City of Madison

Water Utility

Water Conservation and Sustainability Plan

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"When the well's dry, we know the worth of water."
—**Benjamin Franklin**

Water is absolutely critical to successful, growing communities where residents can enjoy a high quality of life. Madison and Dane County are fortunate to have abundant supplies of water that if protected and used in a sustainable manner will last long into the future. Recent news about the water shortages in Atlanta, Georgia and elsewhere in the southeast, continuing concerns about the ability of communities in the southwestern United States to grow when water supplies are scarce, and the uncertainty caused by climate change, drive home the point that communities are not necessarily guaranteed a water supply. With proper management, planning and conservation now, Madison can help ensure clean and abundant water supplies far into the future.

It may seem counterintuitive for a utility that derives its income from selling water to plan for conservation, as more water sold means more income for the utility, on a unit by unit basis. But if the utility has to meet rising customer demand every year, it has to continually increase its pumping and delivery capacity, and it may eventually have to find additional sources of water if its primary source is overwhelmed. Each increase in capacity and supply costs the utility money to develop and operate, and it is actually cheaper for both the utility and its customers to invest in water efficiency rather than increased supply. Additional benefits of water conservation include improved water quality; a reduced burden on surface water quality, as less wastewater is generated; reduced greenhouse gas emissions due to reduced energy spent on water pumping; and increased spring, stream, and river flows, as less of the groundwater that feeds them is withdrawn.

Conservation Goal
Maintain the current annual rate of groundwater pumping, based on an average of five years (2002-2006), while reducing residential per capita water use by 20% below current levels by the year 2020.

BACKGROUND

GROUNDWATER RESOURCES

Below Wisconsin's surface is an estimated 1.2 *quadrillion* (1,200,000,000,000,000) gallons of groundwater which, if above ground, would flood the entire state to 100 feet deep. That fact may beg the question of why water resources are a concern at all in our state (Kassulke & Chern, 2006). A key point to understand initially is that groundwater moves much more slowly than surface water. This fact makes planning for drinking water quantity and quality a challenge. When water is not replaced or recharged at the same rate at which it is pumped out of the ground, shortages can occur. Though we receive about 32 inches of rainfall each year, only 18-30% of that soaks into the ground. The rest either

runs off to the nearest water body or evaporates (UW-ASC, 2007). The amount of infiltration is controlled by a number of factors, including the intensity of each rain event and the soil type, but one of the primary influences in an urban area such as Madison is the ground cover. While natural areas, such as forests and prairies usually have high infiltration rates, urban surfaces, such as roofs and pavement, allow almost no infiltration at all. Thus, maintaining a sustainable infiltration rate in an urban area poses a particularly difficult challenge.

An additional challenge in maintaining quality groundwater for drinking water supply is preventing contamination. Industrial and other potential groundwater contaminants are abundant in urban areas, and keeping them out of the aquifer requires widespread acceptance of water quality protection plans. When groundwater becomes contaminated, it can become unusable as a drinking water source for many years. With over 70% of Wisconsinites using groundwater for their water supply and various industries relying on it for their livelihood, it is imperative that we keep this resource plentiful and free of anthropogenic contaminants (GCC, 2006).

Dane County sits atop two aquifers that are separated by an aquitard (collectively called the Cambrian Eau Claire Formation). The aquitard, a mostly-impermeable shale layer, occurs at around 200 feet below the surface and is up to 60 feet thick in some areas. The upper aquifer is a source of water for many private wells, while the lower aquifer, called the Mount Simon Formation, is the main water source for all Dane County municipalities, and is up to 700 feet thick (Bradbury et al., 2007). The 23 Madison municipal wells range from 500 feet to 1,175 feet deep. Figure 1 below shows a cross-section of the major aquifers in southern Wisconsin. Figure 2 is a profile of Dane County's aquifer formations.

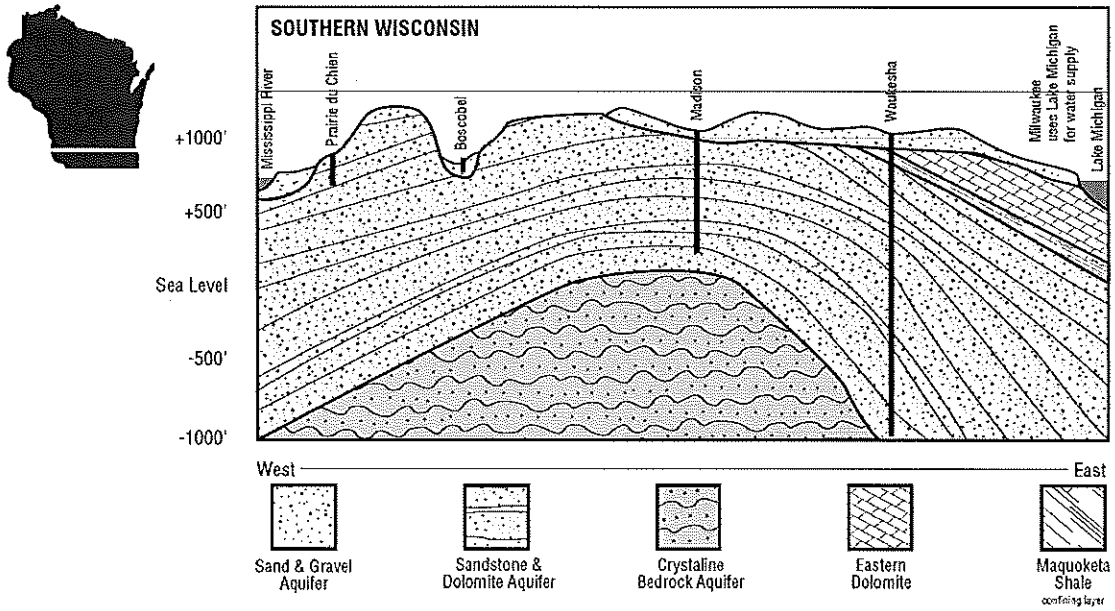

Figure 1: From Wisconsin's Buried Treasure: Groundwater Study Guide (WDNR, 2006)

GROUNDWATER LEVELS

The amount of available groundwater varies by season and region. Water flows slowly underground, its speed varying with the hydraulic conductivity of each type of bedrock material. When traveling through coarse sand, water can reach speeds of up to several feet per day. In very clay-rich areas water may only move inches in a year. Levels of groundwater can vary naturally throughout the year without human intervention. Some snowmelt will infiltrate each spring, allowing groundwater to rise. There is often a drop in levels during the summer months due to plant uptake, decreased rainfall, increased evaporation, and discharge to surface water bodies. When the plants become dormant in the fall, levels often rise again. When the ground is frozen in the winter, with little to no infiltration, the levels usually fall. From year to year, the level varies due to changes in precipitation (Hunt, 2003).

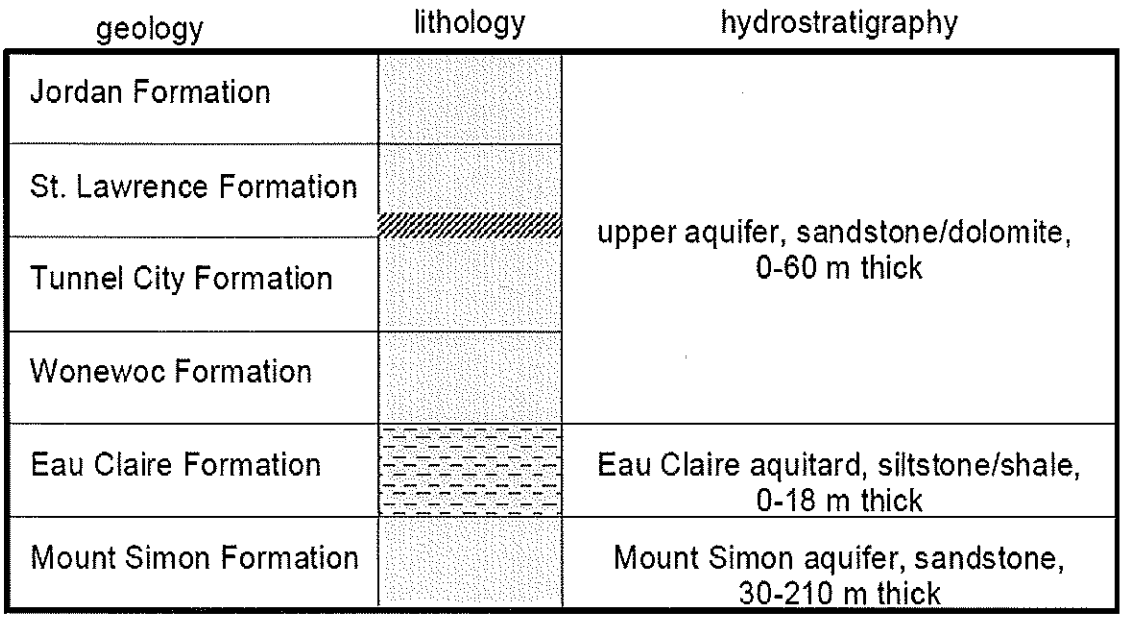

Figure 2: Cambrian stratigraphy of Dane County, Wisconsin (Bradbury et al., 2007)

[1 meter = 3.28 ft]

Human Impact

Madison citizens use, on average, about 73 gallons of water per day (based on the five-year average of 2002 to 2006). To supply these needs, the City of Madison pumps between 20 million and 54 million gallons per day (City of Madison Water Utility Data, 2007). Dane County pumps around 50 million gallons per day (Hunt et al., 2001), while the state pumps over a billion gallons each day to supply the drinking, industrial, commercial, livestock, irrigation, and other needs of its citizens.

