of the cost covered by the grant, Ramsey residents would be able to join the program without having a large budget. By completing these replacements Ramsey would be able to save approximately 52,000,000 gallons of water per year, along with being able to decrease irrigation and water usage at home.

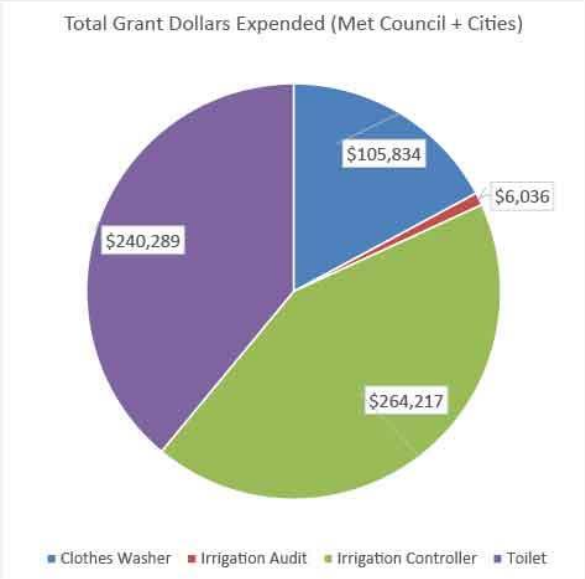


Figure 9: Grant Dollars Expended by Category

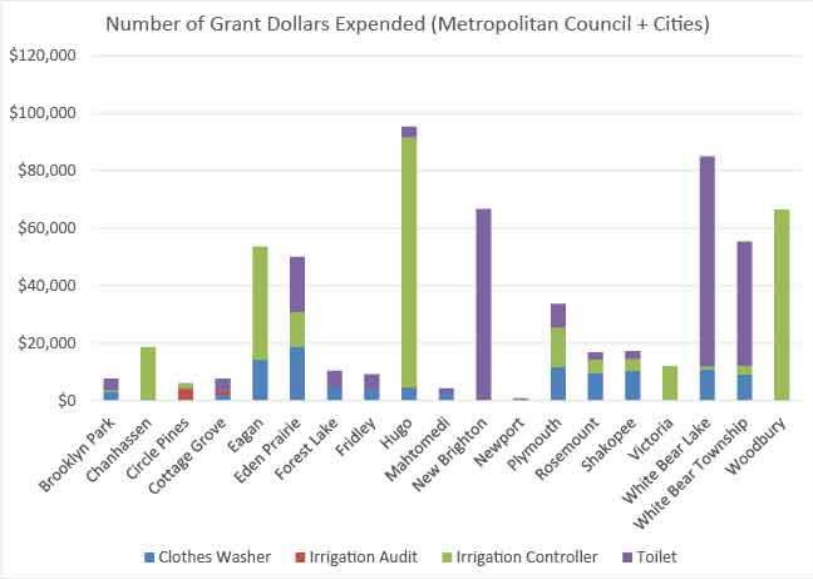


Figure 10: Grant Spending Per City

4

[4] Source for Figures 9 & 10: https://metrocouncil.org/Wastewater-Water/Planning/Water-Supply-Planning/Studies-Projects-Workgroups-(1)/Ongoing-Studies-Projects/Water-Efficiency-Grant-Program.aspx

Conclusions and Recommendations:

Potential tips for saving water are presented in Figure 11. Our group has concluded that the City of Ramsey's current water systems and consumption can benefit from additional conservation measures; especially with the projected growth of the city. To conclude our findings, Ramsey's

