Responses Regarding Water Conservation and Water Use Efficiency

Comment CE1

The City must demonstrate and document compliance with the Tier 3 water conservation and water use efficiency requirements contained in ch. NR 852. More specific comments are enumerated below.

Response

Refer to Water Conservation Plan Supplement, Section 4.

Comment CE2

Water CEMs contained in s. NR 852.04 (2) (Table 1) should be implemented and documentation provided with the diversion application.

Response

Refer to Water Conservation Plan Supplement, Section 4.

Comment CE3

A Water Conservation Plan that complies with s. NR 852.07 and describes conservation and efficiency measures that have been and will be implemented should be submitted to the department for review. The Water Conservation Plan should address how conservation and efficiency measures will apply now and in the future for water users in the entire Water Supply Service Area, including those not currently receiving water from the Waukesha Water Utility. Water conservation and efficiency measures that need particular attention in this section are PWS-1, Water Audit (including results of the audit).

Response

Refer to the Water Conservation Plan Supplement, Sections 3 and 4.

Comment CE4

CEMs contained in s. NR 852.05 (2) (Table 2) should be implemented and documented in the Water Conservation Plan provided with the diversion application. Water conservation and efficiency measures that need particular attention in this section are: PWS-R1, Distribution System Pressure Management; PWS-R2, Residential Demand Management Program; PWS-R3, Commercial and Industrial Demand Management Program; and PWS-R4, Water Reuse (including the results of an analysis that was used to determine feasible options that were implemented).

Response to Comment CE4

Refer to the Water Conservation Plan Supplement, Section 4.

Comment CE5

The City should document its analysis to identify cost-effective or environmentally sound and economically feasible conservation and efficiency measures and provide that documentation to the department with the application. For example, the Alliance for Water Efficiency tool may be a good methodology to conduct this analysis, although other tools or methods of analysis may be used. Documentation of the implementation of the conservation and efficiency measures identified through this analysis should also be delivered to the department.

Response

Refer to the Water Conservation Plan Supplement, Sections 4 and 5.

Comment CE6

A quantitative description of water use by the Waukesha Water Utility and its customers for the past 5 years (at a minimum) should be provided. The analysis should show how implemented CEMs have affected water use. The analysis should include quantitative calculations of water use, including but not limited to the ratio of peak daily demand to average daily demand and per capita residential water use. All residential water use should be included in this analysis, both single family and multifamily dwellings. The analysis should quantitatively account for loss of industrial customers, weather variability, economic considerations, and other identified factors that may have affected withdrawal amounts.

Response

Refer to the Water Conservation Plan Supplement, Section 3.

Comment CE7

Documentation of prior implementation of Public Water Supply Sector CEMs in Table 1 and Table 2 will need to be included in the Water Conservation Plan. Additional cost effective measures identified by the cost effectiveness analysis, or the analysis of environmental soundness and economic feasibility of measures should be included in the plan along with an implementation timeline.

Response

Refer to the Water Conservation Plan Supplement, Sections 4 and 5.

Comment CE8

If a 10 percent reduction option is selected, as allowed by this section, additional documentation and a defensible analysis of water use for the most recent complete year should be submitted. Water use and water use intensity should be adjusted to account for unique facility, economic, or weather variability. The water use or water use intensity from the most recent complete year of water use will be the basis of a 10 percent reduction calculation. The 10 percent reduction should be in addition to any reduction in water use or increase in water reuse or efficiency achieved through implementing the CEMs set forth in s. NR 852.04 (2) and should not be included in the calculated percent reduction. The City must select conservation and efficiency measures that can show by way of documentation to reduce water use by 10 percent, and these measures should be implemented before submitting an application.

Response

Refer to the Water Conservation Plan Supplement, Sections 1 and 3.

Water Conservation Plan Supplement

Prepared in conjunction with the Application for Lake Michigan Water Supply

Submitted to:
The Wisconsin Department of Natural Resources

Submitted by:
City of Waukesha

April 2011

WBG110509184022MKE

Waukesha Water Utility
SERVING WAUKESHA SINCE 1886

115 DELAFIELD STREET
WAUKESHA, WI 53188-3615

Telephone: (262) 521-5272 • Fax: (262) 521-5265 • E-mail: contactus@waukesha-water.com

Conserving Water Makes Good Sense

In this century, access to plentiful supplies of freshwater will be a major global concern. Water shortages are predicted throughout the world, including the United States, because of factors like growing population and climate charge. Even in our water-rich region, there are increasing pressures on water resources to meet demands for drinking water, energy production, agriculture and industry. The most effective and economical way the City of Waukesha can preserve drinking water resources is by water conservation.

The City of Waukesha's formal commitment to water conservation was established in the City's 2006 Water Conservation and Protection Plan. Since then, the City has implemented and maintained numerous water conservation and efficiency measures. As a result, our customers have taken steps to use water more efficiently in their homes and businesses. Water conservation and efficiency measures contribute to the reduction in water use over the past 20 years. Overall, since 1990, our water use had declined 20%—even as our population grew 20%. The City can take pride in the actions taken to use water wisely.

We recognize there is much more to do to improve efficient water usage and protect our water supply for the future. The City is leading by example. We continue to invest millions of dollars each year to replace aging infrastructure such as leaking water mains. We have changed our operations to conserve water. We completed water conservation improvement projects. We continue to partner with other agencies to educate our customers and raise awareness of how water conservation is an integral part of the City's long-term water supply plan.

We must be good stewards of our water resources and invest today in sustainable practices like water conservation. When we do this, we improve the quality of life for ourselves and future generations. To meet our water conservation goals, our plan is to continue to invest in our system and encourage our customers to reduce waste. We will continue to pilot test water conservation measures to determine which practices provide the most benefits to our customers at the lowest cost. Investing in these measures now will make more water available in the future. Conservation just makes good sense.

Sincerely,

Dan Warren

Daniel E. Warren
Waukesha Water Utility Commission Chair

Report

Water Conservation Plan Supplement

Submitted to

The Wisconsin Department of Natural Resources

April 2011

Submitted by

City of Waukesha, Wisconsin

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Contents

Appendixes

Exhibits

1. Introduction

The City of Waukesha adopted its Water Conservation and Protection Plan in 2006. Since then, the City has implemented a wide variety of conservation and efficiency measures (CEMs). In 2010, the City submitted to the Wisconsin Department of Natural Resources (WDNR) its draft Application for a Lake Michigan Water Supply. The City is applying for a Great Lakes water supply with return flow to meet its long-term water supply needs. Whether its drinking water supply is Lake Michigan or groundwater, the City's long-term water supply plan includes an increased level of water conservation.

In 2010, WDNR developed a new state rule which establishes certain mandatory water conservation and efficiency measures for withdrawals in the Great Lakes basin and water loss approvals statewide. That rule, Wisconsin Administrative Code Chapter NR 852 Water Conservation and Water Use Efficiency (NR 852), was adopted January, 2011. This Water Conservation Plan Supplement presents the City's water conservation goals, planning analysis, and accomplishments to date in a manner consistent with NR 852.

1.1 Purpose

The purpose of this Supplement is to respond to comments WS4, CE1, CE2, CE3, CE4, CE5, CE6, CE7, and CE8 in the WDNR's letter to the City dated December 2, 2010, regarding the draft Application. This Supplement builds on the established foundation of the City's 2006 Water Conservation and Protection Plan (2006 Plan), attached as Appendix A. The Supplement to the 2006 Plan provides detailed discussion and information to further demonstrate the City's commitment to managing its existing and future water supplies efficiently. It establishes the path forward for customer service-oriented water use efficiency planning and implementation.

In 2011, the City is undertaking a comprehensive update to its Water Conservation and Protection Plan. The planning process to update the 2006 Plan will include public involvement, collaboration with elected officials, and detailed coordination with the Wisconsin Public Service Commission (PSC) and the WDNR. This Supplement provides the background information and technical path forward for planning work that will continue in 2011 with the City's key stakeholders.

1.2 Background

In Wisconsin, the City has been a municipal leader in water conservation. Beginning with the adoption of its 2006 Plan, the City set out to implement measures to achieve three primary goals:

1. Reduce water use to conserve limited available public water supplies.
2. Protect source water areas to ensure water sources are protected from pollution.
3. Protect stormwater recharge areas to help replenish groundwater resources.

This Supplement focuses on the City's actions to achieve the first goal, water use reduction.

1.2.1 Water Conservation Planning by the City

For the City, water conservation planning is a long-term process that is accomplished in phases of research, evaluation, implementation, monitoring, and adaptation. The process used, shown in Exhibit 1-1, is modeled after guidance published in American Water Works Association (AWWA) Manual 52 *Water Conservation Programs – A Planning Manual,* (2010).

EXHIBIT 1-1
Water Conservation Planning Process

Successful performance of the City's conservation program is achieved when water use efficiency is improved in a cost-effective manner while customers' needs are met. Advancing CEMs in a stepwise manner provides the City flexibility to make improvements as needed in response to changing consumption patterns, technology, and customer expectations.

1.2.1.1 Research

Gathering information, setting conservation priorities, establishing goals, and identifying candidate CEMs comprise "Research." The City reviews its detailed water demand forecast, uses published guidance from AWWA, the Alliance for Water Efficiency (AWE) and the United States Environmental Protection Agency (EPA), and collaborates with leading water conservation experts to set practical goals and maintain a successful conservation program. Between now and 2030, the City will expand its water conservation program to achieve the following water use savings goals set forth in its *Application for Lake Michigan Water Supply*:

- An additional 0.5 million gallons per day (mgd) between 2010 and 2030
- An additional 0.5 mgd between 2030 and 2050, for a total of 1 mgd of savings (about 10 percent of the City's average day demand) by 2050

To identify candidate CEMs for evaluation, the City considers a wide range of criteria including water use by customer class, the water system infrastructure, water system standard operating and maintenance procedures, state regulations, and existing conservation measures.

1.2.1.2 Evaluation

Feasible CEMs are evaluated on the basis of economic and non-economic considerations. The cost-effectiveness of candidate activities is analyzed on the basis of potential water savings and probable costs to the City and its customers with a conservation calculator, like the AWE Water Conservation Tracking Tool. Other measures are evaluated on the basis of qualitative and other non-economic criteria like perceptions of how well the public is

educated on a water conservation issue, customer acceptance of a particular measure or how water use behaviors change in response to water price. After input from customers and other stakeholders, a plan of action is prepared by selecting a package of conservation measures for implementation.

1.2.1.3 Implementation

Ultimately, the City gains approval for CEM implementation through review by the water utility commission and, if appropriate, with the City Council. Whenever possible, the City partners with other organizations like the Wisconsin Water Conservation Coalition, the Waukesha school district or Wisconsin Focus on Energy to implement measures as economically as possible.

1.2.1.4 Monitoring

To monitor the real costs and water savings that result from implementing CEMs, the City gathers and reviews extensive water use and financial data. To determine the overall effectiveness of CEMs, the City solicits feedback from customers. Monitoring the results of water conservation efforts is a part of routine City operations. Annually, the City reports a detailed analysis of the water conservation program to the state, by order of the PSC.

1.2.1.5 Updating

At least annually, CEMs in the City's water conservation program will be reviewed and modified, as appropriate, to improve performance. In this process, the City will:

- Identify efficiency measures and performance goals based on extensive research.
- Communicate the City's vision for water use efficiency to customers.
- Educate customers, using a broad spectrum of media, about the costs and benefits of water conservation.
- Implement measures that provide monetary benefits and water use savings.
- Make informed decisions about needed changes to the conservation program based on measured water use and customer feedback.

1.2.2 Reduced Water Use in the City

The City has demonstrated its commitment to conservation. Since the adoption of the 2006 Conservation Plan, the City has successfully advanced various water conservation measures through public information and education, regulations, collaborative partnerships, and incentive programs. Water use in the City has been reduced, in part, because of these measures. Other factors that influence water use include weather and economic conditions. Reduced water use is illustrated by the following aggregate metrics:

- Between the base year of 2005 and 2009[1], total water pumping was reduced 12.6 percent.[2]

[1] 2009 data is used throughout the Application and this Supplement as the "most recent" complete `data year because the Application was submitted during 2010.

- Between 2005 and 2009, peak seasonal pumping was reduced 16.8 percent.[3]
- Since 2005, declining water use reduced the number of days water demand exceeded 10 mgd from 28 to 0. The City has an operational goal to pump 10 mgd or less, to help meet its radium compliance order and stipulation.[4]
- Residential customers who have replaced a toilet in conjunction with the City's rebate program are saving an average of over 15,000 gallons per year.[5]

Under order from the PSC, the City annually reports detailed information on the performance and costs of its conservation program. Appendix B contains these reports.

[2] Annual Reports of City of Waukesha Water Utility to the Public Service Commission of Wisconsin, 2005–2009.

[3] City peak season water pumping data, May through September, 2005–2009.

[4] Waukesha Water Utility Report on Water Conservation Programs to the Public Service Commission of Wisconsin, 2010.

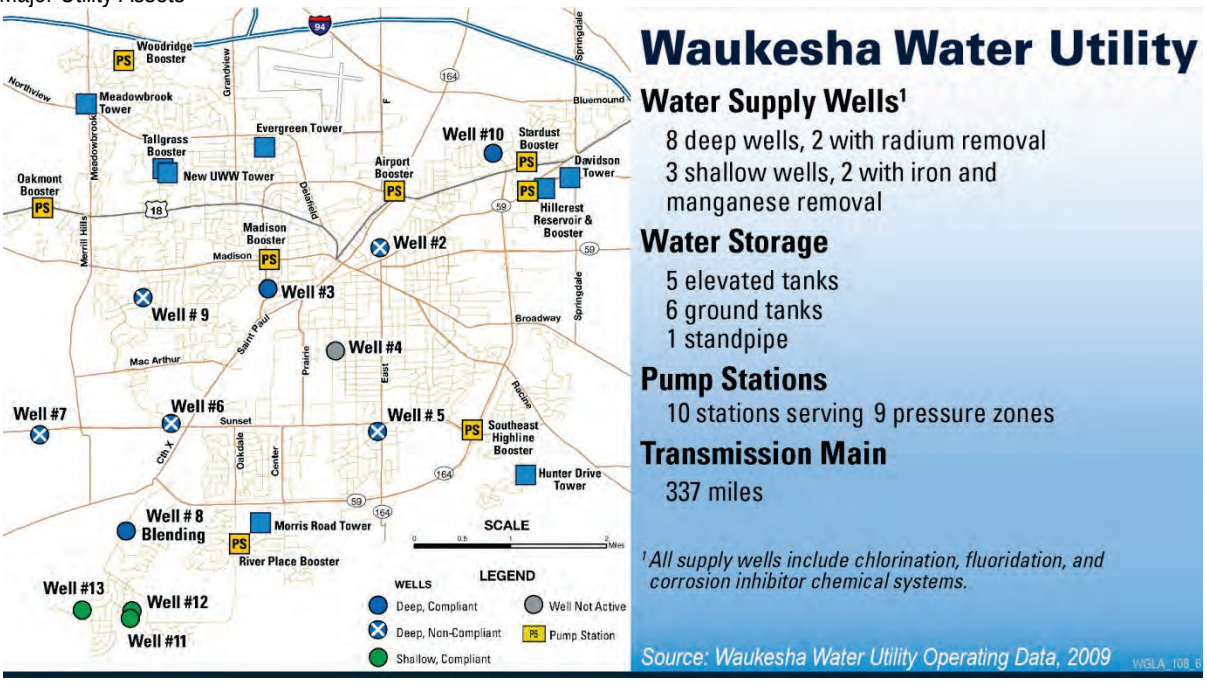
[5] Ibid.

2. City Water System and Service Area

2.1 Current Water System

The City of Waukesha water system is comprised of groundwater supply, treatment, storage, and conveyance assets summarized Exhibit 2-1 and described in detail in the City of Waukesha Water Supply Service Area Plan. The water system has a total capacity of 17.9 mgd. The City of Waukesha and some areas outside the city limits comprise the current water supply service area.

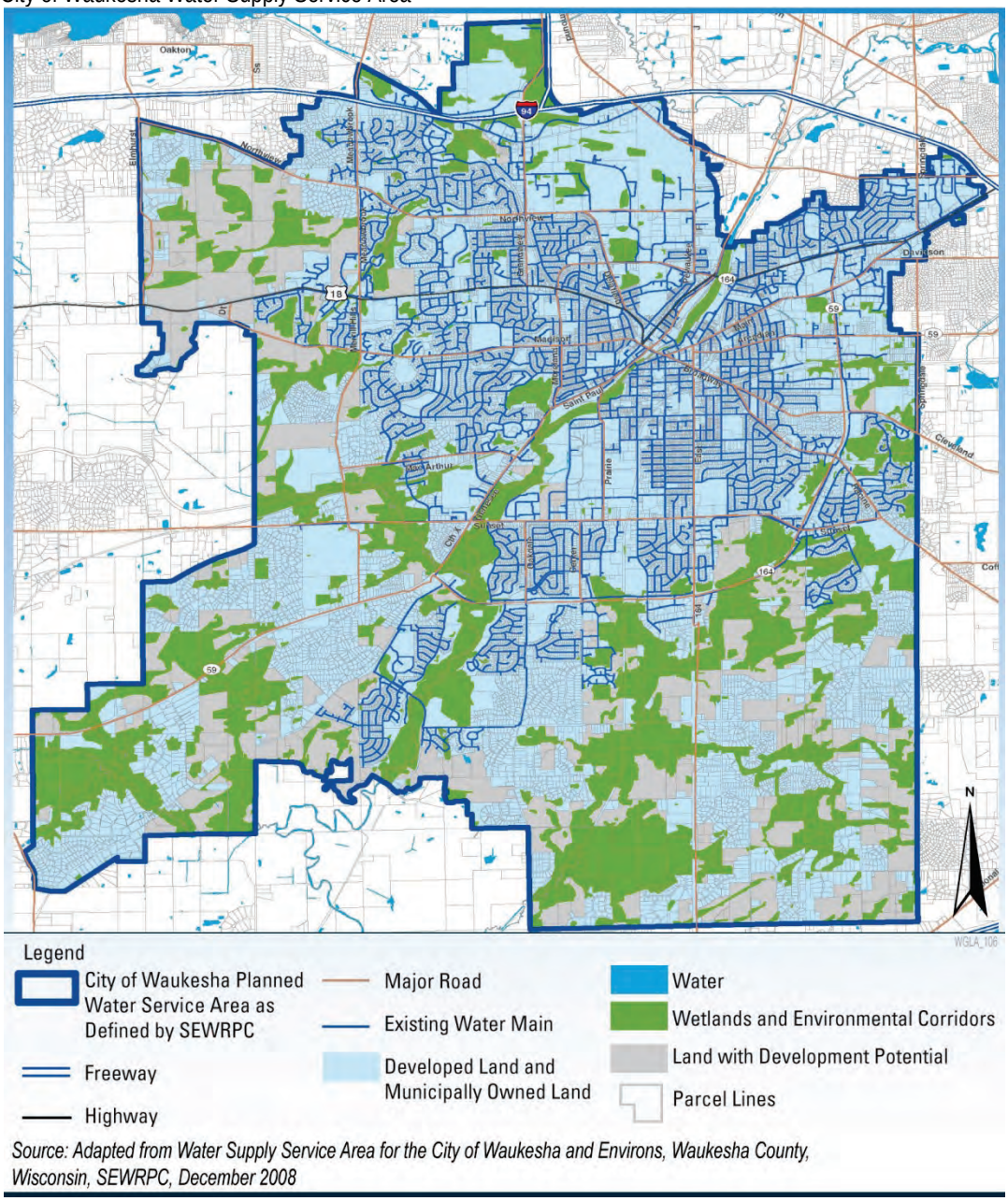
EXHIBIT 2-1
Major Utility Assets



2.2 Water Supply Service Area

The City's water supply service area, delineated by the Southeastern Wisconsin Regional Planning Commission (SEWRPC), includes the City of Waukesha and areas outside the City's jurisdiction. Those areas primarily encompass the towns of Waukesha and Genesee. While the City provides water service to a limited number of properties outside of the city limits by special agreements, it is does not currently serve the towns; however, it must be prepared to provide service if requested to do so. The Town of Genesee has passed a resolution indicating that they may potentially request delivery of water from the City of Waukesha in the future. The passing of a similar resolution in the Town of Waukesha is pending.