With the introduction of high-efficiency toilets, low-flow showerheads, faucet aerators, and other conservation measures, groundwater use per capita has generally stabilized nationwide (Hunt, 2003). However, an increasing population continues to create a demand for groundwater. In some areas around the state, such as the Fox River Valley, southeastern Wisconsin, and Dane County, the groundwater levels have already been significantly drawn down (WGAC , 2006).

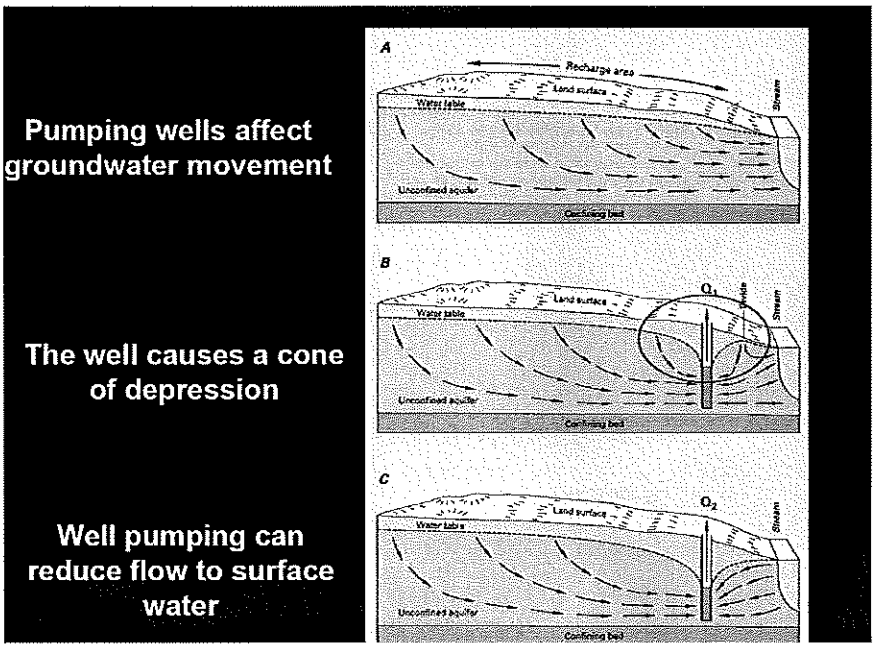

Figure 3: Groundwater Drawdown (from K. Bradbury presentation, September 14, 2006)

In addition to direct pumping of groundwater, humans have also impacted aquifers by decreasing the surface area available for recharge. Land development increases the amount of impervious surfaces, such as roofs and pavement, which causes more runoff and less infiltration of precipitation and snowmelt. In addition to the problems this trend causes for the aquifer, it can also contribute to flooding and surface water pollution, as stormwater carries dirt and oil from parking lots and streets to the nearest water body. In undeveloped areas, a higher percentage of rainwater stays where it lands, sinking into the ground and eventually becoming groundwater (WDNR, 1997).

GROUNDWATER DRAWDOWN

Because groundwater moves slowly, when a well is pumped for a long period of time, a cone of depression in the water table is formed surrounding that well (the water level is lowered significantly adjacent to the well, and less farther away, creating a cone shape). If pumping stops, the cone eventually disappears. When groundwater is pumped at a higher rate than it is recharged, drawdown occurs. When too many wells are placed near one another, their cones of depression merge and drawdown can be severe. Severe drawdown in a deep aquifer may pull water out of shallow aquifers, which in turn can affect springs and surface water bodies as well.

Streams, lakes, and wetlands can all be affected by groundwater drawdown. Some streams rely entirely on groundwater for their baseflow during dry periods, and without enough groundwater input they may run dry, compromising wildlife habitat. Many wetlands rely on groundwater for up to 70% of water input. Groundwater drawdown can greatly impact these sensitive areas (WDNR, 1997). In Dane County, there is a cone of depression of about 30 feet in the deep aquifer (Mount Simon Formation), caused by municipal water use. This drawdown affects the surface water by drawing down the shallow aquifer *at least* 40 feet in localized areas (Bradbury, 2006).

Because of this substantial drawdown, the Wisconsin Groundwater Advisory Committee has warned it could designate Dane County as a Groundwater Management Area. The governor and State Senate and Assembly leaders appointed the members of this committee. Their charge, as directed by 2003 Wisconsin Act 310, is to identify areas with groundwater quantity issues. Two areas of the state were immediately identified as Groundwater Management Areas: the southeast area (all or parts of the Milwaukee, Waukesha, Washington, Ozaukee, Walworth, Kenosha, and Racine counties) and the Lower Fox River Valley (all of Brown and parts of Calumet and Outagamie Counties). These two areas have experienced drawdown of more than 150 feet. Identifying locations as Groundwater Management Areas triggers a requirement to create a regional groundwater management plan with assistance from the Department of Natural Resources. It also gives the DNR more authority over the approval process for high capacity wells (WGAC, 2006).

In its 2006 report, the Groundwater Advisory Committee recommended that Dane County be listed as a Groundwater Attention Area, which is one step below a Groundwater Management Area. An Attention Area is considered a warning that the groundwater conditions are such that a coordinated management plan should be put into place to prevent further drawdown. General managers from Dane County water utilities have been meeting since early 2007 to discuss regional groundwater issues.

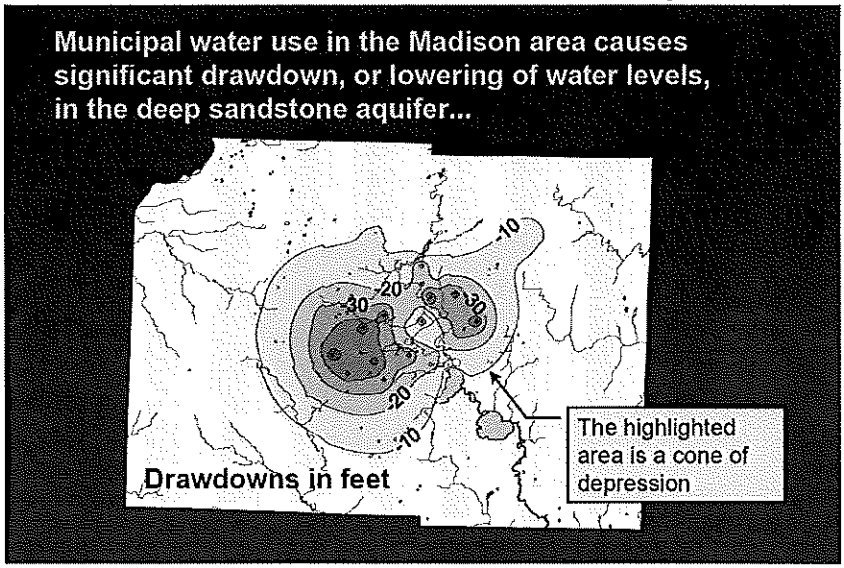

Figure 4: Groundwater Drawdown (from K. Bradbury presentation, September 14, 2006)

One cause of groundwater drawdown in the Dane County area is the fact that the Madison Metropolitan Sewerage District (MMSD) discharges most of its effluent to Badfish Creek, which is outside the originating watershed of the city's drinking water. The groundwater is

pumped from one watershed and discharged into another one. An exception to the MMSD's handling of wastewater is the case of the City of Verona, whose effluent is returned to its originating watershed in Badger Mill Creek. However, the effluent does not necessarily address groundwater recharge.

The drawdown has caused a decrease in baseflow for many of Madison's streams and shallow springs, especially around Starkweather Creek and Lake Wingra. Prior to groundwater pumping, it is believed that groundwater flowed into the Madison area lakes, but in some locations it now appears that this flow has reversed, drawing lake water into the groundwater (WDNR, 1997). Research by Baumann and colleagues (1974) indicated that at least 28 springs in the Lake Wingra watershed have dried up.

Concerns about the drawdown spurred a multi-departmental collaboration in 1992 called the Regional Hydrologic Modeling and Management Program to look more closely at groundwater issues. The group continues to update a regional groundwater-modeling program. The model is able to show current conditions as well as predicted conditions based on various pumping rates (DCRPC, 2004).

Mitigation Projects

Concerns about threats to groundwater quantity have spurred several area mitigation projects. One such project resulted from the construction of the new West Campus Cogeneration Facility on the UW campus. Since spring 2005, the facility has used water from Lake Mendota in its operations. While the amount withdrawn has minimal effects on the lake itself, it could potentially lead to problems downstream in the Yahara River during droughts. To mitigate any adverse effects from pumping, a group of public and governmental entities worked together to create a mitigation plan.

After about 20 site evaluations, the Odana Hills Golf Course was chosen as the best location to infiltrate treated stormwater. Stormwater draining to the Odana Ponds is treated onsite and pumped to an underground infiltration field located in the golf course. The water quality and quantity is monitored extensively before infiltration. Completed in 2006, the Ponds' infiltrated water will eventually feed shallow springs that flow into Lake Wingra, with minimal impacts to the existing pond. While it will take about 30 years for the infiltrated stormwater to reach the springs, an effect is likely to be seen much sooner, due to an increase in head pressure in the upper aquifer. The goal of this project is to infiltrate 80 million gallons per year. (MGE, 2007). See Figure 5 for a map of this project.