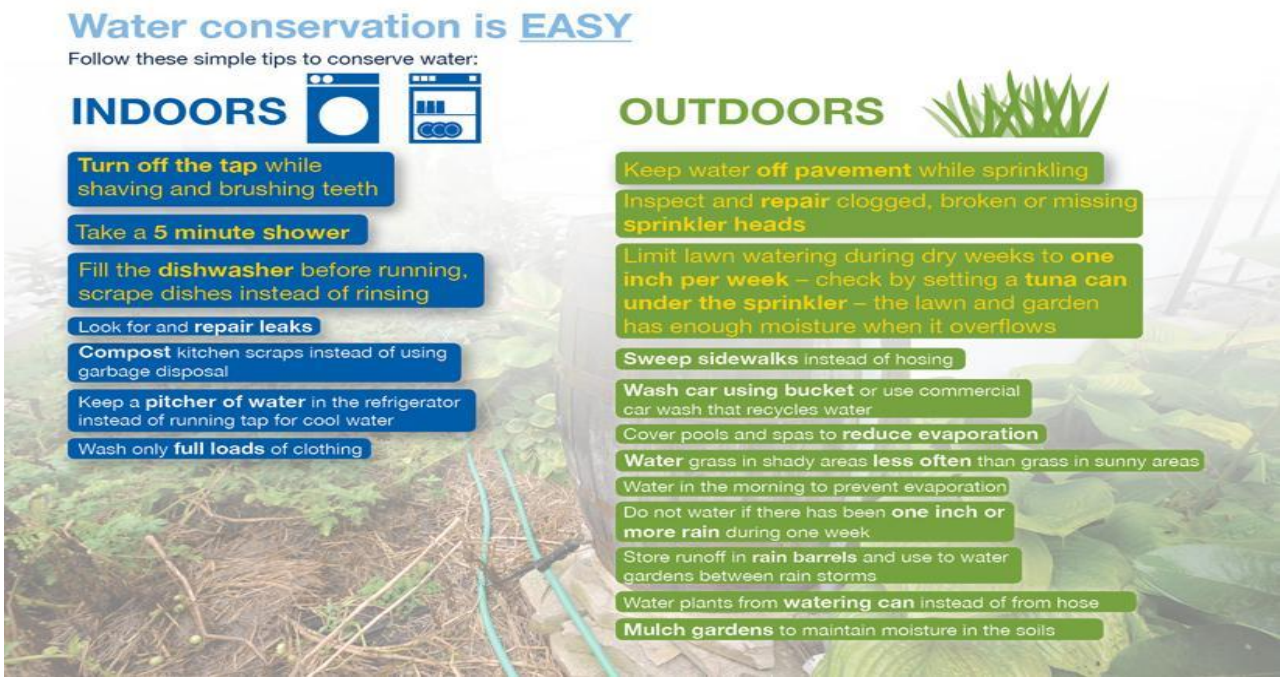


Figure 11: Easy Water Conservation Tips

soil is composed mainly of sand and silt, which has poor water retention properties. In addition, the City of Ramsey relies solely on groundwater wells to supply the town's water demand. Overuse of the groundwater is not sustainable and may pose a danger to Ramsey's water resources in the future. The seasonal variation in water consumption in Ramsey also poses problems, especially during the summer season with the high increase in water consumption. Finally, the City of Ramsey is projected to have a steady population growth and a large amount of their population is homeowners. This established the root of our project and our project's objectives.

Through our research and interviews our group was able to design possible solutions and recommendations to reduce the water usage in the City of Ramsey. These recommendations primarily focused on possible areas that Ramsey can change or implement with relative ease.

The first recommendation is raising the city's water tiered prices during summer months, while breaking down the billing period to a monthly or bi-monthly schedule. The increase in price could increase exponentially depending on what tier the home or business falls into, with higher levels seeing exponentially higher prices. This will discourage flagrant water consumption without penalizing residents who have minimal or responsible water usage. Breaking down the billing period allows residents to see how much they are spending on water during the highest consumption summer months. Lastly, the change in the tiered pricing would allow residents to change their actions as they are confronted by their bills, instead of getting one bill during the fall for the entirety of the summer.

The second recommendation focuses on different types of resilient landscaping Ramsey can implement to reduce the need for residents to irrigate their lawns with city water. In particular, rain gardens and rain barrels can capture rain water which can then be used to irrigate lawns and gardens. We recommend the city either incorporates the use of these options into development policies or provide incentives and rebates for homeowners who choose to install them on their own dime.

Lastly, we recommend Ramsey apply for the *Water Efficiency Grant Program*, run by the Metropolitan Council. The program could provide a wide array of benefits to the city and

its residents while encouraging sustainable programs and actions. The city could then apply portions of the program money to fund other programs, or actions, such as resilient landscaping rebates.

To conclude, the reduction of water consumption in Ramsey holds vital importance to the city. Without a reduction in water usage the City of Ramsey could face future water challenges, especially with Ramsey's projected population growth. The high usage of water also affects the environment surrounding Ramsey as the over consumption of water leads to runoff. Though Ramsey is faced with many challenges in terms of water conservation, we believe our recommendations are pertinent and applicable, and that Ramsey can overcome these challenges.

(Pilera, Recycle Water)

Image Source: https://bit.ly/2JFtkL3

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