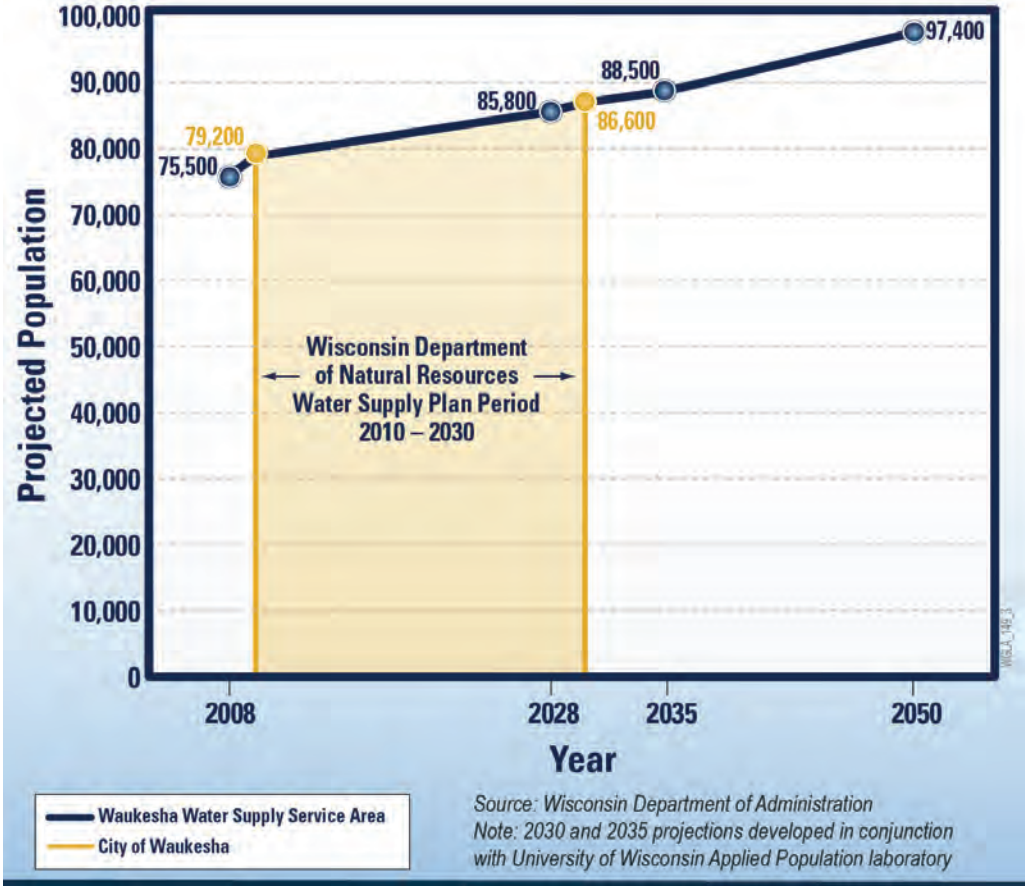
EXHIBIT 2-2
City of Waukesha Water Supply Service Area



Source: Adapted from Water Supply Service Area for the City of Waukesha and Environs, Waukesha County, Wisconsin, SEWRPC, December 2008

The City of Waukesha water supply service area shown in Exhibit 2-2 represents the full planned development, envisioned in the Waukesha County Comprehensive Plan. Full development, or build-out, condition is projected for sometime beyond 2030. While projections are inherently more uncertain the further out the planning horizon, the build-out condition will likely occur around 2050, based on historical state population trends. SEWRPC prepared population projections for the water supply service area: 85,800 in 2028, 88,500 in 2035, and an ultimate buildout population of 97,400 (Exhibit 2-3). These projections are based on municipal estimates from the State of Wisconsin Department of Administration with 81 percent of the population served being located in the City of Waukesha; 10 percent, the Town of Waukesha; and 9 percent, the Town of Genesee.

EXHIBIT 2-3
Water Supply Service Area Plan Population Projections



2.3 Water Conservation Applied Across the Water Service Area

The water conservation measures implemented by the City apply universally to its customers, whether within city limits or not. Under current tariff provisions regulated by the PSC, all customers are subject to the City's conservation measures, including the water rate schedule, outdoor water use restrictions, and financial incentives to install water-saving toilets. If water service is extended to other areas outside the City's jurisdiction, customers will be required to adhere to the City's conservation program as established in the tariff provision as well as in future service contracts. The City will provide water conservation public education to new customers and make available information, services and incentives to help its customers use water wisely. Beyond current tariff provisions, the City encourages voluntary implementation of additional conservation design and practices in new development. The City consults with applicants for new service to explore opportunities to incorporate water-saving technologies and processes in their development.

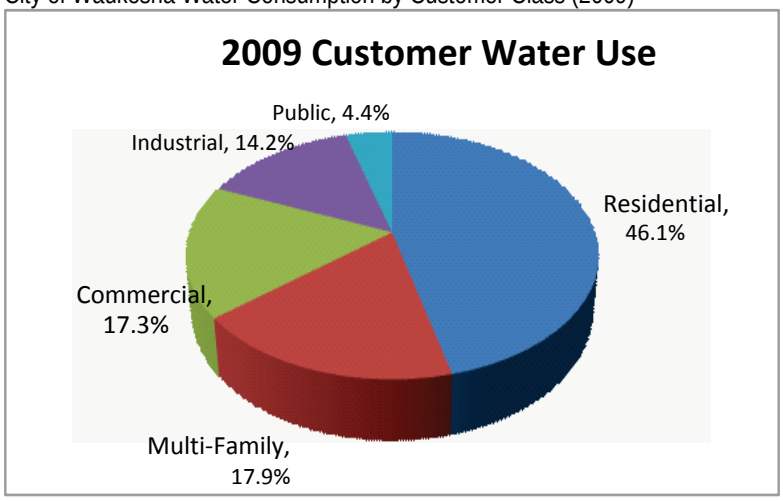
3. Water Use

Historical water use; population projections; regional, county, and City land use plans; and water conservation and efficiency goals were used to prepare water supply service area water demand forecasts. For water use efficiency measures to be effective, the City uses these data and information to design elements of its water conservation program.

3.1 Historical Water Use

Exhibits 3-1 and 3-2 (see page 3-3) summarize water use by customer class and historical water consumption for the period 1999 to 2009. Residential customers consistently represent the City's largest customer class. The City's residential population increased about 9 percent between 1999 and 2009, but water use by that customer class decreased 5 percent. Over this same period, total water pumping decreased 18 percent.

EXHIBIT 3-1
City of Waukesha Water Consumption by Customer Class (2009)



Since its adoption in 2006, the City's Water Conservation and Protection Plan provided additional focus on water use efficiency. This is evidenced by the greater than 12 percent reduction in total pumping between 2005 and 2009. Some water use reduction may be attributed to weak economic conditions and seasonal rainfall over the same period; however, some of the water saved can be attributed to water conservation education, regulation, and incentives.

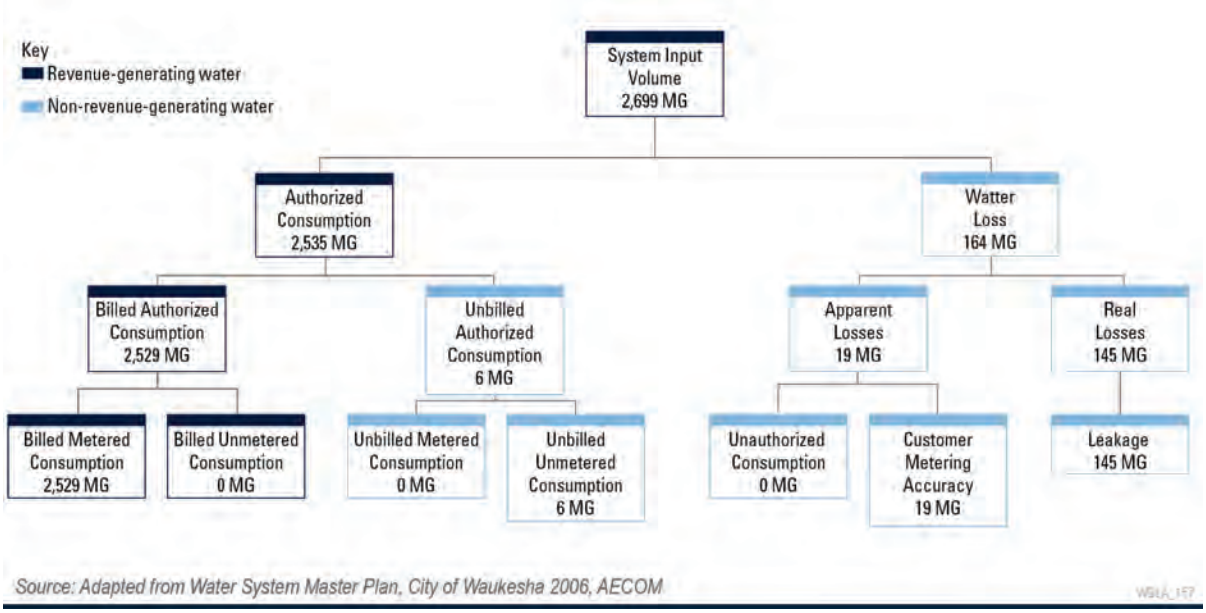
3.1.1 Water Use Audit

In 2006, as part of its comprehensive Water System Master Plan, the City conducted a water use audit following the procedures indicated in PSC 185. The water audit method was developed by the International Water Association Water Loss Task Force and has been adopted in the latest version of the American Water Works Association (AWWA) *Manual of Water Supply Practices M36 Water Audits and Water Loss Control Programs*. The results of the analysis are summarized in Exhibit 3-3. Other conclusions from the analysis (see Appendix C)[6] include the following:

[6] Earth Tech. May 2006. *Water System Master Plan, City of Waukesha.*

- The City's TIRL (technical indicator for real losses), a measure of the total volume of water losses in a distribution system, is 21 gallons per service connection, the fourth lowest among 34 communities surveyed with TIRL values ranging from 10 to 215 gallons per connection.[7]
- The City's ILI (infrastructure leakage index), a measure of how well a distribution system is managed with respect to real water loss from leakage, is approximately 1.3, significantly less than the average of 5 from among the communities surveyed.[8]

EXHIBIT 3-3
City of Waukesha Water Audit Summary



3.1.2 Nonrevenue Water

The difference between total pumpage and total water sales is termed nonrevenue water and is usually expressed as a percentage. The portion of nonrevenue water attributed to leakage, meter inaccuracies, and other unknown losses is often termed *unaccounted-for water* and can be an indicator of the condition of the water system. Between 1999 and 2009, the unaccounted-for water has ranged from 3 to 7 percent (Exhibit 3-2). In 2009, unaccounted-for water was equivalent to 7 gallons per capita per day (gpcd). The City operates and maintains its water system to minimize unaccounted water well below the AWWA-recommended 10 percent and the PSC action level of 15 percent.

[7] A. Lambert, D. Huntington, and T.G. Brown. 2002. "Water Loss Management in North America: Just How Good Is It?" *Water Loss Control Manual.*
[8] Ibid.

EXHIBIT 3-2
City of Waukesha Historical Annual Water Consumption

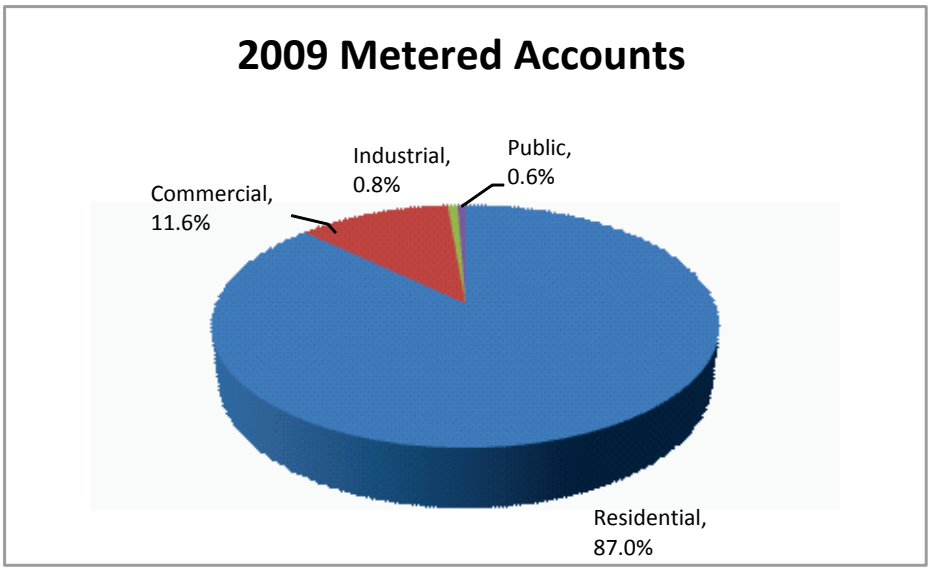
Year	Residential	Commercial	Industrial	Public	Total Water Sales	Total Pumpage	Water Used but not Sold	Unaccounted for Water	Unaccounted for Water, %
2009	1,054,288	806,736	325,667	99,619	2,286,310	2,479,895	27,930	165,655	7
2008	1,056,650	827,543	382,413	99,646	2,366,252	2,530,964	37,879	126,833	4
2007	1,086,542	846,566	404,079	110,532	2,447,719	2,618,682	3,791	167,172	6
2006	1,077,127	858,062	424,603	109,846	2,469,638	2,620,450	14,676	136,136	5
2005	1,193,851	874,418	428,518	120,126	2,616,913	2,831,510	5,054	209,543	7
2004	1,117,325	854,624	435,004	121,601	2,528,554	2,698,980	6,169	164,257	6
2003	1,176,115	895,850	461,885	120,071	2,653,921	2,795,859	3,228	138,710	5
2002	1,185,745	914,138	612,856	119,173	2,831,912	2,953,216	21,540	99,764	3
2001	1,128,475	874,030	586,552	114,492	2,703,549	2,821,969	37,909	80,511	3
2000	1,067,184	848,664	660,364	108,873	2,685,085	2,836,141	19,057	131,630	5
1999	1,112,499	847,914	722,097	177,408	2,859,918	3,028,414	n/a	168,496	6

Note: Consumption volume values are given in 1,000 mgd.

3.1.3 Metered Water Customers

To account accurately for water use and to comply with state regulations, all City customers are metered. Exhibit 3-4 summarizes the numbers of meters by customer class.

EXHIBIT 3-4
City of Waukesha Metered Water Accounts (2009)



	Number of Meters				
Year	Residential	Commercial	Industrial	Public Authority	Total
2009	16,955	2,264	147	117	19,483
2008	16,827	2,276	144	116	19,363
2007	16,677	2,264	141	116	19,198
2006	16,501	2,235	144	123	19,003
2005	16,295	2,189	144	121	18,749
2004	15,983	2,141	144	119	18,387
2003	15,686	2,112	144	119	18,061
2002	15,508	2,101	143	119	17,871
2001	15,209	2,038	142	120	17.509
2000	14,754	1,952	138	119	16,963
1999	14,593	1,925	137	119	16,774

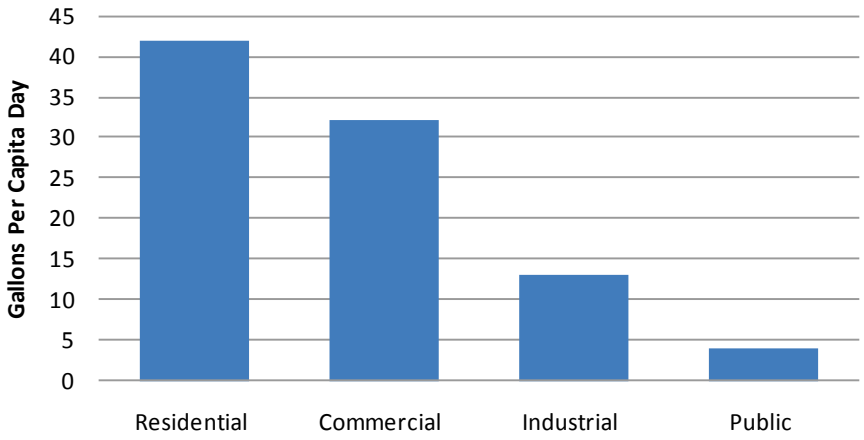
Source: City of Waukesha Water Annual Reports to the Wisconsin Public Service Commission, 1999–2009.