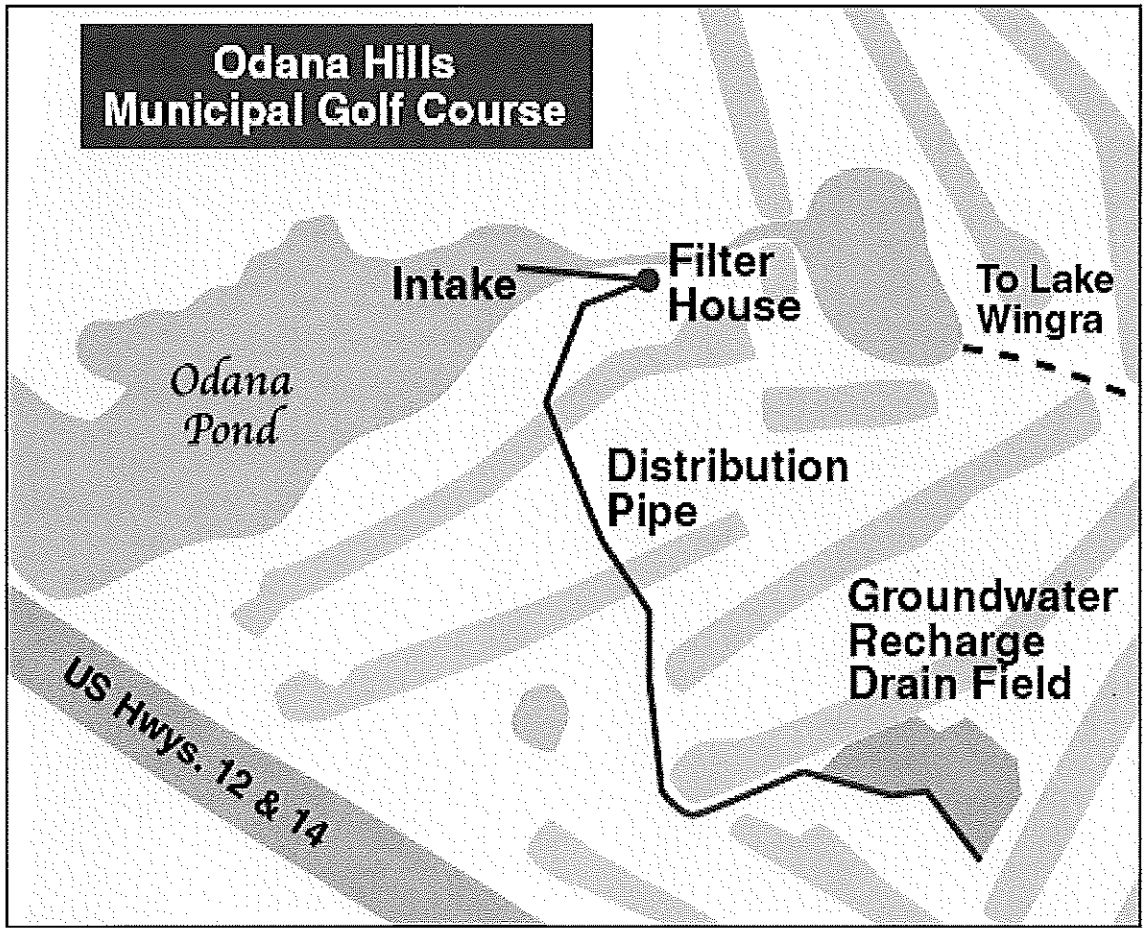

Figure 5: Map of the Odana Hills Golf Course stormwater infiltration project (MGE, 2007)

GROUNDWATER QUALITY

Certain areas around the state are fairly susceptible to groundwater contamination and shortages. For example, areas with bedrock very close to the surface have limited available water and are prone to contamination because percolating water receives only minimal filtration. Other areas have very sandy soils that allow water to flow through faster than it can be filtered and so are prone to problems with contamination from fertilizers and pesticides (WDNR, 1997). In southeastern Wisconsin and the Fox River Valley, increasing levels of radium are encountered due to groundwater drawdown. Some of these areas are now faced with the need for new water sources.

Because groundwater moves slowly relative to surface water, contamination below ground can have an impact for many, many years. Depending on soil conditions, residue from a spill might be detectable for hundreds or even thousands of years. The relatively slow movement of groundwater has significant implications for water quantity as well as quality (Bradbury et al, 1985; Alley et al, 1999).

Wellhead Protection Plans

In 1986, the federal government, through amendments to the federal Safe Drinking Water Act, required statewide wellhead protection programs. In 1993, the EPA approved a state program overseen by the Wisconsin Department of Natural Resources. In turn, the DNR requires a wellhead protection plan for any municipal well constructed after May 1992. There is a second, voluntary state program for wells developed prior to 1992. Wellhead protection is intended to protect public water supply wells from contaminants that could enter the public water supply by managing land use activities in areas that contribute water to the wells. Sixteen of the 34 Dane County municipal water systems have at least one wellhead protection plan in place. Fourteen systems have wellhead protection ordinances. The City of Madison has completed wellhead protection plans for 11 wells thus far and has a wellhead protection ordinance in place.

Madison's General Ordinance 28.107 established Wellhead Protection Districts. Each well district has two zones. Zone A is defined as "the area around the well in which it has been determined that groundwater and potential contaminants will take five (5) years or less to reach the pumping well." Zone B is the area in which it would take contaminants 100 years to reach the well or within 1,200 feet of the well. The Water Utility reviews proposed uses that fall within either of the zones before construction plans can be approved. Existing uses are allowed, but expansion of those uses must be approved. Proposed uses are considered on a case-by-case basis. The City of Madison's General Ordinance Chapter 13.22 Wellhead Protection states the following:

> To prevent contamination of wells supplying municipal water systems, the Water Utility General Manager or his/her designee shall review all proposed uses on zoning lots in Zones A and B in Wellhead Protection Districts.
>
> Review will be based on the presence, use, or storage on the lot of hazardous chemicals, as defined by the Environmental Protection Agency. Consideration will be given to factors including but not limited to the following: whether the zoning lot is in Zone A or Zone B, effective storage or containment of particular hazardous chemicals, and the magnitude and/or frequency of use of the hazardous chemicals. Approval of the use may be contingent on specific conditions being met. A current list of hazardous chemicals, as defined by the Environmental Protection Agency, shall be maintained.

Water Utility staff are currently working on creating a wellhead protection plan for each municipal well in the city by 2010. Changes to the ordinance are currently under consideration that would establish wellhead protection areas around each of the 23 wells, even before the wellhead protection plans are completed.

DRINKING WATER

In 1880, a petition to the Madison Common Council requested that a municipal water service be constructed for its 10,324 citizens. The Madison Water Utility now provides service to more than 62,000 locations in the City of Madison, Town of Madison,

Shorewood Hills, Maple Bluff, Blooming Grove, and Town of Burke. Despite being adjacent to Lakes Mendota and Monona, the City developed its water supply system using deep wells.

Overall, Wisconsin has high quality drinking water, though some areas are more susceptible to well contamination than others. In recent years, complaints of colored water, a result of elevated levels of Manganese (Mn) and Iron (Fe), have shaken public confidence in the safety of Madison's public water supply. While the colored water is not a public health problem, it is considered a water quality problem. The Water Utility has proposed to treat four wells that have had levels of Mn and Fe that exceed the EPA's Secondary Standards for water quality.

Economic and Environmental Costs of Water Use

In 2007 MWU pumped 11.392 billion gallons of water and used 22.287 million kilowatt hours (kWh) of electricity to pump that water. In 2007 it took an average of 1,956 kWh to pump 1 million gallons of water.

	Per Million Gallons of Water Pumped
2007 Electricity Usage	
Average kWh	1,956
Average kWh cost	.088
Electricity cost	$172.10
2007 Chemical Usage	
Average cost of Chlorine	2.17
Average cost of Fluoride	13.51
Total Cost to Pump and Treat	$187.79
CO2 produced @ 2.216 lbs per kWh	4,334.50 lbs
CO2 in tons	2.1673 tons

A Focus on Energy Report from May 2004 provides statewide emissions factors of 2.216 pounds of CO2 produced per kWh. That equates to 4,334.5 pounds of CO2 produced for every million gallons of water pumped. Madison Water Utility is enrolled in the Green Power Tomorrow program with MG&E and is purchasing 2,265,900 kWh of Green Power Tomorrow electricity. This purchase will offset electricity use at an annual cost of $22,659. The annual offset of CO2 will be 5,021,234 pounds.

Conservation benefits attributed to this topic would be that for every 1million gallons of water that the utility avoids pumping, the result would be a savings of $187.79 in 2007 dollars, and the prevention of 4,334.50 pounds of CO2 being put into the air.

WATER CONSERVATION PLAN

This plan has been compiled for the City of Madison Water Utility as a guidance document to **maintain the current annual rate of groundwater pumping**, excepting growth in new areas, provided that the recharge rates in new areas are sustainable. In the City of Madison, annual pumping has remained steady at about 11.3 billion gallons per year for the past 10 years. The introduction of water-saving appliances has assisted in conserving water at every level. The loss of high water demand industries has also contributed to the reduction in the growth of consumption. The University of Wisconsin and Oscar Mayer have also implemented aggressive conservation plans.

In order to maintain the current pumping level, however, certain measures will need to be put in place to further reduce the per capita use. Consequently, a secondary objective is to **reduce the residential per capita water use by 20% by the year 2020.** The current average for residential water use is about 73 gallons per day (5-year average, 2002-2006). In order to meet the 20% goal, each person would need to decrease their daily water use by about 15 gallons, which corresponds to a residential goal of **58 gallons per day**.