3.1.4 Per Capita Water Use

Residential, commercial, industrial, and public water use intensity often is correlated to a community's population as a means of measuring efficiency trends over time as populations

grow or change. Exhibit 3-5 summarizes usage per person for various water use sectors (customer classes) based on water sales records. Water service to multi-family residential housing is included in the commercial customer class. Across all customer classes, water consumption per capita decreased over the last 10 years.

EXHIBIT 3-5
City of Waukesha Per Capita Per Day Water Use (2009)



Year	Residential	Commercial	Industrial	Public
2009	42.0	32.1	13.0	4.0
2008	42.6	33.3	15.4	4.0
2007	43.9	34.2	16.3	4.5
2006	43.6	34.7	17.2	4.4
2005	48.2	35.3	19.3	7.5
2004	45.8	35.0	17.8	5.0
2003	48.2	36.7	18.9	4.9
2002	49.0	37.8	25.3	4.9
2001	47.3	36.7	24.6	4.8
2000	45.1	35.9	27.9	4.6
1999	48.4	36.9	31.4	7.7

Note: Values are given as gallons per capita per day.

3.1.5 Variations in Customer Demand

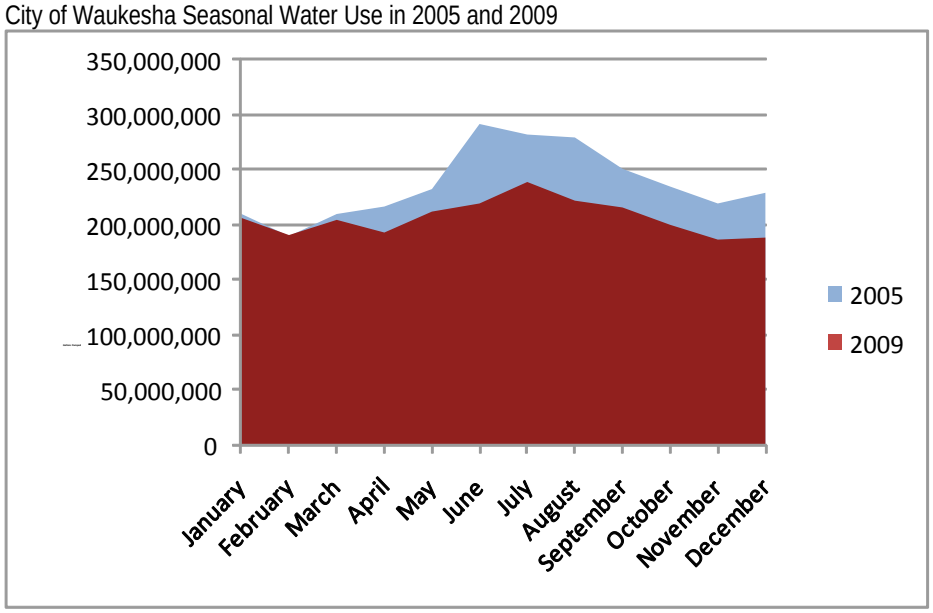
Water demand varies with several factors including precipitation, temperature, economic conditions, personal income, and community conservation goals. While reductions in water use in wet and cool years or increases in water use associated with higher personal income may be observed, it is not a straightforward process to measure how these factors affect each other. Additional data points are needed to robustly quantify and disaggregate the effect of variables such as weather (especially temperature and rainfall), economic conditions and public awareness on water use. Information in the following sections presents results of the City's

review of available data indicating trends that provide insights into long-range water demand forecasts.

3.1.5.1 Seasonal Variation in Water Demand

Seasonal water use patterns provide helpful information regarding the water use in City's service area. Exhibit 3-6 presents monthly water use in 2005 (before the 2006 Plan) and in 2009. In 2006, the City restricted outdoor water use by municipal ordinance to conserve water. Since then, seasonal peak demands have declined significantly. While the City must plan for a peak pumping season from May through September, its water demand forecasts for the future assume the City will continue to restrict peak season outdoor water use.

EXHIBIT 3-6
City of Waukesha Seasonal Water Use in 2005 and 2009



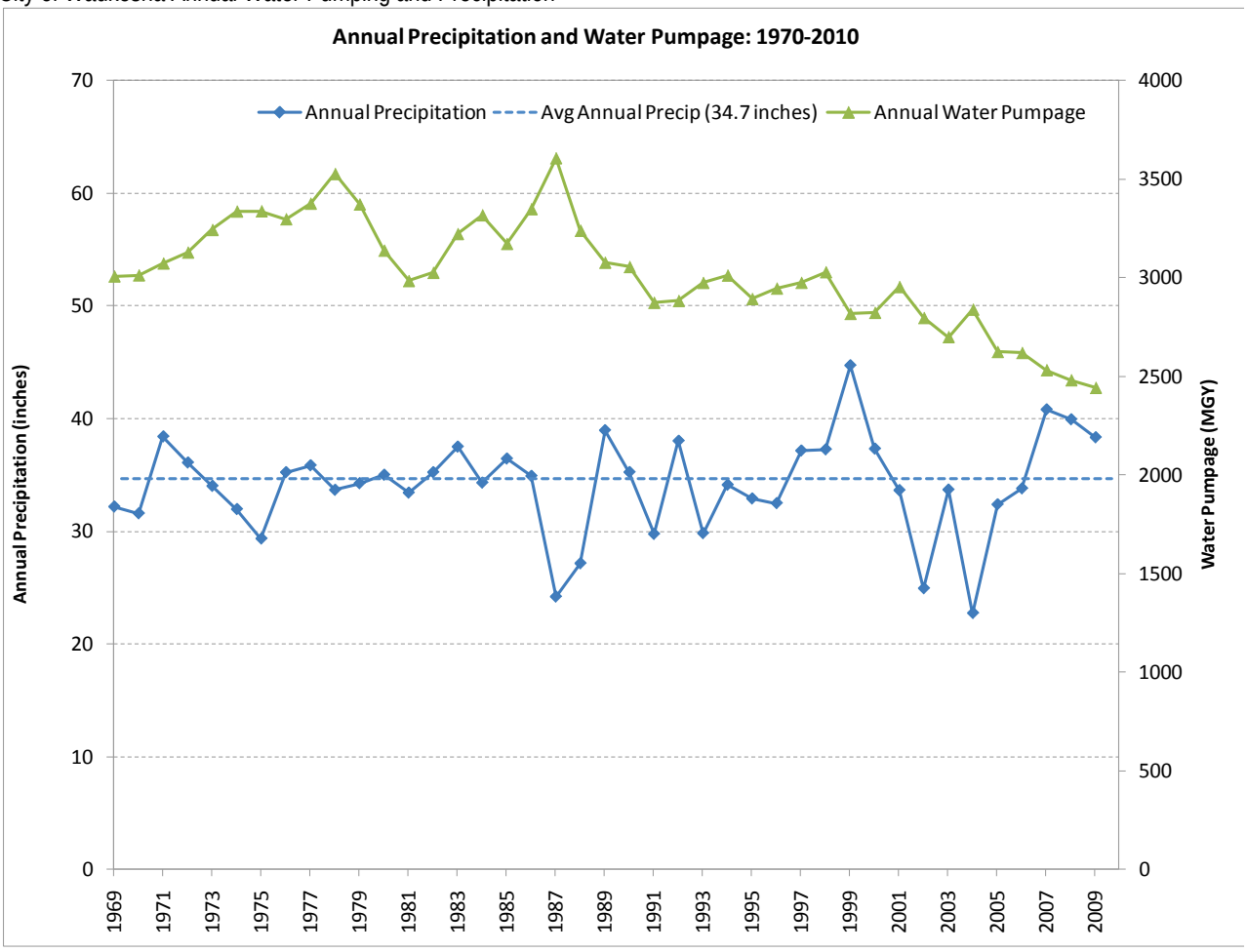
Source: City of Waukesha Annual Report to the Wisconsin Public Service Commission, 2009.

3.1.5.2 Water Demand Variation with Precipitation

Because local climate conditions (e.g., temperature, wind) and precipitation events (duration, number, and intensity of storms) vary widely, the effect of precipitation on water use is not readily discerned. To look for high-level water use trends, the City reviewed the annual water pumpage and precipitation data over the past 40 years, summarized in Exhibit 3-7. The data indicate a declining trend in the volume of water pumped to meet City demand. This may be attributed to many factors including new water conserving appliances required by code since the mid 1990s, the City's water conservation measures, and the recent economic downturn. The data also illustrate that water demand in the City increases in years of below-average rainfall.

Even though the City receives an average of 34.7 inches of precipitation annually and has implemented a conservation program, it must plan for periods of abnormally dry to moderate drought conditions when water demands may increase or supplies may be constrained. Sound engineering practice requires planning for potential droughts to maintain to meet water needs for customer uses, fire-fighting, maintenance and other similar requirements.

EXHIBIT 3-7
City of Waukesha Annual Water Pumping and Precipitation



3.1.5.3 Water Demand Variation due to Economic Conditions

During the economic downturn of the last several years, water use in the City has declined. In fact, water use, both in terms of volume and water use intensity, is at historic low levels. During a weak economy, discretionary water use declines; customers make changes in their behavior, processes, appliances and equipment to use water more efficiently. In recent years, the City's commercial and industrial customers have implemented water use efficiency measures to reduce or maintain the cost of providing their services and products. Measured water savings in response to extreme market challenges for the City's industrial customers are described in Section 4.

With respect to long-term planning, the City considers the impacts of economic cycles transitory. That is, when economic conditions improve during the future planning period, the forces that restrain growth and water use will be removed and water demand will return to higher levels and gradually increase with future growth. Thus, during in the planning horizon, growth in the commercial and industrial water use sectors is expected to occur at a faster rate than for the residential sector.

3.1.5.4 Diurnal Variation in Customer Demand

Exhibit 3-8 summarizes historical variation in average day and maximum day demand over the past 10 years. Based on analysis of the City's pumpage data (1970-2008), the maximum day to average day pumping factor used for water system facility design is 1.68,. The analysis of this system performance metric is included in Appendix D, Summary of Water Requirements. As shown in Appendix D, the appropriate average to peak day ratio used for long-term planning and design (1.68)reflects that value with a 98 percent confidence level (i.e., probability) that the actual peak day pumping will be of equal or lesser value. This value is just slightly higher than the average to peak ratio in 2005. Although average to peak ratio appears to be trending downward since 2005, how much of the decrease is due to reliable long-term water use efficiency and how much is due to rainfall, the economy and other factors are not known.

EXHIBIT 3-8
City of Waukesha Maximum and Average Daily Flow, 1999–2009

Year	Average Day Pumpage (mgd)	Maximum Day Pumpage (mgd)	Maximum Pumpage Date	Ratio of Maximum to Average Day
2009	6.79	9.35	08/04	1.38
2008	6.91	9.93	08/19	1.43
2007	7.17	9.79	07/24	1.36
2006	7.18	10.23	07/18	1.42
2005	7.76	12.87	06/23	1.66
2004	7.39	10.48	09/13	1.42
2003	7.66	11.67	08.22	1.52
2002	8.09	12.78	07/17	1.58
2001	7.73	12.53	07/09	1.62
2000	7.72	10.15	06/27	1.31
1999	8.30	11.59	07/07	1.40

Source: City of Waukesha operating data.

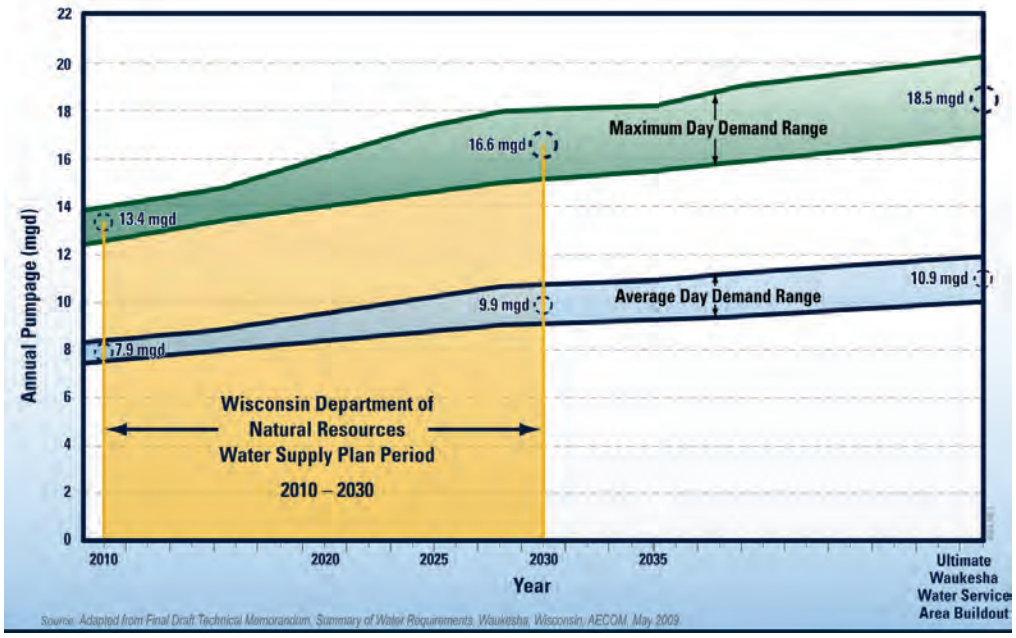
3.2 Water Demand Forecasts

As part of its 2006 water system master plan, the City prepared water demand forecasts. These were updated in 2009 to reflect updated water service area population projections and City water use after implementation of conservation measures. Appendix D, Summary of Water Requirements, contains the analysis of future water demands that provides the basis for this Supplement. Exhibit 3-9 shows the average day and maximum day water demand projections.

The future water demand forecasts are based on the following major assumptions:

- The City's water conservation program is maintained and expanded to meet long-term conservation goals and customer needs.
- If water conservation measures are not in place, the estimated increase in water demand from 2009 levels is forecast to be 0.5 mgd in 2030 and 1 mgd in 2050.

EXHIBIT 3-9
Water Demand Projections



- The target 10 percent savings of 1 mgd average day flow by 2050 complies with Regional Water Supply Plan for Southeastern Wisconsin, which evaluated several levels of water conservation ranging from 4 – 10 percent reductions of average daily demand. The regional water supply plan proposed three water conservation tiers: basic level (about 4 percent), intermediate level (about 6 – 8 percent), advanced level (about 10 percent), depending on limitations of existing water supply in terms of quantity or quality and limitations of existing infrastructure.[9] The City selected the most stringent 10 percent reduction level. The City verified this goal was achievable through detailed water conservation planning described in this Supplement.

- The range of possible future flow requirements is defined by the population projections and water use intensity factors that incorporate savings from water conservation along with uncertainties associated with long-term water supply planning. These uncertainties include drought, changes in customer class, particularly the number and type of commercial and industrial users, and in prevailing economic conditions.

9 *Regional Water Supply Plan for Southeastern Wisconsin*, Newsletter 4, January 2011

4. Conservation Efficiency Measures

The City has implemented or completed the water conservation efficiency measures (CEMs) that meet the mandatory requirements enumerated in Table 1. The City shall implement all the CEMs identified in § NR852.05 (2) Table 2. The CEMs implemented by the City have not resulted in adverse environmental impacts. The environmental soundness of proposed future CEMs will be evaluated prior to implementation to ensure that water savings are not gained at the expense of other important environmental considerations; for example, at the cost of higher energy use and greater carbon footprint.

To meet the requirements of §NR852.06 (1), this section presents a timeline for implementation of CEMs. Timeline information, along with best practices for water efficiency that have high-level applicability and effectiveness within the City, are input for the cost-effectiveness analysis presented in Section 5, Evaluation of Conservation and Efficiency Measures.

4.1 Conservation and Efficiency Measures, Table 1

Rule NR 852 requires all Public Water Supply (PWS) systems applying for a new or increased withdrawal, diversion, or water loss to provide documentation showing implementation or completion of specified measures that do not require retrofitting. Prior to the submission of its Application for a Great Lakes Diversion with return flow, the City has implemented all the Table 1 CEMs.

The City will maintain these best practices in the future. Refer to Exhibits 4-1 and 4-2.

4.1.1 PWS-1, Water Use Audit

CEM #	Description	Required Element
PWS-1	Water Use Audit	Perform a water use audit and prepare written documentation of the audit results using the process outlined in one of the following: Public water systems regulated by the Public Service Commission shall follow the audit procedures indicted in ch. PSC 185. Public water systems not regulated by the Public Service Commission, shall submit water use audit results with the water conservation plan required in s. NR 852.07.

The City understands that using water wisely is central to its mission:

> The Water Utility will provide high quality water to our customers in amounts which meet their need and protect their health at a fair price. We will provide services with sensitivity to customer's concerns; diligently strive to conserve vital resources and support community interest and growth.

The City continuously audits water use with the following established practices:

- Measures and records all water that is withdrawn from groundwater aquifers.

- Measures and records all water that used in water treatment processes.
- Measures and records all the water pumped at distribution system booster stations.
- Meters and records all water use by customer class.
- Measures and records water used each month for flushing, fire fighting, and main breaks.
- Calculates the percentage of unaccounted-for water each month and reports it to the PSC annually.
- Performs customer water audit and repairs leaks in response to billing system alerts that detect water usage above and below the "normal" usage of that meter.

The City prepared a water use audit in 2006 in accord with ch. PSC 185, as described in Section 3, Water Use, and presented in detail in Appendix C. The City used the water use audit to more clearly understand the system's condition and water balance; that is, the volume of water supplied and the water use volumes. This understanding helped identify ways to minimize nonrevenue water, or water that has been produced and "lost" before it reaches the customer. For example, to minimize nonrevenue water, the City implements capital improvements, like looping mains to eliminate dead ends and minimize the volume of water that would be lost to routine main flushing.

In the future, the City will continue to conduct periodic system wide water use audits in accordance with ch. PSC 185. The City will also develop a unidirectional flushing program within the next 5 years and begin implementing it within 10 years. Unidirectional flushing results in thoroughly cleans water mains and requires less water than conventional flushing.

4.1.2 PWS-2, Leak Detection and Repair Program

CEM #	Description	Required Element
PWS-2	Leak Detection and Repair Program	Prepare a written program to control system losses in accordance with one of the following: 1. Public water systems regulated by the Public Service Commission shall follow the procedures indicated in ch. PSC 185 regarding system losses. 2. If a public water system not regulated by the Public Service Commission has 1,000 or more service connections and system losses greater than 15%, or has fewer than1,000 service connections and system losses greater than 25%, the public water system shall complete a survey of leaks using one of the available technical methods and complete a corrective action plan.

The City complies with the procedures regulated by the PSC in ch. PSC 185 regarding system water losses. The water system has very low unaccounted-for water, which includes water loss from leaks. The City operates and maintains its water system to minimize unaccounted-for water to typically 5 percent, well below the AWWA-recommended 10 percent, the PSC action level of 15 percent and the requirement for a leak detection and repair program established in PWS-2. None-the less, the City has implemented leak prevention, detection and repair measures as described in the following paragraphs.

EXHIBIT 4-1
NR 852 Table 1 Conservation and Efficiency Measures

2005–2009						2010–2030						2030–2050					
Conservation Measure	Date	Residential	Commercial	Industrial	Public	Conservation Measure	Date	Residential	Commercial	Industrial	Public	Conservation Measure	Date	Residential	Commercial	Industrial	Public
PWS-1, Water Use Audit																	
Perform water use audit following procedures in ch. PSC 185.	2006	X	X	X	X	Perform water use audit following procedures in ch. PSC 185.	Every 5 years	X	X	X	X	Perform water use audit following procedures in ch. PSC 185.	Every 5 years	X	X	X	X
Minimize water loss and un-accounted water with universal metering.	Continuously	X	X	X	X	Minimize water loss and un-accounted for water with universal metering.	Continuously	X	X	X	X	Minimize water loss and un-accounted for water with universal.	Continuously	X	X	X	X
Loop water mains to reduce water volumes needed for annual flushing.	Annually	X	X	X	X	Loop water mains to reduce water volumes needed for annual flushing.	Annually	X	X	X	X	Loop water mains to reduce water volumes needed for annual flushing.	Annually	X	X	X	X
						Develop unidirectional waterman flushing program to improve flushing efficiency.	2015					Conduct unidirectional flushing to reduce water used for routine waterman maintenance.	Annually	X	X	X	X
						Implement unidirectional flushing to reduce water used for routine waterman maintenance.	2017–2030	X	X	X	X						
PWS-2, Leak Detection and Repair																	
Proactively investigate aberrant flowmeter readings to detect leaks.	Continuously	X	X	X	X	Proactively investigate aberrant flowmeter readings to detect leaks.	Continuously	X	X	X	X	Proactively investigate aberrant flowmeter readings to detect leaks.	Continuously	X	X	X	X
Replace old mains to avoid leaks.	Annually	X	X	X	X	Replace old mains to avoid leaks.	Annually	X	X	X	X	Replace old mains to avoid leaks.	Annually	X	X	X	X
						Survey and repair watermain and service connection leaks at level where water savings benefits exceed program costs	Annually	X	X	X	X	Survey and repair watermain and service connection leaks at level where water savings benefits exceed program costs	Annually	X	X	X	X
PWS-3, Information and Education Outreach																	
Planning and Monitoring																	
Implement Water Conservation and Protection Plan with near-, mid-, and long-term water efficiency goals.	2006	X	X	X	X	Update Water Conservation and Protection Plan with input from customers and City leaders.	Every 5 years	X	X	X	X	Update Water Conservation and Protection Plan with input from customers and City leaders.	Every 5 years	X	X	X	X
Prepare annual PSC Water Conservation Program summary reports.	2009–2010	X	X	X	X	Prepare annual PSC Water Conservation Program summary reports.	Annually	X	X	X	X	Prepare annual PSC Water Conservation Program summary reports.	Annually	X	X	X	X
						Prepare annual WDNR Water Conservation Program summary reports.	Annually	X	X	X	X	Prepare annual WDNR Water Conservation Program summary reports.	Annually	X	X	X	X
Collaboratively establish and maintain leadership role in regional Wisconsin Water Conservation Coalition.	2006–2009	X	X	X	X	Maintain leadership role in Wisconsin Water Conservation Coalition.	Continuously	X	X	X	X	Maintain leadership role in Wisconsin Water Conservation Coalition.	Continuously	X	X	X	X
Outdoor Water Use																	
Adopt City ordinance to restrict outdoor sprinkling.	2006	X	X	X	X	Implement "My Brown Lawn is Green" yard sign campaign.	2010	X	X	X	X	Launch sprinkler restriction public awareness campaign.	Annually	X	X	X	X
Provide refrigerator magnet with sprinkler guidelines to all customers.	2008	X	X	X	X	Conduct workshop on wise outdoor water use with public parks representatives.	2010				X	Provide educational materials at Spring City Gardeners Club Event.	Annually	X	X		

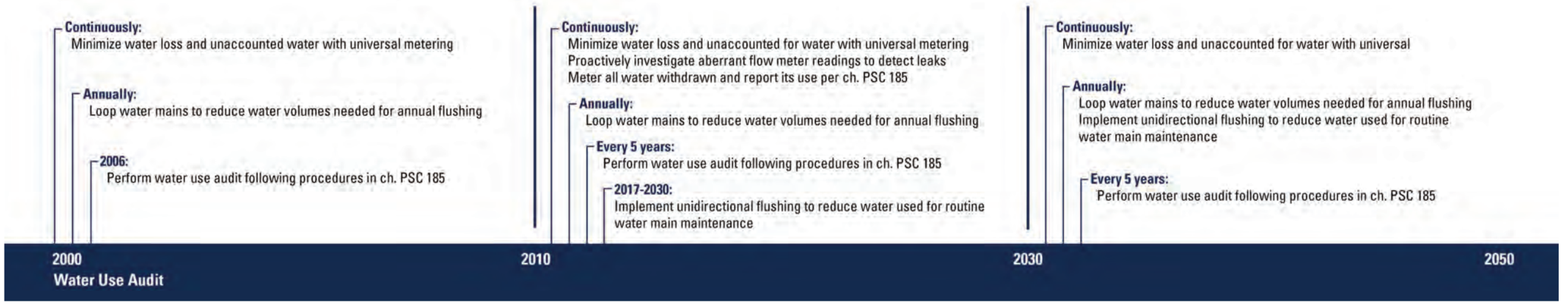
EXHIBIT 4-1
NR 852 Table 1 Conservation and Efficiency Measures

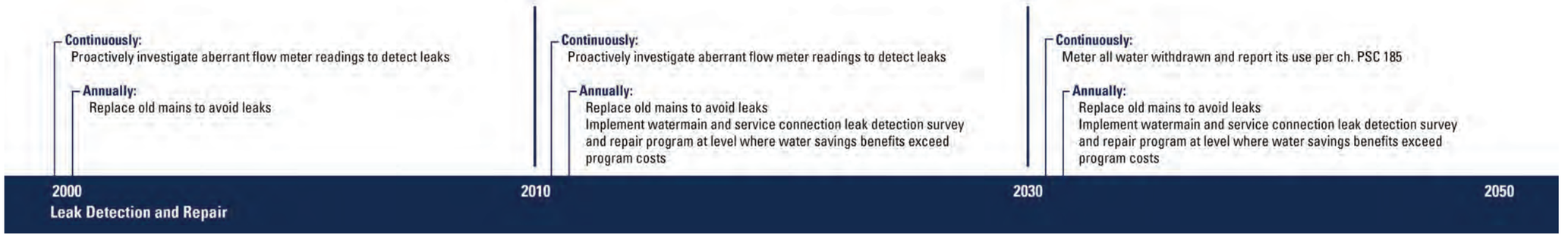
2005–2009						2010–2030						2030–2050					
Conservation Measure	Date	Residential	Commercial	Industrial	Public	Conservation Measure	Date	Residential	Commercial	Industrial	Public	Conservation Measure	Date	Residential	Commercial	Industrial	Public
Install municipal street signs with sprinkler guidelines.	2007	X	X	X	X	Launch sprinkler restriction public awareness campaign.	Annually	X	X	X	X	Conduct customer irrigation control outreach to large irrigators.	Annually		X	X	
Provide educational materials at Spring City Gardeners Club Event.	2008–2009	X	X			Provide educational materials at Spring City Gardeners Club Event.	Annually	X	X								
Educate other area water utilities on starting a rain barrel program.	2008				X	Conduct survey of outdoor water use practices by public customers.	2012				X						
						Survey landscape professionals and equipment suppliers on local irrigation control practices.	2013	X	X	X							
						Conduct customer irrigation control outreach to large irrigators.	2015–2030		X	X							
Education and Outreach																	
Water Conservation in City of Waukesha Public School Curriculum; Educate 1,000 5th graders each year on water supply and conservation.	1990–2009	X				Water Conservation in City of Waukesha Public School Curriculum.	Annually	X				Water Conservation in City of Waukesha Public School Curriculum.	Annually	X			
Water conservation training for City employees; educate staff on conservation goals, implemented measures, and public education information.	2005–2009	X	X	X	X	Water conservation training for City employees.	Annually	X	X	X	X	Water conservation training for City employees.	Annually	X	X	X	X
Residential Challenge & Award — Collaboration with Wisconsin Water Conservation Coalition.	2008	X				Residential Challenge II & III.	2018, 2028	X				Residential Challenge IV & V.	2038, 2048	X			
Restaurant Association Annual Conference Informational Booth and Table Tents.	2009		X			Restaurant Association Annual Conference Participation.	Annually		X			Restaurant Association Annual Conference Participation.	Annually		X		
Water & Energy Efficiency Expo Event Sponsorship and Information Booth.	2010	X	X	X	X	Public Building Retrofit Demonstration Project.	Every 5 years				X	Public Building Retrofit Demonstration Project.	Every 5 years				X
Waukesha Water Utility Administration Building Fixture Retrofit Demonstration Project.	2005				X	Conduct a student water conservation contest.	Every 5 years	X				Conduct a student water conservation contest.	Every 5 years	X			
City Hall Fixture Retrofit Demonstration Project: install high efficiency plumbing fixtures; WDNR support; press release.	2006				X	Conduct Fix-A-Leak Week Promotional Campaign with Informational Materials and Leak Tablet give-away.	Annually	X	X	X	X	Conduct Fix-A-Leak Week Promotional Campaign with Informational Materials and Leak Tablet give-away.	Annually	X	X	X	X
Informative Presentations, Displays Booths																	
Carroll University Water Wise Event.	2006–2009	X	X	X	X	Waukesha Public Library Displays.	Annually	X	X	X	X	Waukesha Public Library Displays.	Annually	X	X	X	X
Waukesha Public Library Displays.	2006–2009	X			X	Various Civic (e.g., Rotary Club) Meetings	Annually	X	X	X	X	Various Civic (e.g., Rotary Club) Meetings.	Annually	X	X	X	X

EXHIBIT 4-1
NR 852 Table 1 Conservation and Efficiency Measures

2005–2009						2010–2030						2030–2050					
Conservation Measure	Date	Residential	Commercial	Industrial	Public	Conservation Measure	Date	Residential	Commercial	Industrial	Public	Conservation Measure	Date	Residential	Commercial	Industrial	Public
Waukesha County Technical Institute, Water Conservation for Commercial and Industrial Applications.	2009		X	X		Professional Society Seminars and Conferences (AWWA, NRWA, Groundwater Guardians, etc)	Annually	X			X	Professional Society Seminars and Conferences (AWWA, NRWA, Groundwater Guardians, etc.).	Annually	X			X
Various Civic (e.g., Rotary Club) Meetings.	Annually	X	X	X	X	Various Civic (e.g., Rotary Club) Meetings.	Annually	X	X	X	X	Various Civic (e.g., Rotary Club) Meetings.	Annually	X	X	X	X
Waukesha Middle School Water Fest.	2009	X				Prairie School Health Fair.	2010	X				Waukesha County Boy Scouts.	Annually	X			
City of Waukesha Open House Forums.	2010	X	X	X	X	Waukesha County Boy Scouts.	Annually	X									
Wisconsin Section American Water Works Association Conference—water conservation and outreach planning.	2005, 2007, 2009	X			X	City of Waukesha Open House Forums.	2010–2015	X	X	X	X						
Wisconsin Section American Water Works Association Water Efficiency Seminar—Conservation Water Rates.	2009	X			X	Environmental & conservation groups meetings.	2010–2020	X	X	X	X						
Wisconsin Groundwater Guardians Festival.	2005	X			X												
Wisconsin Rural Water Association—water conservation planning.	2009	X			X												
GE Medical Energy and Water Conservation Fair.	2008–2009			X													
Promote water conservation goals of City's largest industrial users.	2007				X												
Meetings with environmental groups including Clean Wisconsin, Wisconsin Environmental Action League, and Midwest Environmental Advocates.	2006–2009	X															
Other Communication Media																	
Radio Interview.	2010	X	X	X	X	WUWM Lake Effect Feature Story.	Annually	X	X	X	X	Radio station feature story.	Annually	X	X	X	X
Gus Gnorski Show.	2009	X	X	X	X	Television interview.	Annually	X	X	X	X	Television interview.	Annually	X	X	X	X
Public Access Cable TV	2006–2009	X	X	X	X	Public Access Cable TV.	Annually	X	X	X	X	Public Access Cable TV.	Annually	X	X	X	X
Water Utility Web site news, information, educational materials.	2006–2009	X	X	X	X	Water Utility Web site news, information, educational materials.	Continuously	X	X	X	X	Water Utility Website news, information, educational materials.	Continuously	X	X	X	X
Water Utility bill stuffers.	2006–2010	X	X	X	X	Water Utility bill stuffers.	Annually	X	X	X	X	Water Utility bill stuffers.	Annually	X	X	X	X
						Press releases, radio and TV interview.	Annually	X	X	X	X	Press releases, radio and TV interview.	Annually	X	X	X	X
Press releases, radio and TV interviews.	2006–2010	X	X	X	X	Social media (Facebook, Twitter).	2010–2030	X	X	X	X	Social Media (Facebook, Twitter).	Annually	X	X	X	X
PWS-4, Source Management																	
Meter all water withdrawn and report its use per ch. PSC 185.	Continuously	X	X	X	X	Meter all water withdrawn and report its use per ch. PSC 185.	Continuously	X	X	X	X	Meter all water withdrawn and report its use per ch. PSC 185.	Continuously	X	X	X	X

EXHIBIT 4-2
Implementation Schedule





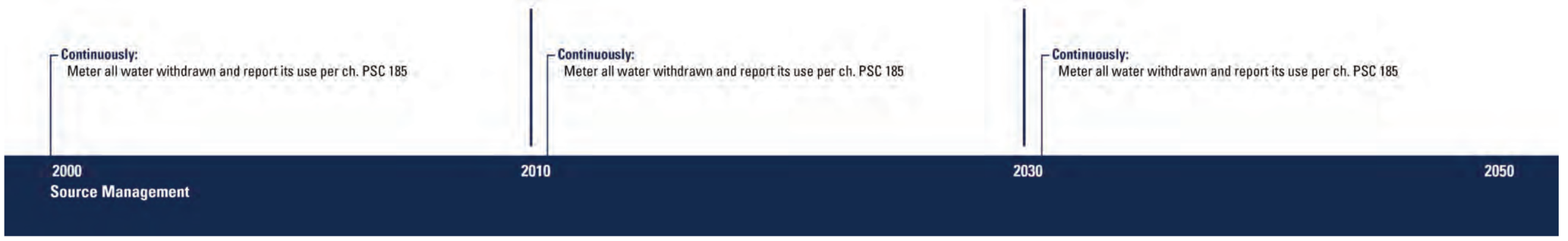
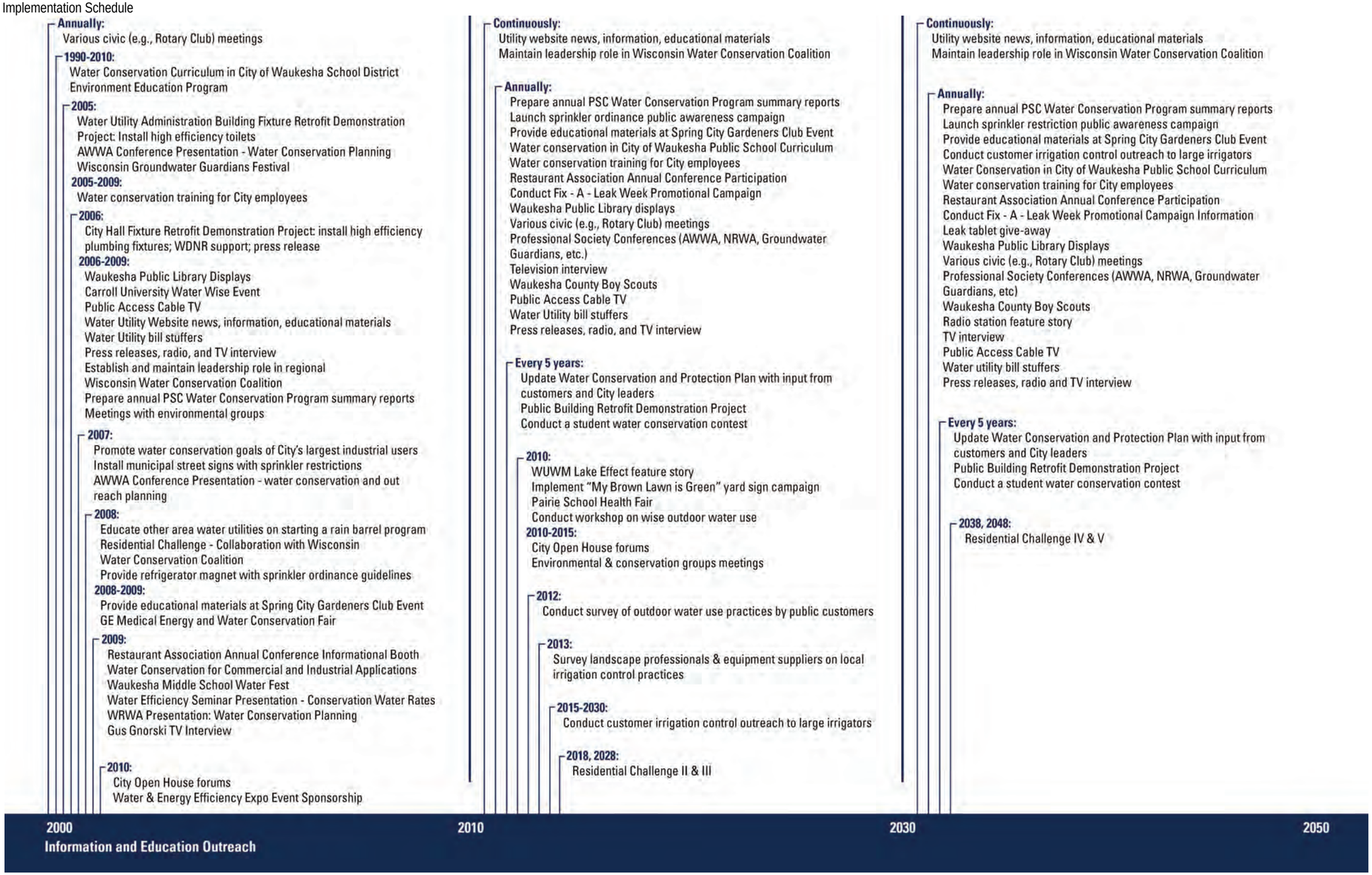


EXHIBIT 4-2
Implementation Schedule



The City's water distribution system has very few water main breaks that result in water loss. The average number of annual main breaks from 2005-2010 was approximately 25 and typically is 30 or fewer. Appendix G contains leak data and an evaluation of leaks in the City's water system. The evaluation concluded that main breaks are not a major contributor to water loss in the City's system.