Because the Madison Water Utility has different types of customers who use water in very different ways, the conservation steps outlined in this plan are broken into sections corresponding to each of these groups. Included are sections for residential, commercial, industrial, and municipal/government accounts, as well as the University of Wisconsin.

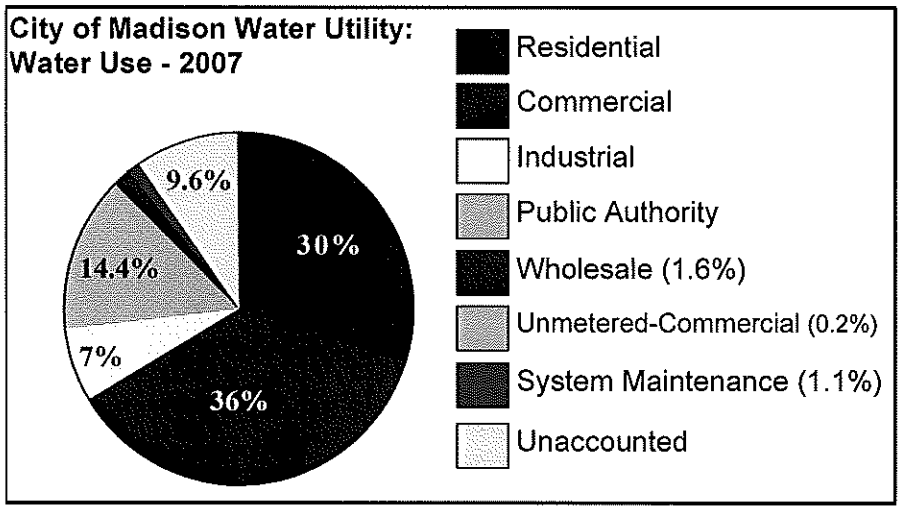

Figure 6: Percent Annual Water Use by Water Utility Customers, 2007

RESIDENTIAL

Goal: To reduce per capita residential use of water by 20% by 2020.

The 55,000 residential accounts in the City of Madison far exceed the number of commercial, industrial and municipal accounts, though representing only 41% of metered sales.

Water Use Statistics

Nationwide, daily **indoor** water use per capita is 69.3 gallons. By installing all high-efficiency fixtures, this daily use drops by about 35% to 45.3 gallons. The breakdown by activity follows:

Table 1: Indoor Water Use (Vickers, 2002)

Use	Gallons Per Capita Per Day– Typical	Gallons Per Capita Per Day-Conservation
Showers	11.6	8.8
Clothes Washers	15.0	10.0
Dishwashers	1.0	0.7
Toilets	18.5	8.2
Baths	1.2	1.2
Leaks	9.5	4.0
Faucets	10.9	10.8
Other Domestic Uses	1.6	1.6
TOTAL	**69.3**	**45.3**

In the City of Madison, the residential average daily use per capita (indoor and outdoor) is about 73 gallons per day. By 2020, the City of Madison is expected to have over 245,000 residents, assuming a growth rate of 1.1%. Reducing per capita residential water use by 20% by 2020 would keep total residential water usage approximately equal to, or perhaps slightly less than current rates. The daily average use would need to be about **58 gallons per person**. This is the foundation for being able to maintain the current annual pumping rates, which is the overall goal. Progress toward this goal shall be measured using a rolling 5-year average in order to minimize fluctuations due to weather variations.

Water Utility staff recently compared average water use of an established, older neighborhood and a new neighborhood to see if higher-efficient appliances/fixtures in the newer homes have an impact on average water use. Data was derived from a cross-section of 1,029 customers in seven different billing routes, some of which were in the older neighborhoods and some in newer. The results, surprisingly, indicated a near-identical water use between the two neighborhoods. It does not appear that the newer homes exhibit any greater water efficiency than the older homes. It is difficult to determine how much water use can be attributed to irrigation in the larger lot sizes (pervious area) because there seems to be a greater correlation with home size

(impervious area), which would no doubt relate to more people in the home consuming water for all household purposes.

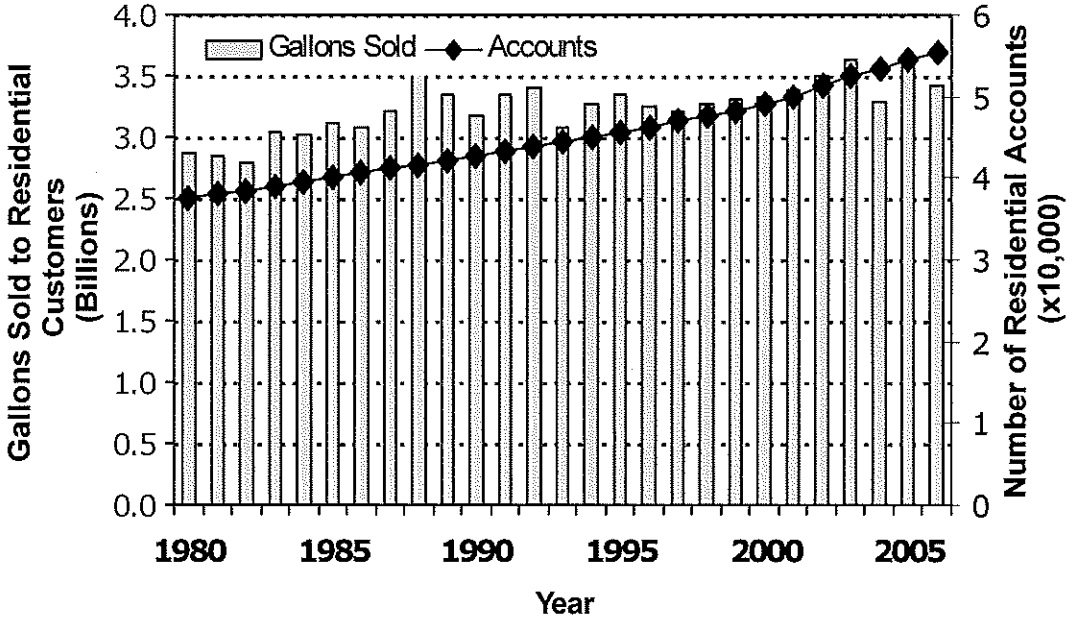

Figure 7: Gallons of water pumped by City of Madison Water Utility and the number of customers served (1980-2006) (data from Madison Water Utility)

Seasonal Water Use

For many residents, water use increases significantly in the summer due to outdoor activities such as car washing, lawn care, and swimming pool use. According to the EPA, lawn care makes up about ⅓ of all outdoor water use nationwide. Also, when using a hose to wash off sidewalks and driveways, about 50 gallons of water is used every 5 minutes.

In some municipalities, ordinances related to outdoor use are put in place to control the increased demand for water in the summer. According to the University of Wisconsin Extension office, an established lawn requires only about 1 inch of water each week, and it is best to water just once per week to encourage vigorous root growth. In addition, watering during the middle of the day causes most of the water to be lost to evaporation before it has a chance to infiltrate. However, many homeowners can be seen watering their lawns nearly every day and often during the hottest time of the day.

While encouraging indoor water conservation will continue to be an important aspect of groundwater sustainability, water-efficient appliances make this a fairly easy step for many homeowners. Outdoor water conservation will likely have the biggest impact from

the residential sector. A recent analysis of one residential billing group showed a 25% increase in summer over winter use.

The Utility has a 6-month billing system, and residents fall into one of six billing cycles. This can make it difficult for the Utility to estimate monthly residential use as well as for homeowners to track their prior use. The amount of water *pumped* is tracked monthly, though this does not necessarily reflect the amount of water that is *sold* each month as the Utility needs to pump more water than it sells. Figure 9 shows the total monthly pumping rates in 2007 for all classes.

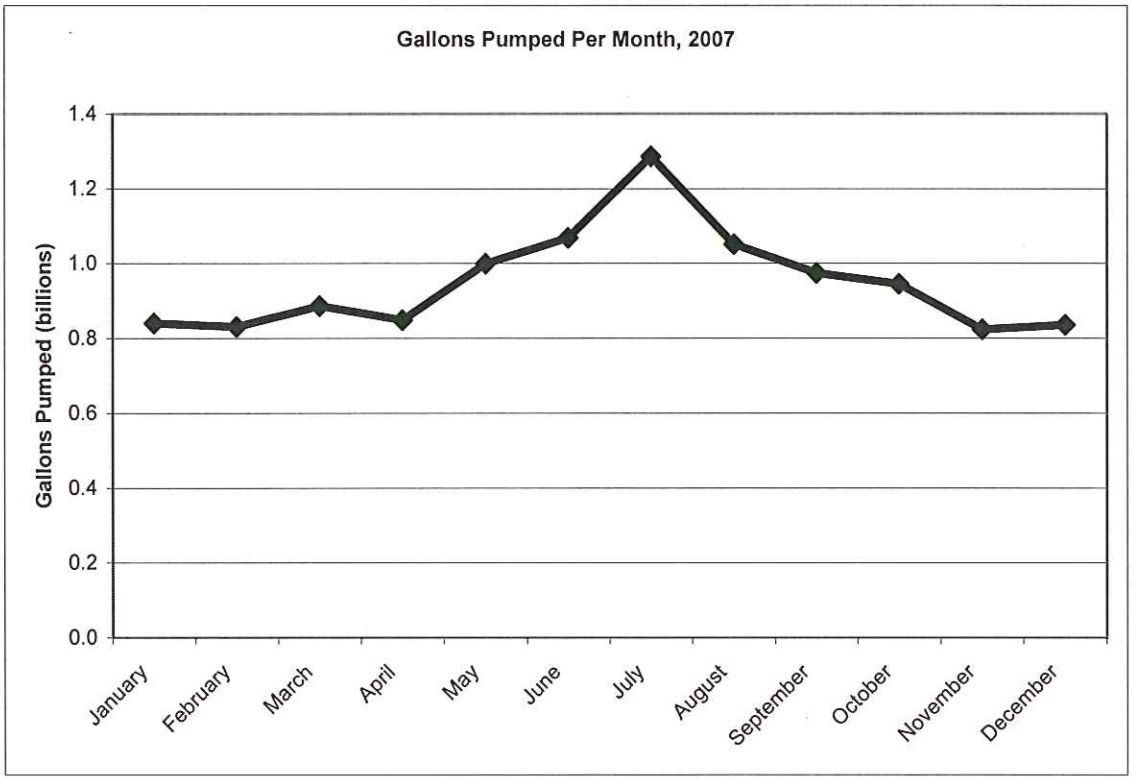

Figure 8: Gallons of water pumped per month by City of Madison Water Utility in 2007