To minimize leaks, the City reinvests in its system with on-going water main replacement projects. Investment varies annually, but the 2011 capital budget for water transmission and distribution main replacement is $2.5 million.[10] This proactive investment strategy to replace aging infrastructure limits system water loss and contributes to the City's low water loss rates.

To detect and repair leaks early, the City searches for leaks by routinely monitoring customer meter readings. When meter readings are unusually high or low, the City investigates the cause promptly to avoid wasted water or inaccurate water measurement. In this way, leaks are identified and repaired in a timely manner. Also, upon customer request, the City conducts water use studies to define water use trends and look for leaks.

In the future, the City will maintain its present leak mitigation measures and implement water main and service connection leak detection survey and repair program at a level where water savings benefits exceed program costs.

4.1.3 PWS-3, Information and Education Outreach

CEM #	Description	Required Element
PWS-3	Information and Education Outreach	1. Provide information to employees and customers regarding water conservation and water use efficiency. Include all of the following items: reasons why water conservation is necessary, consequences of not conserving water, and actions needed to achieve the water conservation goals of the community. Provide information and education in an effective format to customers and employees specific to landscape watering practices. Public water supply systems regulated by the Public Service Commission shall follow the utility billing procedures indicated in ch. PSC 185. 2. Develop and deliver a training plan to educate and train employees on the implementation of water conservation and efficiency measures at public water system facilities. Information and education materials shall be made available to the department.

Using lessons learned by other cities across the country, the City designed its water conservation program with education and outreach as the cornerstone. Through a wide array of events, media, and strategic collaborations, the City's customers have been made aware of the City's conservation goals and been given resources to help them save water.

The City designs and delivers water conservation and water use efficiency information to its customers through a variety of communication channels. Exhibit 4-1 is a comprehensive list of the City's water conservation communication activities, aimed to educate customers and staff. Examples of the City outreach program materials are included in Appendix F. Because of its efforts, ranging from educating thousands of City elementary school students to showcasing customer water conservation success stories, the City has been recognized by

[10] City of Waukesha Water Utility annual budget.

the Waukesha School District Most Valuable Partner Award (2007) and the Wisconsin Water Association's Water Efficiency Award (2008).

Through education and outreach, the City has learned that its customers value saving money, understanding local water issues, and doing the right thing. The City also learned that its customers are willing to change their water use practices. For example, through the Residential Customer Challenge in 2008, some City customers reduced water use by 50 percent.[11]

The City has also learned the value of strategic partnerships in "getting the message out." In particular, the City's innovative collaboration with the Wisconsin Water Conservation Coalition advances outreach to the residential, commercial and industrial sectors and creates the opportunity to neighboring communities to coordinate conservation efforts.

The City trains its employees annually on water conservation so that they may serve as ambassadors of the program and help enforce water use restrictions. Employees, particularly those who interface directly with customers, are provided with resources, like standard forms and information, to help them educate customers and, if necessary, enforce conservation measures like the sprinkler ordinance.

No conservation program can be successful without the informed participation of its customers. Therefore, the City will continue to gather data and work closely with customers so that it can measure the water saved from changed water use behaviors and their associated costs. Specific outreach activities the City is considering in the near-term future include:

- Expanding its Web site on-line library of resources
- Making available to customers an on-line water use calculator
- Expanding the City's school water education program to include "Teach the Teacher" workshops

4.1.4 PWS-4, Source Measurement

CEM #	Description	Required Element
PWS-4	Source Measurement	Measure or estimate all water withdrawals monthly or more frequently to allow for identifying and understanding variability in water use over time. Public water supply systems regulated by the Public Service Commission shall follow the metering requirements provided in ch. PSC 185.

The City measures water withdrawals daily and reports all water meter data in accordance with ch. PSC 185. In addition, the City meters all of its customer connections. The City complies with the meter flow testing and accuracy requirements stipulated in ch. PSC 185.

Section 3 summarizes 10 years of water production and water use data. The City uses this information to better understand variability of water use over time for each customer class. It also uses the information to design effective conservation measures, including the sprinkler ordinance to shave peak season flows, and an inclining rate block structure. Such information also is used to identify water trends and to develop future programs to encourage water savings.

[11] City of Waukesha customer meter data.

Water source measurement and evaluation will continue to be used in the future to optimize City water system operations and realize water use savings goals.

4.2 Conservation and Efficiency Measures, Table 2

In addition to the mandatory measures required in Table 1, the CEMs identified in § NR852.05(2) Table 2 are required to be implemented by "Tier 3" applicants for Great Lakes diversion. The City has implemented all of the measures in Table 2. The City will maintain these best practices in the future. Refer to Exhibits 4-3 and 4-4.

4.2.1 PWS-R1, Distribution System Pressure Management

CEM #	Description	Required Element
PWS-R1	Distribution System Pressure Management	Analyze distribution system pressure management to identify opportunities to reduce water use and minimize plumbing fixture leaks.

Following development of the City's 2006 water system master plan, an analysis of distribution system pressure management was conducted. Conclusions from this work, contained in Appendix I, include the following:

- The distribution system is operated to meet pressure requirements stipulated in Wisconsin Administrative Code NR 811.70 (4). These requirements include maintaining a minimum 20 pounds per square inch (psi) of pressure under all conditions and maintaining pressures from 35 to 100 psi under normal static conditions.
- The system's eight pressure zones are designed to deliver adequate water supply and pressure over widely varied service area topography.
- Through comparison of published drinking water industry benchmarks and historical system performance data, pressure does not appear to be a major contributor to main breaks or leaks

The City notifies their customers via mailings when they make occasional adjustments to system pressures due to system upgrades. They use this opportunity to further educate their customers about checking for and repairing potential leaks in their home. An example of this correspondence is included in Appendix G.

In the future the City will continue to use its hydraulic distribution system model to evaluate and optimize pressure and customer demand changes.

4.2.2 PWS-R2, Residential Demand Management Program

CEM #	Description	Required Element
PWS-R2	Residential Demand Management Program	Establish and publicize a program to complete residential customer water use audits and leak surveys upon customer request based on high or aberrant water use. In developing the program a waiver of liability and written permission from the customer may be needed.

The City provides resources for residential customers to conduct home water use audits. For example, this year the City started and will maintain distribution of leak tablets along with home water audit guidance in conjunction with the EPA WaterSense® Fix-A-Leak Week promotional event.

Also, upon customer request, the City will conduct a water use study by monitoring real time water use to define water use trends and look for leaks.

Furthermore, because residential customers represent the City's largest customer class in terms of water consumption and number of connections, residential demand management is the initial focus for the City's water conservation program. Early activities include customer outreach and information, a residential water use reduction contest, fixture replacement incentives, and policies to encourage efficient outdoor water use. These residential demand management measures result in water savings:

- Toilet rebate program participants save over 15,000 gallons per year.[12] As of 2010, the total volume of water saved from the toilet rebate program was 1,430,825 gallons.[13]
- Between 2005 and 2009, peak season pumping was reduced 16.8 percent.
- Since 2005, declining water use reduced the number of days water demand exceeded 10 mgd from 28 to 0. The City has an operational goal to pump 10 mgd or less, to meet its radium compliance consent order.
- There is a declining trend in peak season use.

The City also uses pricing signals to encourage water use efficiency through its residential increasing block rate structure which assesses higher incremental rates for higher consumption tiers. To more closely align water use behaviors with billing statements, the City will evaluate converting from a quarterly to a monthly billing cycle.

Starting this year (2011) and moving forward, the City will expand its residential fixture replacement incentive program to include larger financial incentives and include showerheads and clothes washers. Toilets, washing machines and showers are among the highest daily indoor water uses.[14]

[12] City residential meter reading data, 2008–2010.

[13] Waukesha Water Utility Report on Water Conservation Programs to the Public Service Commission of Wisconsin, 2010.

[14] P. Commes, T. Rockaway, J. Rivard, and B. Kornstein. 2011. "Residential Water Use Trends in North America." *Journal AWWA.* February.

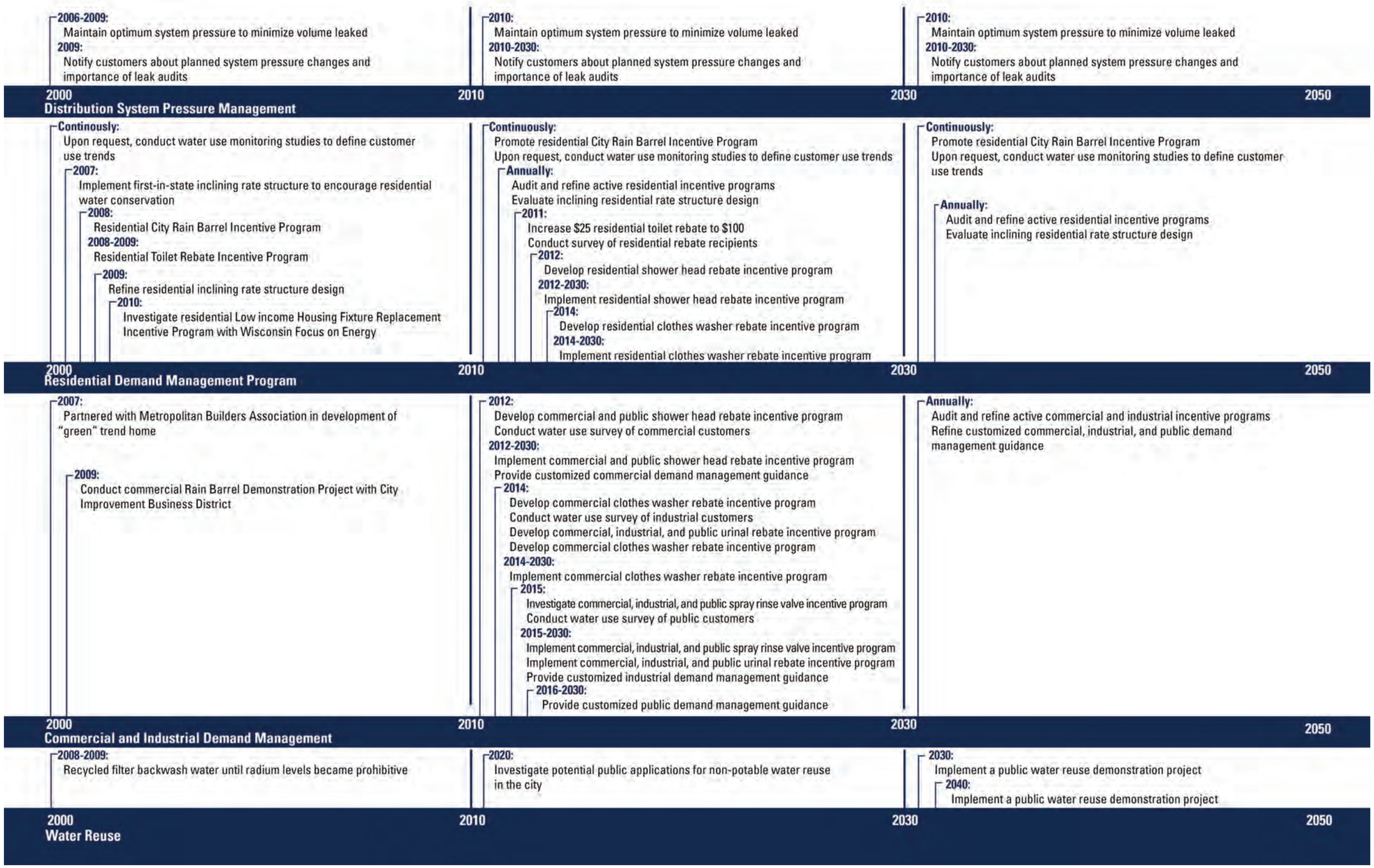
EXHIBIT 4-3
NR 852 Table 2 Conservation and Efficiency Measures

2005–2009						2010–2030						2030–2050					
Conservation Measure	Date	Residential	Commercial	Industrial	Public	Conservation Measure	Date	Residential	Commercial	Industrial	Public	Conservation Measure	Date	Residential	Commercial	Industrial	Public
PWS-R1, Distribution System Pressure Management																	
Maintain optimum system pressure to minimize volume leaked.	2006–2009	X	X	X	X	Maintain optimum system pressure to minimize volume leaked.	2010–2030	X	X	X	X	Maintain optimum system pressure to minimize volume leaked.	2030–2050	X	X	X	X
Notify customers about planned system pressure changes and importance of leak audits.	2009	X	X	X	X	Notify customers about planned system pressure changes and importance of leak audits.	2010	X	X	X	X	Notify customers about planned system pressure changes and importance of leak audits.	As Needed	X	X	X	X
PWS-R2, Residential Demand Management Program																	
Incentives Programs																	
Toilet Rebate Incentive Program.	2008–2009	X				Increase $25 toilet rebate to $100. Conduct survey of rebate recipients.	2011	X				Audit and refine active incentive programs.	Annually	X			
Initiated City Rainbarrel Incentive Program.	2008	X				Audit and refine active incentive programs.	Annually	X				Promote City Rainbarrel Incentive Program.	Continuously	X			
Conduct water use study to define customer use trends	2006 -2009	X	X	X	X	Conduct water use study to define customer use trends	Annually	X	X	X	X	Conduct water use study to define customer use trends	Annually	X	X	X	X
						Promote City Rainbarrel Incentive Program.	Continuously	X									
						Investigate low income housing fixture replacement incentive program with Wisconsin Focus on Energy.	2010	X									
						Develop clothes washer rebate incentive program.	2014	X									
						Implement clothes washer rebate incentive program.	2014–2030	X									
						Develop showerhead rebate incentive program.	2012	X									
						Implement showerhead rebate incentive program.	2012–2030	X									
Residential Demand Management Water Pricing																	
Implement first-in-state inclining rate structure to encourage water conservation.	2007	X				Evaluate inclining rate structure design.	Annually	X				Evaluate inclining rate structure design.		X			
Refine inclining rate structure design.	2009	X				Investigate converting from quarterly to monthly billing frequency.	2016	X									
PWS-R3, Commercial and Industrial Demand Management																	
Conduct Rainbarrel Demonstration Project with City Improvement Business District.	2009		X			Conduct water use survey of commercial customers to develop criteria to customize demand management and water use guidance.	2012		X			Audit and refine active incentive programs.	Annually		X	X	X

EXHIBIT 4-3
NR 852 Table 2 Conservation and Efficiency Measures

2005–2009						2010–2030						2030–2050					
Conservation Measure	Date	Residential	Commercial	Industrial	Public	Conservation Measure	Date	Residential	Commercial	Industrial	Public	Conservation Measure	Date	Residential	Commercial	Industrial	Public
Partnered with Metropolitan Builders Association in development of "Green" Trend Home.	2007		X			Provide customized commercial demand management guidance.	2013–2020		X			Refine customized commercial, industrial, and public demand management guidance.	Every 5 years			X	
						Conduct water use survey of industrial customers to develop criteria to customize demand management and water use audit guidance.	2014			X							
						Provide customized industrial demand management guidance.	2015–2030			X							
						Conduct water use survey of public customers to develop criteria to customize public demand management and water use audit guidance.	2015				X						
						Provide customized public demand management guidance.	2016–2030				X						
						Develop urinal rebate incentive program	2014		X	X	X						
						Implement urinal rebate incentive program.	2015–2030		X	X	X						
						Develop clothes washer rebate incentive program.	2014		X								
						Implement clothes washer rebate incentive program.	2014–2030		X								
						Develop showerhead rebate incentive program.	2012		X		X						
						Implement showerhead rebate incentive program.	2012–2030		X		X						
						Investigate spray rinse valve incentive program in collaboration with Wisconsin Focus on Energy.	2015		X	X	X						
						Implement spray rinse valve incentive program.	2015–2030		X	X	X						
						Evaluate inclining rate structure for commercial and industrial customers.			X	X							
PWS-R4, Water Reuse																	
Recycled filter backwash water until radium levels in water prohibited this practice.	2008–2009					Investigate potential applications for nonpotable water reuse in the City.	2020				X	Implement a water reuse demonstration project	2040				X
Audit water utility facilities to identify water reuse applications.	2008					Implement an environmentally sound water reuse demonstration project.	2030				X						

EXHIBIT 4-4
Implementation Schedule



4.2.3 PWS-R3, Commercial and Industrial Demand Management Program

CEM #	Description	Required Element
PWS-R3	Commercial and Industrial Demand Management Program	Establish and publicize a program to complete commercial and industrial customer water use audits and leak surveys upon customer request based on high or aberrant water use. In developing the program, a waiver of liability and written permission from the customer may be needed.

The largest industrial customers in the City include food processors, metal processors, foundries, and health care facilities. The City actively provides water conservation information to the industries it serves. Through the Wisconsin Water Conservation Coalition, representatives of several large industrial customers collaborate with the City to promote and accomplish water conservation. Some examples, including the following, are documented in Appendix H:

- Navistar Waukesha Manufacturing performed a water use assessment and replaced hard water in its cooling tower applications with softened water. As a result, less water is added to the system and fewer purge cycles are needed. Automatic shut-off valves and controls further optimize water use in the water cooled heat exchangers. This saves 15,000,000 gallons per year, a 23 percent decrease in water usage, saves $30,000 annually and had a return on investment of 6 months.[15], [16]

- Dean Foods/Golden Guernsey Dairy conducted a water audit and identified several water saving ideas. The company implemented changes to water lubricated systems, cooling water recirculation in homogenizing units, and wash water handling with an estimated total water savings of 1,850,000 gallons per year.

- GE Healthcare Waukesha Campus focused water conservation efforts on employee education, installation of faucet aerators, leak detection, and reducing water wasted in janitorial services. The resultant water savings is 324,000 gallons per year.[17]

Through the Wisconsin Water Conservation Coalition, the City has worked with commercial class customers to promote water conservation in restaurants, use of rain barrels in the City's business district, and development of "green" residential homes with high-efficiency plumbing fixtures and grey-water systems.

In the near future, the City will undertake more detailed evaluations of water use within the commercial and industrial sectors. This information and additional research will help the City design commercial and industrial demand management measures customized to customers. In the interim, the City has commercial and industrial demand management and water audit guidance available upon request.

[15] Navistar Waukesha Manufacturing, WAU Use Softened Make-Up Water to Furnace Cooling Tower, 11/22/2010.

[16] Case Study: Pure Power Technologies Water Savings Summary. 2010.

[17] GE Healthcare water conservation summary presentation, 2010.

4.2.4 PWS-R4, Water Reuse

CEM #	Description	Required Element
PWS-R4	Water Reuse	Conduct a technical assessment to evaluate the feasibility of water reuse in the operation of the facility. Implement water reuse projects identified by the assessment and allowed under current state law.

The City has evaluated the feasibility of water reuse in the operation of its water supply, treatment, and distribution facilities. There are negligible opportunities for water reuse for the following reasons:

- Plumbing fixtures in the Administration Building have been retrofit with high-efficiency units.
- Landscaped areas are not irrigated.
- Water used in water treatment processes cannot be recycled because of high radium concentrations.

Based on preliminary outreach with industrial customers, the City will investigate industrial water reuse opportunities. For example, it may be cost-effective to replace water used for seasonal irrigation with spent cooling water that otherwise would be discharged to the sewer.

5. Evaluation of Additional Conservation and Efficiency Measures

To implement a water conservation program that meets the target goals of 0.5 mgd of water saved by 2030 and 1.0 mgd of water saved by 2050 in accordance with its *Application for Lake Michigan Water Supply*, the City evaluated a wide range of conservation measures through a process that involved initial screening of alternatives, cost-effectiveness analyses, and consideration of non-economic criteria. The CEMs evaluated in this section demonstrate compliance with §§ NR 852.06–.09.

5.1 Initial Screening of CEMs

The City evaluated best practices for water use efficiency from across the country, including those in the AWE Water Conservation Tracking Tool Version 1.2 (AWE Tool) library. This guidance, along with an understanding of customer water use, allowed the City to screen CEMs at a high level to identify those most likely to be effective. Exhibit 5-1 lists the results of the City's initial screening of CEMs for residential customers.

EXHIBIT 5-1
Screening CEMs for further Evaluation for Residential Customers

	AWE Library	Applicable	Not Applicable	Comments
Meter installation	✓		✓	All residential customers are metered.
Residential surveys	✓	✓		
Ultra low flow toilet rebates	✓		✓	High efficiency toilet retrofits would provide greater savings.
High efficiency toilet rebates	✓	✓		CEM will be maintained and improved with monitoring data and customer input.
High efficiency toilet direct installation	✓		✓	Would be challenging to implement because of City's public bidding process.
High efficiency washer rebates	✓	✓		
Dishwasher rebate	✓	✓		
Low flow showerheads	✓	✓		
High efficiency water heater rebates		✓		
Rain gauge or sensor	✓	✓		
Irrigation technologies	✓	✓		
Landscape practices		✓		
Stormwater reuse; e.g., rain barrels	✓	✓		
Turf replacement	✓		✓	Would not be well received by customers.

Commercial, industrial, and institutional water users provide the following vital services:

- Public health (hospital)
- Public safety (county correctional facility)
- Education (college, school district)
- Retail, tourism and other services
- Manufacturing jobs

An assessment of current commercial, industrial, and institutional (CII) customers indicates that water use savings can be achieved most efficiently by focusing on key water uses such as toilets, laundry facilities, and kitchens in customer facilities with resident populations, such as hotels, dormitories, nursing homes and hospitals. Exhibit 5-2 summarizes the results of the City's high-level screening of CEMs for these customer classes.

EXHIBIT 5-2
Screening Additional CEMs for Further Evaluation for Institutional, Commercial, and Institution Customers

	AWE Library	Applicable	Not Applicable	Comments
½ gallon urinal	✓	✓		
Ultra low flow toilet	✓		✓	High efficiency toilet retrofits would provide greater savings.
HE toilet	✓	✓		
Laundromat	✓	✓		
Dishwasher	✓	✓		
Spray rinse valve	✓	✓		Collaborate with Wisconsin Focus on Energy.
Cooling tower	✓	✓		
Large landscape surveys	✓	✓		
CII water use audits		✓		
Food steamer rebate	✓	✓		
Ice machine rebate		✓		
Rainwater/condensate reuse incentive		✓		
Water heater		✓		
Irrigation technologies	✓	✓		
Landscape practices		✓		

It is expected that the CEMs, along with other ideas, will be evaluated further in conjunction with customer and stakeholder input during the 2011 formal update to the 2006 Plan.

5.2 CEM Cost-Effectiveness with AWE Tool

Several candidate CEMs identified through the initial screening process were used to build a portfolio of activities with water savings, costs, and benefits estimated by the AWE Tool. The activities selected for the cost-effectiveness evaluation met the following specific criteria:

- Saves water so that less is needed to meet future demands
- Improves water efficiency so that infrastructure capacity is better utilized and infrastructure economic life is extended
- Provides long-term benefits from avoided capital, operating, and maintenance costs
- Maintains or improves customer satisfaction

In preparation for using the AWE Tool, the City attended a training workshop led by the Alliance for Water Efficiency and participated in the 2009 Water Research Foundation study "A Balanced Approach to Water Conservation: Removing Barriers and Maximizing Benefits." Through the study, the City gained support from national experts who assisted in the development of the AWE Tool to populate the tool with City data. During the process of simulating alternative water conservation program scenarios, the City's technical consultant reviewed all data and results for quality control. The City also verified input data values and tool output through comparison with metrics and water use information published in the *Handbook of Water Use and Conservation* by Amy Vickers (2001).

5.3 AWE Tool Results

Using guidance in NR852, the implementation timeline, City water utility data, and experience gained from existing conservation activities, the AWE Tool was used to analyze the performance of the City's conservation program as it is expanded to meet its goals. The set of additional CEMs that comprise this analysis is shown in Exhibit 5-3. Of the activities listed in Exhibit 5-3, three have been completed by the City: the $25 toilet replacement for residential and commercial customers and the fixture retrofit demonstration project at City Hall. The remaining activities will be implemented during the 2010– 2030 planning horizon as described in Section 4.

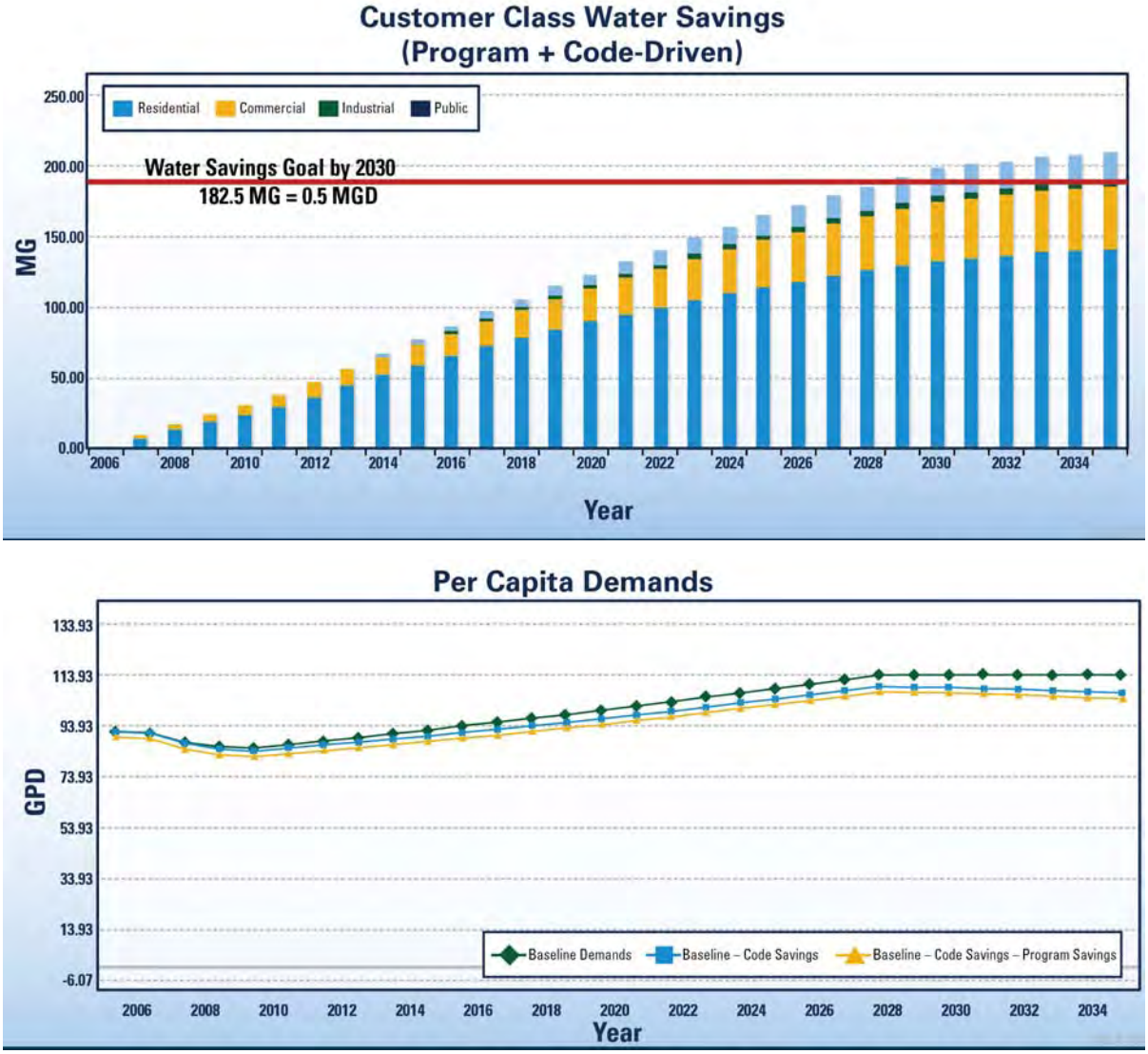
The estimated water use savings shown in Exhibit 5-4 represent the results of the program activities by customer class and

EXHIBIT 5-3
City Water Conservation Program CEMs

Activity Name
Residential HE Toilets, SF—$25 Rebate
Residential HE Toilets, MF & Commercial—$25
Residential HE Toilets, SF—$100 Rebate
Residential HE Toilets, MF—$100 Rebate
CII HE Toilet—$100 Rebate Commercial
CII HE Toilet—$100 Rebate Public
CII HE Toilet—$100 Rebate - Industrial
Residential LF Showerhead Rebate $20, Single-Fam
LF Showerhead $20 Rebate, Multi-Family
LF Showerhead $20 Rebate, Commercial
LF Showerhead $20 Rebate, Public
LF Showerhead $20 Rebate, Industrial
CII 1/2 Gallon Urinal $100 Rebate: Commercial
CII 1/2 Gallon Urinal $100 Rebate: Public
CII 1/2 Gallon Urinal $100 Rebate: Industrial
Residential HE Washer Rebate $50, SF
HE Washer Rebate $100, MF
City Hall Retrofit Demonstration Project
CII Hotels/Healthcare laundries$100 Rebate

include code-driven water savings that occur over time as codes are revised to require more efficient plumbing fixtures. Appendix I presents the estimated water savings from each activity.

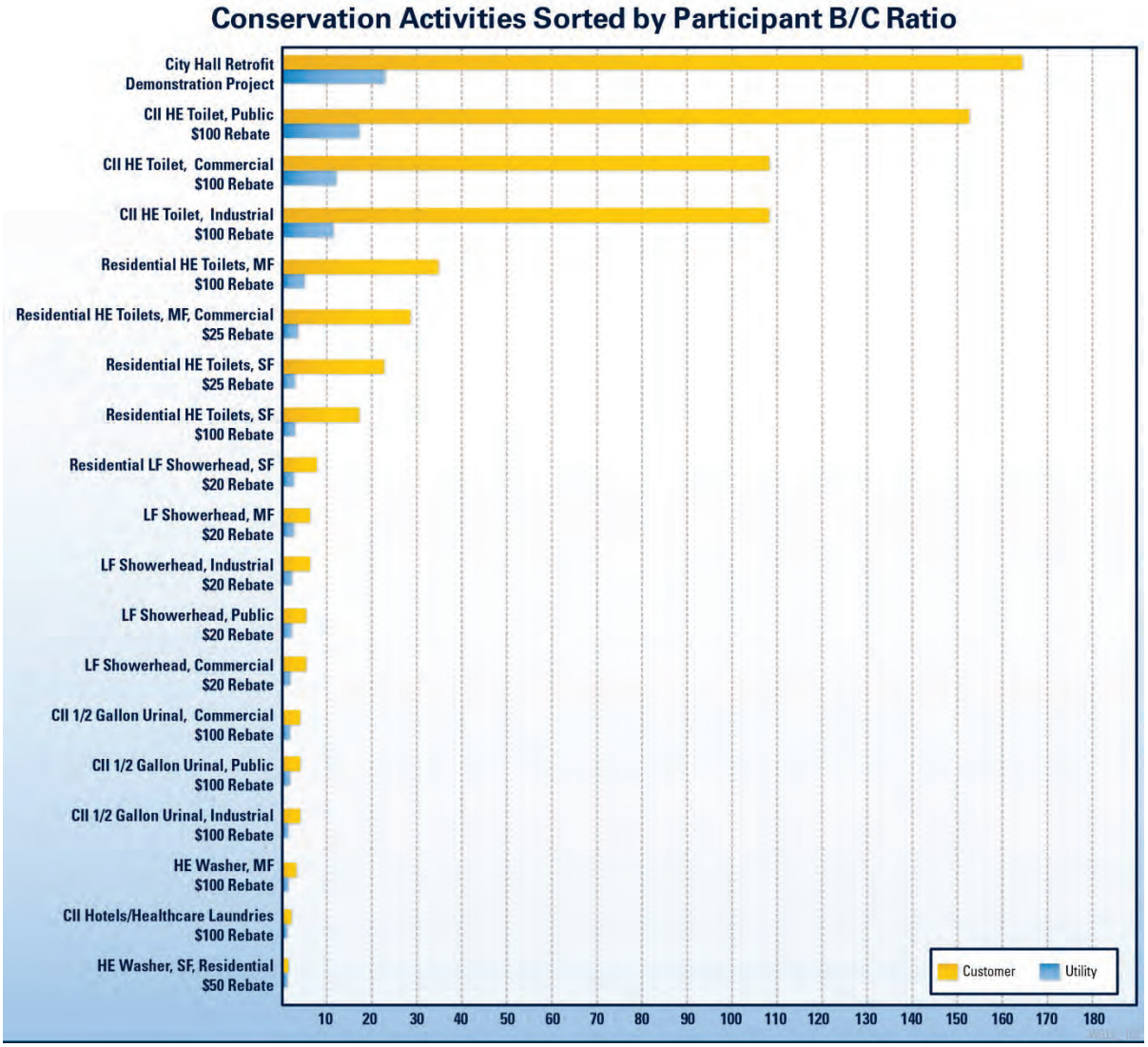
EXHIBIT 5-4
City Estimated Water Use Savings



This menu of additional CEMs establishes the baseline of activities the City will implement to reduce water use by 0.5 mgd (182 MGY) by 2030 through conservation. These activities will be expanded between 2030 and 2050 to achieve an additional 0.5 mgd savings to achieve the 1.0 mgd, or 10 percent, reduction goal. While water use intensity, as measured in gallons per capita per day, is at all-time historical low levels now, it is anticipated the economic recovery particularly in the commercial and industrial sectors will restore water use to year 2000 levels (about 112 gpcd) before 2030. This is consistent with the water supply planning analysis conducted for the City's *Application for Lake Michigan Water Supply*.

The benefit-to-cost ratio (B/C) for each conservation activity for the City and its customers is presented in Exhibit 5-5. A conservation measure with a B/C greater than 1 is an improvement. Measures with a B/C less than one should be re-evaluated to consider changes to the program activity or to consider other non-economic benefits. For this package of CEMs, the overall B/C for the City is 4.0 and for City customers, 19.4. Exhibit 5-5 depicts the B/C of individual conservation activities.