Water Rates

Basic economic principles dictate that higher prices will decrease demand for nearly any good, and water is no exception. Conservation rate structures create a higher rate charge when water use exceeds a predetermined level. Rate structure may also have multiple tiers with increasing rate associated with each subsequent tier. Western Resource Advocates, a non-profit environmental law and policy organization, recently evaluated thirteen Colorado utilities on their water conservation strategies. One component of their analysis was the rate structure. Ten of the thirteen Colorado utilities employed an inclining block rate structure in which a higher per unit charge is imposed when a threshold is exceeded.

Moving to a system of rates that actively promotes conservation needs to be done carefully to minimize impacts on low-income residents while also maintaining an adequate revenue stream. Changes to billing frequency and incorporation of new software need to be addressed, both of which generate additional costs. Despite these added costs, communities across the country are implementing conservation rate structures. Madison Water Utility is committed to doing what is best for customers and the long-term sustainability of our water resources, and so shall analyze the costs and benefits of making such a switch.

Currently, the Water Utility uses a declining block rate structure for all classes of customers. Only the biggest water users benefit from the declining rate structure. The **average residential customer (a 2.5 person household) uses 45 CCF every six months or 184 gallons per day.** The Madison Water Utility should consider a conservation rate structure in its 2009 rate case.

Table 2 provides examples of inclining rates for Ann Arbor, MI, Boulder, CO, Tucson, AZ, and Waukesha, WI. Boulder and Tucson are arid, and water resources have been an historic issue. Waukesha has well contamination problems and is undertaking water conservation strategies to assist the City's interest in tapping Lake Michigan's surface water.

As indicated in Table 2, both Ann Arbor and Tucson have used a low rate price point around 15 CCF (61 gallons/day), which is similar to the City of Madison's 20th percentile ranking (20% of all residential customers use 15 CCF or less). This could be described as "subsistence water use level." Waukesha purports to have a conservation rate structure but has set its second rate step so high that few residential customers would be affected.

The staff of the Wisconsin Public Service Commission have informed the Water Utility that the commission has reservations about a conservation rate structure for communities that bill less frequently than four times per year. The Water Utility has projected in its 2010 and 2011 budget years funding for an automatic reading system (AMR) that would enable the utility to bill on a quarterly or monthly basis. This would then meet the PSC's requirement to implement a conservation rate structure.

With these issues in mind, a sustainable rate structure has been proposed in Table 2 for Madison. Inclining rates were calculated based on four different levels of water use. The lowest water users fall into the 20th percentile of current use rates, "the subsistence level." The next level is what a Madison family would use if the 20% reduction goal were met, "the conserving level." The third level is what the current average Madison family uses, the "median level," and the final level shows the 80th percentile of water use (highest water users).

Table 2 also proposes a rate structure for 2009 for illustrative purposes. (The actual rate structure proposed will be determined based upon the PSC procedures.) The proposed

rate structure would not increase for the lowest level of usage. To address the issue of the semi-annual bill, the Water Utility should point out that the cost differences at the various rate steps are reasonably in accord with the current rate structure and the fact that the City could bill quarterly in five to six years.

Table 2: Examples of Conservation Rate Structures

Muncipality	Billing Cycle	Base Meter Rate - 6 Months	Rate Per CCF (748 Gallons) Rate Steps		Rate/CCF	Semi-Annual Cost for Madison Residential Customer 20th Percentile	Conserving	Median	80th Percentile
Semi-Annual Consumption (CCF)						15	36	45	55
Average Daily Use (Gallons)						61	148	184	225
Ann Arbor, MI	Quarterly	$ 22.50	0.0	14.0	$ 1.07				
			14.0	56.0	$ 2.25	$ 39.73	$ 86.98	$ 107.23	$ 129.73
			56.0	90.0	$ 3.61				
			>90.0		$ 4.95				
Boulder, CO	Quarterly	$ 51.30	0.0	33.7	$ 1.41	$ 72.45			
			33.7	56.2	$ 1.87		$ 103.12	$ 119.95	$ 138.65
			56.2	84.2	$ 3.78				
			84.2	112.3	$ 5.61				
			>112.3		$ 9.35				
Tucson, AZ	Monthly	$ 32.52	0.0	15.0	$ 1.17	$ 50.07			
			15.0	30.0	$ 4.09				
			30.0	45.0	$ 5.78		$ 232.80	$ 284.82	
			>45		$ 8.03				$ 365.12
Waukesha, WI	Quarterly	$ 39.00	0.0	80.2	$ 1.95	$ 68.25	$ 138.45	$ 156.00	$ 175.50
			80.2	107.0	$ 2.20				
			>107		$ 2.70				
Madison, WI	Semi-Annual	$ 25.50	0.0	500.0	$ 1.20	$ 43.50	$ 68.70	$ 79.50	$ 91.50
			>500		$ 0.86				
Madison, WI	Semi-Annual	$ 27.50	0.0	15.0	$ 1.20	$ 45.50			
A Proposed Sustainable Rate			15.0	40.0	$ 1.30		$ 72.72		
Structure for Residential			40.0	55.0	$ 1.32			$ 84.50	$ 97.70
Customers.			>55		$ 1.38				

Toilet rebate program

By federal law, manufacturers may not make a toilet that uses more than 1.6 gallons per flush (residential and commercial). A model that uses 1.6 gallons per flush (GPF) is considered a "low-flow" toilet, whereas a high-efficiency toilet (HET) uses no more than 1.28 GPF. The Water Utility proposes to create a new program that would offer incentives to replace old, inefficient toilets with high-efficiency models, similar to the lead pipe replacement program that the utility offered in past years. Pending Public Service Commission approval, the city would work with local plumbers and retail outlets to offer a rebate for the installation of a high-efficiency toilet. In order to receive the rebates, residents would have to prove that older toilets were actually replaced, and each household would be eligible for a rebate on only one toilet. Final details of the program are yet to be determined.

Residential water audit

Most residents simply do not realize how much water they use at home or what they can do to reduce their consumption. The water utility could offer audits of home water use in which utility employees would analyze all water-using appliances and systems. The homeowners would be informed about cost effective ways to reduce their in-home water consumption. Given the staffing burden this could potentially pose to the utility, there would need to be a charge for the service, but it is anticipated that a rebate might be able to cover the cost of the audit if additional steps are taken as a result of the audit, such as replacing toilets, faucets, washers, etc.

Currently, if a customer has an unusually high water bill, water utility staff will send a letter and set up an in-home audit for leak detection. The Water Utility does about 150 audits each year.

Landscaping

Many non-native plants that are used for landscaping purposes require much more water than native species. Using native plants that are adapted to local climate conditions and can withstand seasonal droughts will be encouraged and promoted by the utility and other city departments.

Several cities across the U.S. have already created landscape ordinances for new development that encourage water efficiency. The City of Santa Cruz (CA) enacted a municipal ordinance to promote water conservation in order to control the peak summer water demand. They require a landscape and irrigation plan for new commercial, multi-family, and single-family lots over ½ acre as well as for current customers who are required to modify their landscape in conjunction with a land use approval process. A city water conservation office approves the plans. Requirements include a separate water

meter for irrigation purposes, a landscape water budget, and an irrigation /landscape design.

Education and outreach

The Water Utility will work with SustainDane to publicize and promote the water conservation kits and rain barrels that they provide. They will also continue to provide support and speakers as requested to schools and community organizations to promote education about the importance of water conservation. During times of high water use (hot, dry periods), the utility will continue to run public service announcements reminding residents of the importance of reducing water use and how to do so.

The Utility and City will actively promote the EPA's WaterSense labeling program for toilets, washers, showerheads and irrigation sprinkler systems and will lead by example by choosing WaterSense labeled products for city facilities.

The Water Utility is also getting involved and making a financial commitment to locally promoting 'Green*Plumbers*'. This is a national accreditation program that educates plumbers on new, water-saving techniques and general water conservation. The program's goal is to reach 40,000 plumbers nationwide.

Bottom Line

The five most important actions residents can take to conserve water are:

1. Fix leaks
2. Replace old toilets (largest water user in the home)
3. Replace clothes washer (second largest water user)
4. Plant the right plants
5. Water only what lawn/gardens need

COMMERCIAL

Goal: Promote water conservation through rebate promotions and education

For billing purposes, commercial accounts refer to businesses as well as multi-family housing (more than 3 units). Conservation strategies for this customer class, including targeted rebates, education, ordinances, and a certification program, are briefly described below. The strategies described represent a suite of options available to the utility for consideration.