EXHIBIT 5-5
City of Waukesha Additional CEM Benefit-to-Cost Ratio Analysis Summary



5.4 Non-economic Considerations

Other CEMs essential to the City's conservation program were not evaluated using the AWE Tool because effectiveness cannot be readily measured in terms of water volume saved and invested costs. Instead, the effectiveness of these activities (e.g., public education and outreach, inclining water rates, customized water use audits) is gauged primarily through

qualitative benchmarks such as customer satisfaction, changes in customer water use behaviors, and knowledge gained.

5.5 Monitoring Plan

As noted in Section 1of this Supplement, the City gathers and reviews extensive water use and financial data on an on-going basis to estimate real costs and water savings resulting from CEMs. Annually, the City reports a detailed analysis of the water conservation program to the state, by order of the PSC. To determine the overall effectiveness of CEMs, the City solicits feedback from customers. Monitoring the results of water conservation efforts is a part of routine City operations. Such annual monitoring and adjustment of implementation strategies will allow the City to incorporate new technology and best management practices to meet its water use efficiency goals.

6. Next Steps

This supplement to the City's 2006 Plan was developed in support of the City's *Application for Lake Michigan Water Supply*. The supplement achieves its purpose by:

- Affirming the City's long-term commitment to using drinking water resources efficiently
- Demonstrating a rigorous approach to water conservation planning
- Documenting the City's proactive compliance with recently published NR 852 Establishing a detailed roadmap of future conservation activities that will serve as the basis for the 2011 update to the 2006 Plan

The City will advance its water conservation planning process in the following steps:

- Refine its package of candidate CEMs with input from WDNR.
- Engage customers to review the supplement and to provide feedback on forthcoming conservation activities.
- Gather input from the Waukesha Water Utility Commission, appropriate City departments, and other key stakeholders.
- Draft a formal update to the 2006 Plan.
- Coordinate the 2011 Update with the PSC and the WDNR.
- Present the fully vetted final 2011 Update to the City's Water Conservation and Protection Plan to City Council for adoption.

7. References

AWWA. 2009. *Water Audits and Loss Control Programs.* Manual 36.

AWWA. 2010. *Water Conservation Programs – A Planning Manual.* Manual 52.

Beecher, Janice A. 2010. "The Conservation Conundrum: How Declining Demand Affects Water Utilities."*Journal AWWA.* February.

City of Waukesha, Wisconsin. May 2010. *Draft Application for Lake Michigan Water Supply.*

Earth Tech. 2006. *Water System Master Plan, Waukesha Water Utility.*

Hoffman, H. W. 2008. "Capturing the Water You Already Have: Using Alternate Onsite Sources." *Journal AWWA.* May.

Hopkins, Edward, Ph.D., Assistant Wisconsin State Climatologist, Wisconsin State Climatology Office. March 14, 2011. Personal communication with Linda Mohr, CH2M HILL.

Rockaway, T. D., P. A. Coomes, J. Rivard, and B. Kornstein. 2011. "Residential Water Use Trends in North America. *Journal AWWA.* February.

SEWRPC. January 2011. *Regional Water Supply Plan for Southeastern Wisconsin,* Newsletter 4.

Vickers, Amy. 2001. *Handbook of Water Conservation and Water Use Efficiency.*

Waukesha Water Utility. Water pumpage data, 2005–2010.

Appendix A

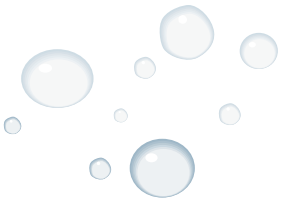
Waukesha Water Utility
Water Conservation and Protection Plan

WATER CONSERVATION &
PROTECTION PLAN

Approved March 2006

Waukesha Water Utility

GeoSyntec
Consultants



Prepared for:

Waukesha Water Utility

(262)-521-5272

http://www.ci.waukesha.wi.us/WaterUtility/

By GeoSyntec Consultants

Jeffrey Edstrom

Bill Ward

(312) 658-0500

www.geosyntec.com

Executive Summary

Overview

Waukesha is proposing a groundwater conservation and protection plan to reduce water use, to ensure the availability of future drinking water supplies and to protect the environment.

Waukesha's existing supply is pumped primarily from a deep confined aquifer. The level of the aquifer has declined over the course of the last 100 years due to pumping from a large number of communities in southeastern Wisconsin and northeastern Illinois. While Waukesha's overall pumpage has decreased over the last 20 years, the aquifer continues to drop due to the fact that it recharges at a slow rate compared to unconfined aquifers in other parts of the state that are recharged by shallow groundwater. The declining aquifers have led to higher concentrations of radium and other contaminants. These problems are forcing the utility to increase water treatment as well as seek new water supplies.

Conserving water provides a number of benefits to water utility customers, the environment, and the utility itself. It saves money for customers by reducing their need for water and by reducing energy costs. The utility saves money through lower energy costs, lower pumping costs, and deferred capital costs. The environment benefits by lessening the strains on water resources.

The following discussion provides background information, a work plan and a schedule for developing a comprehensive water resources protection and conservation program for the City of Waukesha. This discussion concludes with a brief work plan of activities to complete the technical approach in three phases.

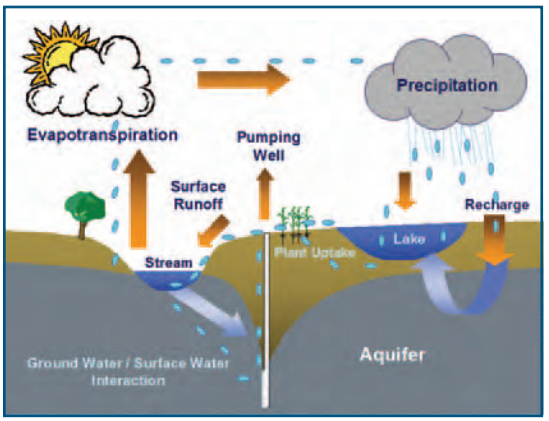


Figure 1. The Water Cycle
Source. Environmental Protection Agency

Recommendations

The Waukesha Water Utility (WWU) must make a decision concerning its long-term public water supply. Potential new water supplies all require conservation, whether it is Lake Michigan or local groundwater. The Great Lakes Governors and Premiers will require conservation before Waukesha can obtain a Lake Michigan surface water supply. Growing communities throughout Waukesha County will all need to coordinate their conservation efforts to ensure that there are adequate supplies for their customers if they seek additional local groundwater. Conservation and protection will help ensure the long-term viability of the sources shared with other Waukesha County communities. If the city obtains a Lake Michigan supply, strong conservation measures will be required by the Great Lakes Governors. **Regardless of the source, the conservation program should be comprehensive in protecting water resources throughout the water cycle** (See Figure 1).

The water conservation and protection plan is based on three primary goals:

1. Reduce water use to ensure that public water supplies are stretched
2. Protect sourcewater areas to ensure water sources are protected from pollution
3. Protect stormwater recharge areas to ensure that groundwater resources are replenished

These goals should be pursued through the following water conservation and protection measures:

1. Increase public awareness about water conservation starting with **"20% by 2020"**, **"Don't Flush Dollar$ Down the Drain"**, and **"Don't Get $oaked by Overwatering Your Lawn"** campaigns.
2. Continue upgrading water main to reduce system leakage. Audit system to detect leaks and prioritize upgrades.
3. Adopt a water sprinkling ordinance that restricts outdoor water use, as well as other residential, commercial, and industrial water use restrictions .
4. Work with the Wisconsin Public Service Commission to develop a water conserving rate structure.
5. Work with the Wisconsin Public Service Commission to develop a water use reduction program that is based on incentives and public education to decrease Waukesha Water Utility customer use.
6. Investigate the phase-out of residential sewer credit meters to discourage outdoor water use.

7. Work with the City of Waukesha, surrounding communities, and Waukesha County to revise existing subdivision and stormwater management ordinances to ensure that they encourage maximum infiltration of stormwater into local groundwater and wetlands and key infiltration areas for existing water resources. This includes the use of green infrastructure and low impact development.
8. Implement sourcewater protection measures in coordination with the county and Waukesha County communities. Zoning regulations should include the use of overlay zones to delineate recharge areas as well as other best management practices to protect source waters.
9. Investigate the reuse of Waukesha's wastewater. Reuse may involve "gray" water separation or redirection of treated wastewater for regional aquifer recharge.
10. Organize a stakeholder group to assist in updating and implementing the conservation plan.

Introduction and Rationale for the Project

Use of water resources by communities in southeastern Wisconsin and northeastern Illinois has reduced local groundwater availability and threatens streams, rivers and other environmental resources. It has led to a decrease in water quality and has increased the costs of water resource protection and water treatment.

The City of Waukesha, like many other Waukesha County communities located to the west of the Lake Michigan watershed surface divide, draws its water supply from Lake Michigan tributary groundwater in the deep sandstone aquifer located beneath this region (See Figure 2). In the past, this deep aquifer provided a plentiful, high quality source of water. The Maquoketa aquitard protected the deep aquifer from contamination sources in the Milwaukee metropolitan area. Furthermore, because the recharge areas to the west have been largely undeveloped, the deep sandstone aquifer was further protected.

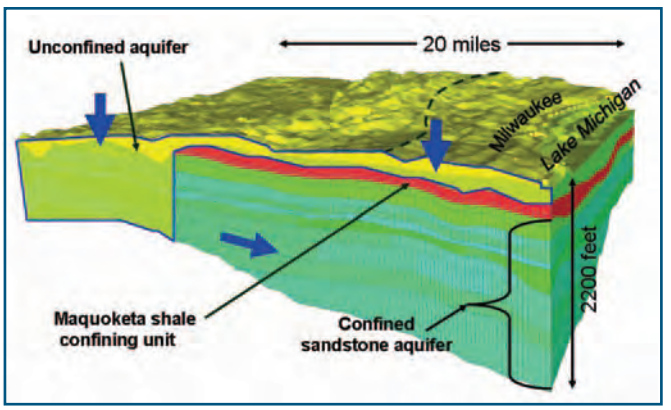


Figure 2. General Hydrogeology of Southeastern Wisconsin
Source: United States Geological Survey

The need for improved groundwater management in the region is further demonstrated by the call for the SEWRPC Regional Water Resource Study and the recent passage of Wisconsin's Groundwater Management Act creating a Groundwater Management Area in Southeast Wisconsin.

Pumping by communities in Milwaukee and Waukesha County over the last century led to a decrease in water levels in the deep aquifers that Waukesha and other communities use for drinking water supply have declined by over 600 feet. As a consequence of this water level decline, radium levels have steadily increased in Waukesha's public water supply wells to the point that they now exceed regulated levels. Waukesha is currently operating under a consent order with the Wisconsin Department of Natural Resources to find a solution to its water resource problems by December 2006.

The City of Waukesha has had success in reducing water use in recent years. The trend for water use is decreasing even as population has increased (See Figure 3). Furthermore, its residential and total per capita water use is among the lowest in southeastern Wisconsin (See Table 1).

Annual Water Use						
	Residential Water Use			Total Municipal Water Use		
County	Total (gallons per day X 1,000)	Per Person (gallons per capita per day)	Per Acre (gallons per acre per day)	Total (gallons per day X 1,000)	Per Person (gallons per capita per day)	Percent Unaccounted for Water
Kenosha	5,619	61	836	13,156	119	12
Milwaukee	51,942	70	1,282	148,378	160	7
Ozaukee	2,570	64	581	5,575	123	14
Racine	7,804	61	832	25,330	175	12
Walworth	2,565	57	474	6,250	111	16
Washington	3,488	66	724	6,411	96	13
Waukesha	11,404	60	506	23,093	102	11
Total Region	85,392	67	911	228,193	145	9

Table 1. Per Capita Water Use in Southeastern Wisconsin by County 2000

Source: Southeastern Wisconsin Regional Planning Commission and Public Service Commission of Wisconsin

However, the Utility's 2005 Master Plan indicates that potential groundwater supplies will be insufficient by 2030 due to growing population in Waukesha and surrounding communities. By 2030, Waukesha's maximum daily pumpage will increase to 17.5 million gallons per day. The deficiencies are only increasing. Continuing to utilize existing deep well sources will lead to the continued depletion of these Great Lakes tributary sources. As population further increases, it will become necessary to utilize much stronger demand-side conservation measures as well as sourcewater protection and stormwater management practices.

"While the overall amount of water pumped has increased for the residential and commercial sectors, per capita use has decreased."

Over the last decade, water use in Waukesha has increased in the residential and commercial sectors. According to the Utility's Master Plan, the relative percentages of water use have changed while overall water use has increased slightly. Metered residential water use has increased from 39% of total consumption to 44%, and in the commercial sector from 29% to 34%. These relative increases are primarily the result of decreases in industrial use. Metered industrial use declined from 28% to 17%, and public metered water use from dropped from 5% to 4%. While the overall amount of water pumped has increased for the residential and commercial sectors, per capita use has decreased. As such, the residential and commercial sectors should be targeted for conservation efforts.

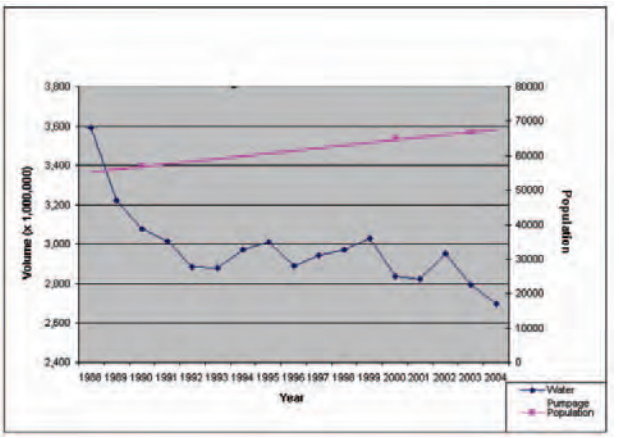


Figure 3. City of Waukesha Water Use and Population
Source: Waukesha Water Utility and the City of Waukesha

As development and population in the region continue to grow, the Southeast Wisconsin Regional Planning Commission (SEWRPC) estimates that groundwater withdrawals in the region are approaching 70 million gallons/day (MGD). The U.S. Geological Survey concluded that this historic heavy pumping rate by Milwaukee and surrounding suburbs in a confined aquifer that recharges more slowly that an unconfined aquifer has resulted in a zone of depression (See Figure 4). The impact has resulted in a reversal of flow in the deep aquifer system away from Lake Michigan, ongoing groundwater drawdown rates at about 6 feet/year, and declining groundwater quality as deeper groundwater contains higher levels of dissolved materials, including radium. All of these trends must be reversed to maintain sustainable groundwater supplies in southeast Wisconsin.

End-of-the-pipe water conservation is not enough to address the impacts of regional water use. Southeast Wisconsin's water resource problem must be addressed more comprehensively to protect, conserve, restore, and improve the groundwater resources that sustain its communities. Water resources can be significantly affected by development activities. Water resources move through the water cycle, sometimes called the hydrologic cycle. The water cycle is the continuous movement of water from ocean, lakes, rivers, and other water bodies to air and land then back to these water bodies through rain and snow in a cyclic pattern as water is used and re-used. Some water infiltrates (or seeps into) the ground or evaporates back into the atmosphere.

Southeast Wisconsin communities will need to supplement their sources of deep groundwater supply with groundwater drawn from shallow wells located in the surficial, sand and gravel aquifers in the less developed portions of Waukesha County. As urban development in the Milwaukee metropolitan area continues to move into Waukesha County, communities must act today to ensure that the groundwater resources in that region are preserved, protected, and enhanced. In addition, the city must look for more innovative ways to promote reuse of wastewater and enhance groundwater recharge. Poorly controlled residential, commercial, and industrial water withdrawals can weaken a community's ability to sustain residents and businesses.

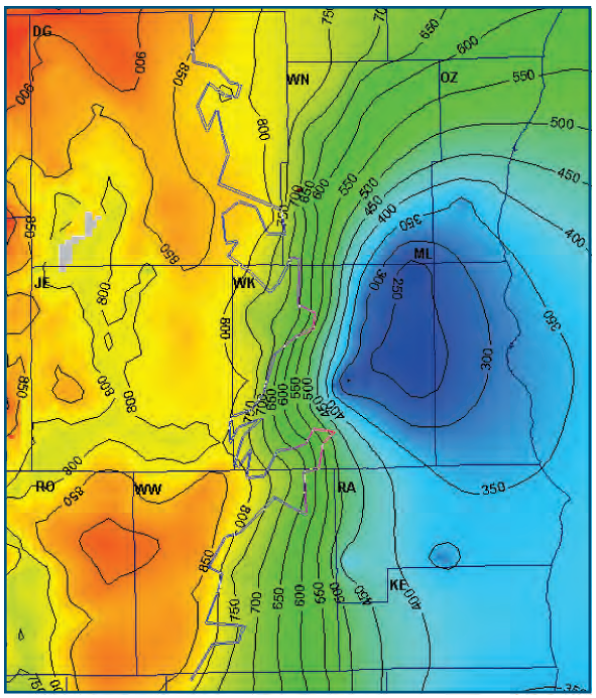


Figure 4. Groundwater Cone of Depression in the Sandstone Aquifer
Source: United States Geological Survey

Technical Approach: Source Water Management and Conservation Plan

Water conservation at the end of the pipe is not enough. Water resources must be protected at every step of the water management cycle through water reuse and enhanced groundwater recharge. Waukesha further recognizes that the city can undertake certain activities in the near term within its corporate jurisdiction, but other activities will need to be coordinated with other communities and the county. The city must work with Waukesha County and its neighboring communities because water resources transcend political boundaries. Regional water management will require additional time and effort to be implemented.

The water management plan encompasses three main activities:

1. Conserving residential, commercial, industrial, and government water use.
2. Protecting existing water resources.
3. Promoting the infiltration and reuse of stormwater and municipal wastewater.

The approach for completing each of these activities is described in the remainder of this report. More timeline details can be found on page 18.