Multi-family/commercial property high-efficiency toilet rebate

Apartment property owners/managers could be eligible for a rebate for replacing a 3.5-gallons per flush (GPF) or higher toilets with a new, higher efficiency toilets that use 1.6 GPF or less. Other utilities offer rebates of $25-$250, where the size of the rebate depends on the efficiency of the replacement toilet.

Denver Water offers a $25 rebate for replacement of an older toilet with a qualifying. low-flow unit that uses 1.6 GPF or less. Commercial customers are eligible for a $125 rebate when they replace an older toilet with a high-efficiency model that uses 1 GPF or less. Denver also offers a rebate of $200 per unit for the replacement of urinals with models that use 0.5 GPF or less. Similarly, Marin Municipal Water District (CA) offers a $250 rebate and the Contra Costa Water District (CA) offers a $175 rebate for the replacement of a 3.5-GPF toilet with one rated at 1.28-GPF or less.

Water utilities in the cities of Sioux Falls (SD), Seattle (WA), and Aurora (CO) offer owners of multifamily housing and commercial establishments rebates that range from $50-$100 for the replacement of older, less efficient toilets. Seattle offers a free high-efficiency toilet (rated at 1.28-GPF) or $80 rebate to replace toilets installed before 1994. Some communities such as Boulder, CO, allow unlimited high-efficiency toilet rebates, while others impose a cap. The city of Aurora limits the rebate to $10,000 per property.

There do not appear to be many programs offering rebates for installing high-efficiency toilets in newly constructed buildings, likely because new toilets are all 1.6 GPF or less. Most programs do not provide recycling or disposal of old toilets. The Santa Clara Valley Water District provides a list of toilet recyclers and their fees, for informational purposes.

The high-efficiency toilet rebate program could also include waterless urinals, which use no water and have no flush. They use a liquid-filled trap in the drain of the unit to allow liquids to flow through while blocking sewer odors. The Dedham-Westwood Water District (MA) offers rebates of $100 for installation of waterless urinals in new construction and $200 for the replacement of conventional urinals.

Commercial laundry equipment rebate

Commercial accounts would be eligible for a rebate, based on the number of gallons saved per year over the previous machine. Before implementing this rebate program, the

utility should survey existing laundry facilities to determine the extent to which these establishments are already using water-efficient washers. In addition, the utility would need to establish whether the rebate was dependent on the type of equipment replaced, i.e. coin-operated top/front loading equipment or larger industrial units used by linen/diaper service companies, hospitals, and hotels. Denver (CO) offers a $150 rebate for each domestic-size, coin-operated laundry machine that replaces an older, inefficient one. Commercial accounts in Boulder (CO) are eligible for $100 per machine rebates for qualifying water-efficient washing machines; there are no limits on the number of eligible rebates per account.

The Contra Costa Water District (CA) offers a rebate of up to $220 for the purchase or lease of a high-efficiency commercial washer, coupled with a $130 rebate from Pacific Gas and Electric Company. There is no requirement that the efficient washers replace older models. However, washers must be installed in commercial laundries or multifamily developments. Seattle (WA) offers rebates up to $100 for the purchase of high-efficiency commercial or shared washing machines. The exact amount of the rebate depends on the efficiency of the machine.

Commercial dishwasher rebate

Commercial accounts could be eligible for a dishwasher rebate whose value is based on the number of gallons saved per year over the previous machine. For example, Marin Municipal Water District (CA) offers a rebate of up to $500 for the five-year lease of a water-efficient commercial dishwasher.

Targeted education and outreach to promote water conservation

Specific commercial enterprises that could be targeted for education/outreach include the hospitality industry, nursing home/retirement communities, hospitals/medical centers, carwashes, business parks, laundromats/linen service, and landscaping. Specific educational materials would be provided in conjunction with any rebate or incentive program. Examples of some proposed outreach activities are provided below.

1. Encourage/provide incentives (rebates) for replacement of older, less-efficient washing machines in

    - Hospitality Industry
    - Laundromats
    - Linen/Diaper Service
    - Hospitals
    - Nursing Homes

2. Encourage/provide incentives (rebates) for replacement of 3.5-GPF or higher toilets with high efficiency toilets in all commercial and multi-family buildings.

3. Provide/promote use of "Request linen washing" cards to the hospitality industry.

4. Promote landscaping/xeriscaping with native plants that minimizes need for watering due to their natural suitability to the existing climate. Landscaping companies would be the primary audience; however, owners of all commercial properties including business parks, retirement communities, nursing homes, shopping centers, and medical clinics with extensive green spaces would also be targeted. In addition to promoting native landscaping, information on plant watering requirements, ideal times for watering, and water-conserving irrigation/watering systems will also be provided. Seminars or workshops on native landscaping also would be planned.

5. Recommend water audits or leak detection surveys to reduce water waste from leaky toilets, faucets, and showers in

   - Multi-family housing
   - Hotels/motels
   - Restaurants
   - Shopping centers/malls
   - Office/business parks

6. Provide best management practice information to car washes and provide certification to those car washes implementing water conservation techniques.

Proposed ordinances

New ordinances that should be considered for implementation are as follows

1. *Water sprinkling ordinance*
   Many communities in water-scarce areas such as Southern California and the arid Southwest impose water-sprinkling restrictions that limit the times of day and/or days of the week when watering may occur. In 2006, Waukesha Water Utility imposed restrictions that limiting watering to two days per week. The ordinance also requires that watering takes place before 9 a.m. and after 5 p.m. The decision to impose water restrictions was driven by water quality issues at a number of city wells, specifically radium levels that exceeded federal drinking water guidelines.

   Currently, the Madison Water Utility General Manager has the authority to impose mandatory or voluntary outdoor water use restrictions. This authority is described in Madison General Ordinance 13.04. Although the utility has the authority, it has not been exercised in the past. Previous general managers have preferred education and public service announcements promoting water

conservation rather than imposing mandatory restrictions. It is our goal to implement a sprinkling ordinance by 2010.

2. *Replacement of all 3.5-GPF or higher toilets*
   Similar to the lead service replacement program for residential customers, all multi-family housing units and other commercial customers would be encouraged to replace all 3.5-GPF or higher toilets with a more efficient (1.6-GPF or less) toilet during a ten-year window. The City of Madison Water Utility would share the cost by offering a rebate available once it was shown that a less efficient toilet was actually replaced by a more efficient one.

3. *Landscape ordinance*
   Examples of directives included in a landscape ordinance could include downspouts directed to turf instead of pavement and requiring a 'water-friendly' landscape plan with new or major reconstruction.

   One component of LEED™ (Leadership in Energy and Environmental Design) certification is the use of water efficient landscaping. More communities are starting to require or encourage LEED™ certification, and so water efficiency will naturally become more important in building design.

4. Car wash reclamation ordinance
   New automatic car washes or existing car washes that upgrade/enlarge their service facility must recycle at least 50% of the water used.

5. *Revise credit meter program and costs*
   Currently, residential and commercial users frequently install 'sewer deduct' meters as there is no initial cost to install from the Water Utility. Installation cost charged by plumbers depends upon the complexity of the plumbing. Once installed, the meter base charge is determined by the size of the meter.

Certification program for businesses that are "water efficient"

Working with partners in the business community, the Water Utility would establish a program for certifying businesses that are "water-efficient." Water efficiency could be demonstrated by evaluation of historic water use at a facility, conservation/water efficiency practices/programs implemented, and the results of a water audit for the facility. Partners would collaborate with the Water Utility to establish the standards, a monitoring program, and promotion of the certification program. Alternatively, the business community could develop a certification program independent of the Water Utility, which could serve as a technical advisor to the program.

Water efficiency is already a part of the Wisconsin Department of Tourism's existing "Travel Green Wisconsin" program, which certifies businesses in the restaurant and hospitality industries on a voluntary basis. The standards do not contain many specific

targets, however; they simply ask businesses if they engage in water efficient practices. These standards could be updated with specific targets.

INDUSTRIAL

Goal: To have a water conservation plan in place for each industrial customer

There are 23 industrial customers in the City of Madison, and they account for 10% of the total water use. Although this is a small number of customers, the opportunity for water savings in this area is significant. Water conservation generally falls into three categories: reducing water usage, reducing water loss, and reusing water that is currently being discarded.

Industrial Customer Water Conservation Plan

Step one in preparing an individualized plan is to prepare and gather pertinent information from company and utility records. This information is gathered using a pre-audit checklist, which would include the following:

1. People who are familiar with the industrial customer's daily operations
2. Building and location information, facility floor plans, plumbing schematics and drawings, operating schedules, number of employees, location maps identifying each water supply meter, and all sub-meters
3. Inventory of plumbing fixtures and all water-using equipment
4. Outdoor water use data, utility records that show water and sewer use, and any prior water and energy audits

Step two would be to perform a site audit of each industrial customer. An initial onsite water audit of all water-using equipment and processes would be used to identify water use. This includes a detailed examination of where and how much water enters the system, and where and how much water leaves the system. Water system audits assess current water use, provide data needed to reduce water and revenue losses, and forecast future demand. With this information, system improvements can be identified where conservation efforts are most needed. Follow-up audits would be conducted twice per year to check on each customer's water conservation progress, inform industrial customers of new water conservation practices, answer customer questions, and educate employees. In order for a water conservation program to succeed, it is important that a good record-keeping system be established to monitor operation and maintenance costs, revenues, and water use.

Step three is preparing an audit report. After the completion of the physical inspection of the facility, in which each water-use area is carefully examined, and water-use data is recorded, it is important to develop a final audit report. This report will provide a baseline for water conservation efforts.

Step four is to identify water conservation opportunities and to develop a site-specific water conservation action plan for the industrial customer. Based on the information

gathered, potential opportunities for reducing water usage, reducing water loss, and reusing water are identified. The following systems should be evaluated for efficiency and water conservation opportunities: cooling towers, boilers, flow meters and sub meters, automated controls, landscaping, irrigation, single-pass cooling, gray water, and reverse osmosis or de-ionized water. In some cases, water-using equipment can be replaced. In other cases, retrofitting existing equipment will be appropriate.

Similarly, a review of opportunities for improvements in equipment maintenance and repair should be completed. The following areas should be reviewed: plumbing fixtures, recirculation pumps, leaks, reused or recycled water systems, proper cleaning and sanitation of equipment, instrumentation-pH meters, total dissolved solids measuring devices, monitoring equipment for correct rinsing process, flow valves, flow restrictors, shut-off valves, reducing valves, solenoid timers, and water meters. Procedural changes can often result in substantial water savings. Furthermore, water conservation measures often pay for themselves by reducing energy costs. Once water conservation opportunities have been identified, a water conservation action plan is developed.

Step five is educating employees and involving them in water conservation efforts. Employees can have a major effect on the success of a water conservation program. It is important to educate and train key employees to make conservation efforts the most effective. Employees must be informed about the program and be made an integral part of the water reduction effort. An important part of this process is the formation of a water conservation and energy team within the organization, though the facility's water conservation goals should be shared with all employees. Industrial customers should educate employees about costs for water, sewer and electrical. These costs should be logged periodically. It is important for the industrial customer to stress to employees that even small projects can produce large savings in water consumption and to publicize water conservation successes--internally and externally. The Water Utility would provide educational materials specific to each customer's need, based on the site audit and water conservation plan.

Water Conservation Award

The Water Utility should consider an awards program to reward and honor industrial customers for their water conservation successes. The Water Utility would present a suitable plaque or certificate of achievement to the chosen industrial customers.

Winners could be selected based on the results of their water conservation efforts in the following areas: landscape and irrigation, plumbing fixture retrofits, quality and effectiveness of the water conservation plan, water leak detection, water recycling or reuse, innovative water conservation measures and methods, overall reduction of water use, and implementation of public education and community relations programs.

Funding for Public Water Conservation Education Programs

In order to make the water conservation effort as successful as possible, a public water conservation education program is essential. Industrial customers may be willing to help fund educational materials for water conservation youth programs or retrofits in low-

income homes. They could also work with Focus On Energy to assist customers in attaining available rebates. Rebate information would be published as part of the educational materials in the public water conservation education program.

MUNICIPAL

Goal: Governmental buildings shall enact water saving programs that support the main goal of maintaining sustainable pumping levels

The municipal division comprises the governmental entities of the City of Madison, Dane County, State of Wisconsin, and Federal government. All buildings that are serviced by the City of Madison Water Utility of these government entities will be included in the Water Conservation Program.

City of Madison Water Utility

The most important section of the City of Madison is the Water Utility itself. The enacting of water conservation measures within the Water Utility can serve as a model for other governmental buildings as well as the public at large. Before conservation measures are implemented, an audit shall be performed of all Water Utility buildings, and toilets, showerheads, and sink aerators will be checked for compliance with current water conservation standards for new construction. The amount of water that is dumped from reservoirs into the storm drains will also be investigated. The flushing program implemented to reduce manganese from the water supply will be inspected. The placement of water meters at the wells and other peripheral buildings will be explored for feasibility. All new Water Utility buildings will be built with water conservation measures in mind.

The following are water saving programs that could be instituted at the Water Utility:

Emphasize and expand the leak detection program
Many leaks in the water distribution system go undetected. By purchasing more leak detection equipment and devoting work-hours, we can reduce leaks. Older pipes and those in areas prone to main leaks will be checked on a systematic basis. The El Paso Water Utility has enacted a leak detection program using devices called "loggers" placed on valves that in three years of use have saved 725 million gallons of water (Buehrer, 2008).

Install low-flush toilets, low-flow showerheads, and sink aerators
Following the internal audit, old toilets shall be replaced with high-efficiency models, showerheads changed to low-flow, and aerators placed on sinks without them.

Quantify water use by utility through better record keeping
Increase the amount of data gathered on Water Utility water use activities and centralize data for ease of accessibility and comparability. New data gathered includes amount of water used during hydrant flushing, amount of water lost when reservoirs are dumped, and amount of water lost from a main break. Gather data from the Fire Department about

amount of water used to extinguish a fire. This new data could be compared to the amounts of water that are unaccounted for when compiling the annual audit of water pumped. A new central computer system could be implemented to ease the ability of pulling up data and comparing water use against various variables.

Installation of meters in wells
Water Utility wells currently do not have meters for the water that is used inside a well, i.e., for toilets and sinks. The feasibility of placing meters in the wells will be investigated. By having meters in the wells, the Water Utility can better monitor how much water is being used and if leaks occur.

Hydrant flushing
Historically, the Water Utility has employed conventional flushing twice a year to remove mineral sediment from water mains. Unidirectional flushing was begun in 2005 as a better technique to scour the water mains and remove sediment. The utility will continue to evaluate its flushing program to minimize the amount of water needed to clean the pipes. Ongoing research at the utility is expected to provide guidance on the frequency needed for flushing.

Well operation and maintenance
The operation and maintenance of a municipal well occasionally requires pumping the water to a sanitary or storm water sewer. The Water Utility should maintain better record keeping for how often these events occur and how much water is pumped to waste. Periodic review of this data should identify potential water conserving strategies for well operations and maintenance.

Use of rain barrels/ rain gardens
Rain barrels can be used at all Water Utility buildings to catch rainwater and reuse the water for lawn/flower watering. Rain gardens may be used to reduce runoff where appropriate. In the building of the new Operations Center, the use of rain barrels and rain gardens should be included.

Other Governmental Buildings (City, County, State, and Federal)

Audits will be performed of all other governmental buildings served by the Water Utility. Individuals in charge of the buildings may perform the audits. A questionnaire would be provided to assist individuals in auditing their own buildings, and further information will be provided to explain potential water saving programs. Ordinances and/or other legislation could be put in place to bring governmental buildings under a predetermined "Green" standard. Information about water saving programs will be made available on the Water Utility website.

Water conservation measures may include replacing old toilets, installing sink aerators, and installing rain gardens and rain barrels. The Madison Common Council recently adopted a Green Building Resolution proposed by Alder Satya Rhodes-Conway that will require any new or substantially renovated city-owned building to be certified under the

LEED© standard. This standard ensures new city buildings will be as energy-and water-efficient as possible.

UNIVERSITY OF WISCONSIN

The University started a water conservation program in 2002 (Dave Bonfield, UW Plumbing Shop Supervisor, Personal Communication). The plan included replacing old toilets with high-efficiency models and installing sink aerators and low-flow showerheads, and removing urinal flush tanks. Due to new construction and major remodeling, he estimates that 90% of the toilets on campus are now high-efficiency. While the showerheads have been accepted by users, the sink aerators were not very popular, and so some may have been altered. Since the inception of the water conservation program, daily water use has decreased by about 30%.

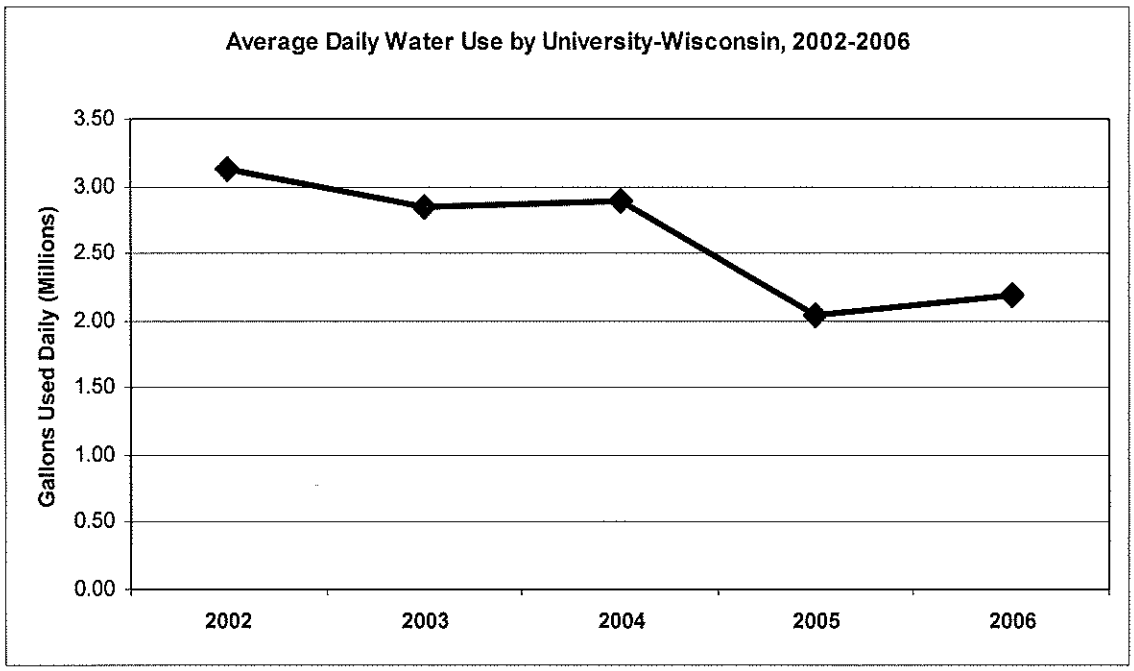

Figure 9: Average Daily Water Use at UW; data does not include dorms on Johnson Street or buildings south of University Ave or East of Randall Ave.

SUMMARY OF EDUCATIONAL COMPONENTS

RESIDENTIAL

- The promotion of the (future) **toilet-rebate program** will be an important educational opportunity for water conservation
- **Rain barrels** may be installed at some MWU facilities for demonstration purposes to allow the public to see their operational features. **Rain gardens** may

be used to reduce runoff where appropriate. MWU will incorporate the use of rain barrels and rain gardens in the renovation of the Operations Center Vehicle Maintenance Facility

- The Water Utility will continue to **provide support and speakers**, as requested, to schools and community organizations to promote education about the importance of water conservation.
- During times of high water use (hot, dry periods), the utility will continue to run **public service announcements** reminding residents of the importance of reducing water use and how to do so.
- The Utility and City will actively **promote the EPA's WaterSense** labeling program for toilets, washers, showerheads and irrigation sprinkler systems, and will lead by example by choosing WaterSense labeled products for city facilities.
- The Water Utility is getting involved in and will be making a financial commitment to locally promoting '**Green*Plumbers***.' This is a national accreditation program that educates plumbers on new, water-saving techniques and general water conservation. The program's goal is to reach 40,000 plumbers nationwide.

COMMERCIAL

- **Targeted education/outreach** to promote water conservation by commercial users is an important component of any educational program.
- **Offer educational information for clothes washers or dishwashers**, which would serve as an important educational component to several sectors of the commercial industry, specifically, the hospitality industry, nursing home/retirement communities, hospitals/medical centers, laundromats/linen service.
- Other incentive/rebate programs could include:
    - Commercial/multi-family **toilet rebate program**
    - Promotion of **"Request linen washing" cards** to the hospitality industry
    - Promotion of **xeriscaping**/landscaping with native plants that require minimal water once established
        - While landscaping companies would be the primary audience, owners of all commercial properties with extensive green spaces (business parks, retirement communities, nursing homes, shopping centers, and medical clinics) would also be targeted. In addition to promoting native landscaping, information on watering requirements, ideal times for watering, and water-conserving irrigation/watering systems will also be provided. Seminars or workshops on native landscaping could also be planned.
    - Recommendation of **water audits** or leak detection surveys to reduce water waste from leaky toilets, faucets, and showers in
        - Multi-family housing
        - Hotels/motels
        - Restaurants

        - Shopping centers/malls
        - Office/business parks
    - Provide best management practice **information to car washes** and provide certification to those car washes implementing water conservation techniques.

INDUSTRIAL

After developing **individual facility plans**, the final step is educating employees and involving them in water conservation efforts. Employees can have a major effect on the success of a water conservation program. It is important to educate and train key employees to make conservation efforts the most effective. Employees must be informed about the program and be made an integral part of the water reduction effort. An important part of this process is the formation of a water conservation and energy team within the organization, though the facility's water conservation goals should be shared with all employees. Industrial customers should educate employees about costs for water, sewer and electrical. These costs should be logged periodically. It is important for the industrial customer to stress to employees that even small projects can produce large savings in water consumption and to publicize water conservation successes--internally and externally. The Water Utility would provide educational materials specific to each customer's need, based on the site audit and water conservation plan.

- The Water Utility should consider an **awards program** to reward and honor industrial customers for their water conservation successes. The Water Utility would present a suitable plaque or certificate of achievement to the chosen industrial customers.

SUMMARY OF CONSERVATION GOALS

The following list is a summary of recommendations put forth in this plan. The goals within each category are listed in order of suggested priority.

	Objective: Maintain Current Pumping Levels			
	Recommendations	**Implementation**	**Timeline**	**Cost**
RESIDENTIAL	**Reduce per capita water use by 20% by year 2020.**	Concerted effort by customers, Water Board, Common Council, & Water Utility Staff	2020	
	Establish a toilet rebate program. Using the figures of the AWWA, Table 1, high efficiency toilets could reduce the daily water use by 10.3 gallons per capita or about 2,301,000 gallons per day or about the output of one well. This represents two-thirds of goal to reduce residential water use by 20% by 2020. A rebate of $100 per dwelling unit is considered a sufficient inducement to encourage the replacement of existing fixtures with high efficiency toilets. It is estimated that the total cost to the customer, using a licensed plumber would be approximately $350 per fixture. It is anticipated that a number of residents would undertake the work themselves. The sum of $250,000 representing 2,500 toilet replacements per year at $100 per dwelling unit has been requested as a part of the annual rate structure. This rebate program would be administered in much the same manner as the Water Utility's successful lead service replacement program, which is drawing to a close. As in the lead service replacement program, the Water Utility proposes to partner with the plumbing construction firms to undertake the work. Consideration will be given to the aspect of recycling the metal from the replaced toilets. The ceramic portion of the fixtures may not lend itself to recycling. Other communities have adopted more ambitious rebate programs including rebates for dishwaters and washing machines. However, the actual reduction of water consumption is harder to document than toilets and not affordable for the Madison Water Utility, at this time.	Water Utility Staff with Assistance from the Recycling Coordinator of the Street Division.	October 2008 (Subject to Rate Structure Approval)	$250,000 annually
	Provide customers with current consumption data The Madison Water Utility issues its bills twice per year to its customers. This does pose a challenge to customers who wish to monitor their water use. However, each customer does have a remote register that measures water use. Generally these registers are located on the side of the dwelling unit and measure consumption in cubic feet. This initiative would provide instruction to customers to track their water use on a monthly basis. Each customer will be mailed a card stock form, which can be used to determine their water use and convert the usage to gallons. In addition, a digital water use tabulator shall be developed so that the customer can load their usage on their computer along with the date and number of residents. The water use tabulator can calculate usage and compare that usage with typical customers. The estimated cost should be on the magnitude of $10,000, with programming. An additional $15,000 would have to be expended for public information.	Water Utility Staff with Vendor Programming Assistance.	January 2009	$25,000

	Enact inclining rate structure A modest rate structure has been proposed to the PSC (Wisconsin Public Service Commission). The rate request was 18%, reflective of the Utility's straitened financial situation. The concept of the proposed inclining rate structure was a rate structure for: 1. The lowest 20th percentile of usage at 61 gallons per day. 2. A Conserving Level at 148 gallons per day. 3. A median level at 184 gallons per day. 4. The 80th percentile at 225 gallons per day. A more aggressive rate structure may be proposed at such time as more frequent bills can be issued or that customers are able to tract their usage with practice.	Water Utility Staff and Wisconsin Public Service Commission	October 2008 (Subject to Rate Structure Approval.)	
	Investigate the Conversion of Water Meters to Provide for Quarterly Billing and the Potential of Monthly Billing (To make a switch from semi-annual to quarterly billing using a non-AMR system would be $417,000 in semi-annual operating costs.)	Water Utility Staff	2011	Capital cost of $5,370,000 in 2010, $5,370,000 in 2011.
	Enact Outdoor Water Usage Restrictions to Maintain Pumpage Below a Preset Daily Amount Section 13.04 of the Madison General Ordinances provides for Voluntary and Mandatory Restrictions for outdoor water usage, which is generally irrigation of turfed areas. In 2007, there were 29 days where pumpage exceeded 40 MGD, 11 days in which pumpage exceeded 45 MGD, and 3 days where pumpage exceeded 50 MGD. This goal would provide that voluntary restrictions be imposed whenever pumpage exceeded 45 MGD for 3 continuous days and manatory restrictions whenever pumpage exceeds 50 MGD for 2 continuous days. While not directly tied to water conservation, the enactment of water usage restrictions would save on electricity during high use days and inform the customer regarding the limitations of the system.	Water Utility Board, and Water Utility Staff	July 2008	$0
	Expand residential water audits from the current high-bill leak detection to include individual requests for onsite inspection/ personalized recommendations	Customer Service/ PIO/ Conservation Manager	Long Term	

	Offer appliance upgrade program for washing machines/ dishwashers	PIO/ Conservation Manager	Long Term	

	Recommendations	Implementation	Timeline	Cost
COMMERCIAL	**Target high-use customers with education/outreach to promote water conservation**		Short Term	
	Enact landscaping ordinance for new development/major redevelopment	General Manager	Intermediate	
	Offer appliance upgrade program (e.g., for laundromats)	PIO/ Conservation Manager	Long Term	
	Enact a certification program for water-efficient buildings	PIO/ Conservation Manager	Long Term	
	Enact a car wash reclamation ordinance	General Manager	Long Term	
INDUSTRIAL	**Perform individual audits for customers**	PIO/ Conservation Manager	Short Term	
MUNICIPAL	**Quantify water use by Water Utility with better record keeping**	Supply/ Operations	Short Term	
	Continue to minimize reservoir dumping	Supply	Short Term	
	Emphasize and expand the leak-detection program Requires purchase of new equipment and devoted work-hours	Operations	Short Term	
	Upgrade Water Utility bill with new software	Customer Service	Short Term	
	Install use meters in well buildings	General Manager	Intermediate	
	Audit other government buildings for water use	PIO/ Conservation Manager/ Facilities Manager	Intermediate	
	Reduce hydrant flushing as well filters are installed (when appropriate)	Engineering	Intermediate	

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