Managing & Implementing Conservation

Introduction and Rationale for the Project

Managing and implementing conservation in Waukesha must be done through a structure that allows for development, implementation, monitoring and review of conservation activities to ensure that they are meeting the timeline and goals of the effort. The Water Conservation program will be implemented in the following eleven tasks:

a) Identify Conservation Goals

Waukesha has set a preliminary goal of a 20% reduction in per capita water use reduction in the city by 2020. This goal is based on prior experience with other municipal water conservation programs in other states. Waukesha is also seeking to reduce peak water demand by 1 million gallons per day (MGD) through controls on water sprinkling. WWU will identify the specific goals for the conservation program and the means to communicate the goals to city officials and the public.

b) Develop a program that provides monetary and other incentives to water users to reduce water use

Many water utilities use incentive-based programs to encourage water use reductions. This is usually done in tandem with a change in the rate structure that discourages the increased use of water. Appendix B provides background on the types of incentives that are offered as well as the effectiveness of different programs.

c) Develop a Waukesha Water Utility Conservation Demonstration Program

WWU will (1) document the conservation activities completed by the utility to date, and (2) prepare a demonstration program to further reduce water use within WWU buildings. The demonstration program will include an audit of current WWU water use and opportunities for leak prevention and hardware retrofits. WWU will document the water savings through the program and prepare information for distribution to the public and the press.

d) Develop a Water Use Profile and Forecast

Document the customer profile and characteristic (e.g., residential vs. commercial) demand by customer type, and overall average and peak water demand. Evaluate forecasts of future demand based on Waukesha Utility and City planning data, SEWRPC forecasts, and county growth data compiled by Southern Illinois University (Dziegielewski, et. al. 2004). Develop a water use profile by analyzing the historic and projected demand by customer sector. Evaluate water loss in the system and the impact of potential infrastructure improvements.

e) Develop a Decision Support Tool to Identify Appropriate Conservation Measures by Water User Sector

Based on the type of information presented in Appendix A, WWU will identify qualitative and quantitative criteria for selecting conservation measures. This work will build on the IWR Main application currently being developed by WWU. The decision support tool will evaluate and rank appropriate conservation measures by customer sector.

f) Evaluate and Design Conservation Measures

WWU will develop detailed plans for the identified conservation measures. Designs will include the types of control measures to be applied, the number of devices needed, the method for distributing and installing the measures, and the anticipated water savings from their application.

g) Identify and Assess Conservation Incentives and Benefits and Costs

WWU will estimate the conservation program benefits, including utility cost savings, as a justification for the conservation measures. WWU will demonstrate why the selected measures provide the greatest water use savings at the least costs.

h) Set Schedule for Conservation Measures and Incentives Implementation

Many of the conservation measures may be applied in phases. Factors governing the implementation schedule may include ease of implementation, cost, customer willingness to participate, and level of anticipated water conservation.

i) Implement Conservation Plan

The WWU will implement the final conservation plan encompassing the information gathered under the preceding tasks and coordinate with a stakeholder group that provides input and support. Circulate the plan to local stakeholders, government officials, and utility staff to generate support for and comment on the plan. Begin implementing the plan's measures and track progress. As part of the plan, anticipate impacts on utility revenues and any need for rate adjustments.

j) Conduct Public Outreach and Education

Actively promote implementation of the conservation plan through public education and outreach in the Waukesha schools and the press. Draw on existing education and outreach materials available through http://www.everydrop.org, http://www.waterwiser.org, and http://www.awwa.org, among others. Prepare outreach materials for distribution with water bills and at community events. Investigate the development of public service announcements and programs to be broadcast through local public access channels.

k) Monitor, Evaluate, and Revise Conservation Program as Needed

Conduct an ongoing monitoring program to assess the effectiveness of water use reduction activities through actual water use savings, customer participation, and costs of device maintenance. Regularly report on the program effectiveness to the Water Utility Commission and through annual reports to the public.

Reducing Water Use

Conservation Through Water Use Incentives and Restrictions

Waukesha has set a preliminary goal of a 20% reduction in per capita water use reduction in the city by 2020. This goal is based on prior experience with other municipal water conservation programs. Waukesha is also seeking to reduce peak water demand by 1 MGD through controls on water sprinkling.

These goals can be met through a combination of reducing leaks in the utility's water system, and reducing outdoor and indoor water use.

Detecting and Reducing Leakage in the Waukesha Water System

Leakage from the water system provides a significant opportunity to reduce the amount of water that is pumped from water supplies by WWU. The WWU should institute a more detailed water audit for the system to identify priority areas for water main replacement While leaks do go back into the groundwater system, the water does not go back into the deep aquifer that provides most of the utility's water supply. Reducing leaks increases water pressure within the system and reduces energy costs for water pumping.

Adopting an Outdoor Water Use Restriction Ordinance

One of the major difficulties facing the city is meeting peak demand. The highest peak days are during the summer when people are watering their lawns. Some of this peak demand is caused by overwatering of lawns during the middle of the day. Lawn watering during the heat of the day uses six times the amount of water than watering in the morning or early evening. Watering during the middle of the day, therefore, not only increases the amount of water required by the whole system, it unnecessarily increases water bills for the individual consumer. Further, by increasing the amount of water needed by the system, it increases costs for developing new wells and treating the water, affecting all ratepayers.

Studies have shown that an adequate amount of water for a lawn is one inch per week. The city should consider an ordinance restricting outdoor sprinkling to times when watering is more efficient. Outdoor sprinkling should only be allowed before 9 a.m. and after 5 p.m. Further consideration should be given to restricting the number of times per week that lawns can be watered. Example ordinance language is included in Appendix A.

This ordinance should be implemented in conjunction with a public education program to reduce sprinkling, **"Don't Get $oaked by Overwatering Your Lawn"**.

Non-Sprinkling Related Water Use Ordinance

There are additional water conservation activities that can be required by ordinance. In the Midwest, Illinois' ordinance requirements provide components that provide a basis for the start for an ordinance. The State of Illinois requires that any communities receiving water from Lake Michigan implement the following water use restrictions to ensure that water is used more efficiently. The requirements include:

- Leakage monitoring and correction for storage, transmission and distribution systems.
- Metering of all new construction.
- Metering of existing nonmetered services as part of any major remodeling.
- The adoption of ordinances which require the installation of closed system air conditioning in all new construction and in all remodeling.
- The adoption of ordinances which require that all lavatories for public use in new construction or remodeling be equipped with metering or self closing faucets.
- The adoption of ordinances which require that all newly constructed or remodeled car wash installations be equipped with a water recycling system.
- Development and implementation of public programs to encourage reduced water use.
- Installation of facilities and implementation of programs to reduce to a reasonable minimum, and to accurately account for, water used for navigational, lockage, and leakage purposes; and pollution treatment, control or abatement purposes.
- If receiving approval to use Lake Michigan water, prepare a phased program designed to end the use of deep aquifer water, other than for emergency or standby use, within five years of the receipt of Lake Michigan water.
- Limit hydrant uses to 1% or less of net annual pumpage in each annual accounting period.
- Adopt water rate structures based on metered water use and that water rate structures be developed which will discourage excessive water use.

Additional ordinance provisions that should be strongly considered include:

- Definitions for water conservation ordinance terminology
- Conservation signage and literature distribution
- Enforcement
- Water waste restrictions
- Conservation fees imposed
- Variance procedures
- Response to water shortage

Example ordinance language is included in Appendix A.

Indoor Conservation Measures

Conservation programs can be targeted in Waukesha in areas where there are likely to be older plumbing fixtures. These are in areas developed prior to 1994, when new plumbing requirements were instituted nationally. Bathroom fixtures, including toilets, faucets, showers, and baths, represent over 50% of indoor water use in the home (see Figure 5). There have also been significant changes in plumbing efficiency over time where there can be significant water savings realized within the city.

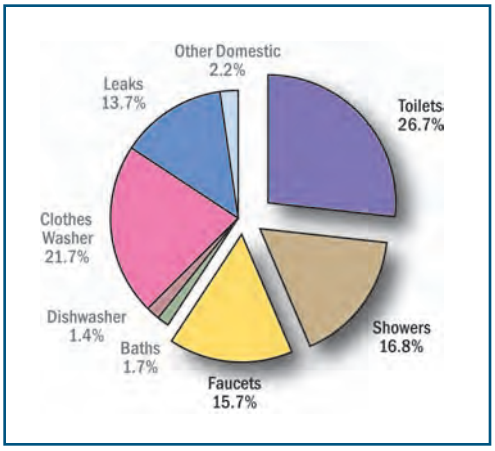


Figure 5. Average Indoor Water Use in a Nonconserving Home

Source: Handbook of Water Conservation and Protection

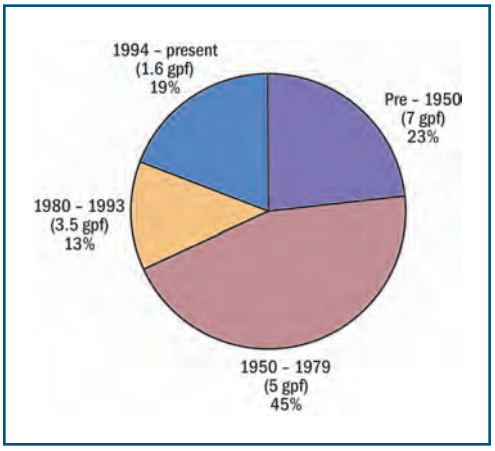


Figure 6. Date of Single Family Home Construction (and original Toilet gallons per flush (gpf)

Source: Waukesha Assessor's Office

Eighty-one percent of single family homes were built prior to 1994 when new plumbing fixtures were required to be water saving (See Figure 6). A map shows the location of areas where the original toilets were 7 gpf (yellow, pre 1950), 5 gpf (red, 1950-1979), and 3.5 gpf (green, 1980-1993). The groupings reveal areas where initial conservation activities can be targeted to maximize their effectiveness. The utility should target these homeowners in areas developed prior to 1994 to educate the owners about the potential savings associated with plumbing upgrades. These areas on the map (See Figure 7) are areas colored in yellow (pre 1950), red (1950-1979), and green (1980-1993). All new toilets installed in homes built since 1994 have 1.6 gallons per flush. If all homes in Waukesha were retrofitted with new toilets, water use would be reduced by up to 500,000 gallons per day, which represents a 5% reduction from the current average daily water use.

"If all homes in Waukesha were retrofitted with new toilets, water use would be reduced by up to 500,000 gallons per day…"

The water savings also represent a potential cost savings for utility customers. In homes that have toilets installed before 1950, a family of four could save $200 per year. A family of four changing 5 gpf toilets would save approximately $125 per year, and changing 3.5 gpf toilets would save the same family $70 per year.

Replacing showerheads installed prior to 1980 can also save significant water and money for homeowners. Replacing showerheads installed before 1980 can save about 5000 gallons per person per year. This saves approximately $25 per person per year in water and wastewater charges.

Develop a Waukesha Water Utility Conservation Demonstration Program

The city began the process of educating the public about the benefits of water conservation in plumbing fixtures with the announcement of the grant of plumbing fixtures at bathrooms in City Hall. The City Hall demonstration project was a first step. WWU will (1) document the conservation activities completed by the utility to date, and (2) prepare a demonstration program to further reduce water use within WWU buildings. The demonstration program will include an audit of current WWU water use and opportunities for leak prevention and hardware retrofits. These water savings will be documented and included in public outreach information for distribution to the public and the press.

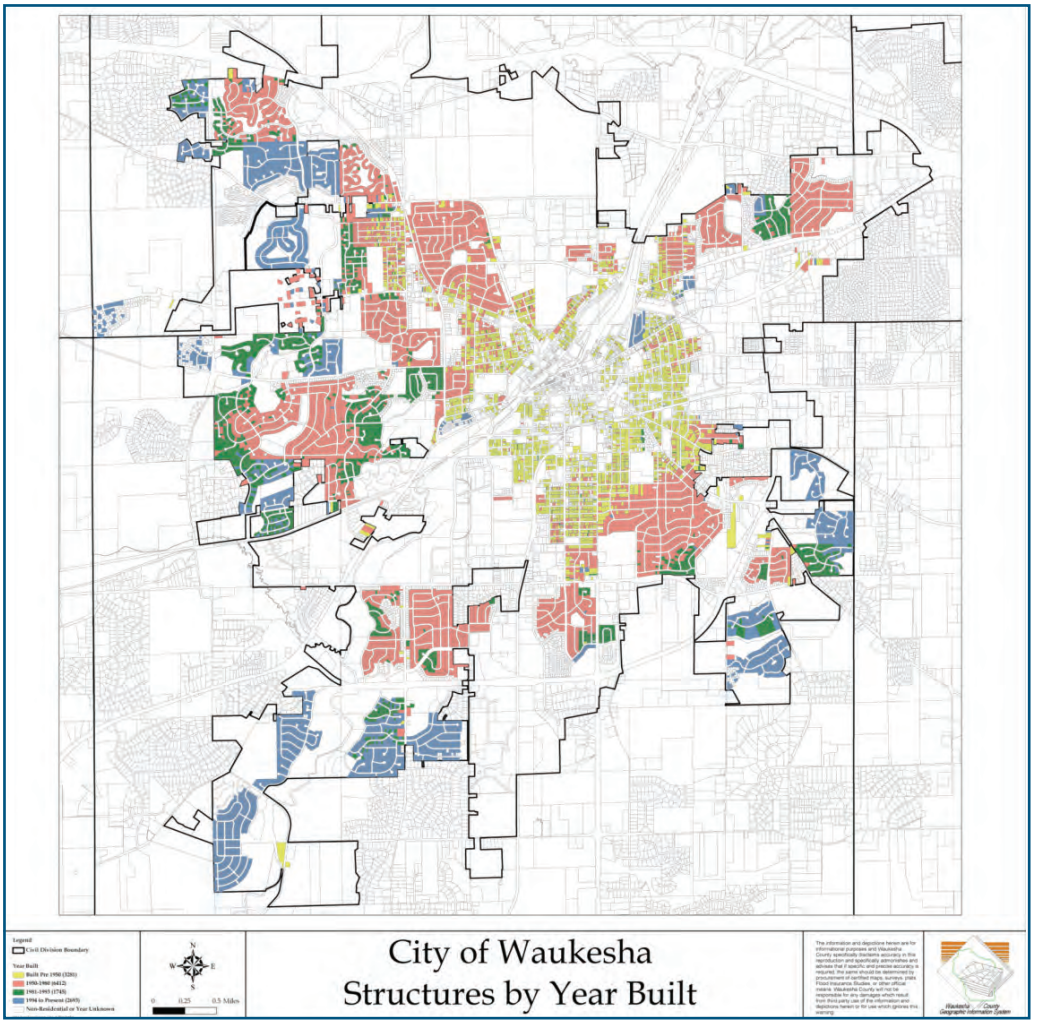


Figure 7. Map of City of Waukesha by Date of Construction
Source: Waukesha Assessor's Office

Implement Inclining Block Rate Structure

Currently, Waukesha has a decreasing block rate structure through which rates decrease as water use increase. This encourages water use and reduces water supply protections. Increasing rates as water use increases builds an incentive for changing plumbing fixtures in the home and reducing outdoor water use. WWU initiated discussions with the Public Service Commission regarding the use of this rate structure. It has not been used in Wisconsin to date, but is in use in other parts of the country. WWU will continue this discussion with the PSC.

Phase Out Residential Sewer Credit Meters

The city should also consider phasing out sewer credit meters for residential units. These meters measure the amount of water that leaves a home through the sewer system. It provides the basis for a credit on the sewer bill. Residences that have the meters do not pay for sewage treatment of the water that does not enter the system. These meters are not in wide usage nationwide because they do not discourage outdoor water use such as sprinkling. Eliminating sewer credit meters would increase the rates for outdoor sprinkling, providing more incentives for reducing water use. Increased revenues obtained by from the phase out of this program could be used by the city to create a conservation incentive program.

Fixture / appliance / location	Type of incentive (Examples)	Eligibility	Incentive value	Conservation level required / delivered
Showerheads	Rebate for replacement with water-conserving model (A)	Residential and commercial customers	Range from $25 up to $150 or 75% of the total cost (whichever is less) for each showerhead retrofitted with an ultra-low flow model	Required maximum of 2.5 gallons per minute per showerhead.
	Free replacement with water-conserving model (A, B, D)	Residential and commercial customers	Value of replacement showerhead.	Delivers 2.5 gallons per minute; has adjustable settings and a non-aerating spray with less temperature loss.
Toilets	Rebate for replacement with water-conserving model (A, B)	Residential and commercial customers; no limit on the number of reimbursed toilets per household or commercial building.	Range from $25 up to $150 or 75% of the total cost (whichever is less) for each toilet retrofitted with an ultra-low flow model	Required maximum of 1.6 gallons per flush per toilet.
	Free dye tablets for determining leaks in toilets (A, B, D)	Residential and commercial customers	Value of dye tablets	N/A
Clothes washing machines	Rebate for replacement with water-conserving model (A, B)	Residential customers	Range from $25 to $100 for all qualifying clothes washers.	Required to be a Level 1 or 2 clothes washers, as listed and posted online at a region-specific website.
Bathroom faucets	Free aerator attachment (A, B, D)	Residential and commercial customers	Value of aerator	Delivers a flow rate of 1.5 gallons per minute.
Kitchen faucets	Free aerator attachment (A, B, D)	Residential and commercial customers	Value of aerator	Delivers a flow rate of 2.2 gallons per minute (2.0 gpm in some cases).
Pre-rinse spray valves	Free replacement with water-conserving model (A)	Commercial customers (food service industry)	Value of the new, high-efficiency, high-velocity spray valve.	N/A

Table 2. Example Incentive Programs

Institute Incentive Programs.

Many water utilities around the country use incentive-based programs to encourage water use reductions. This is usually done in tandem with a change in the rate structure that discourages the increased use of water. Potential incentives are listed in Table 2. Additional information on incentive programs are listed in Appendix B. Pursuing this option is difficult as the Public Service Commission currently has not authorized costs for these types of conservation programs to be recaptured by utilities. However, the utility should continue discussions with the PSC to ensure that existing and future water sources are protected and used efficiently.

Evaluate Appropriate Conservation Measures by Water User Sector

Based on the type of information presented in Appendices A and B, WWU will work to identify qualitative and quantitative criteria for selecting conservation measures. This work will build on the IWR Main application currently being developed by WWU. The decision support tool will evaluate and rank appropriate conservation measures by customer sector.

Protect Existing Water Resources

Source Water Protection

Source water is water collected from streams, rivers, lakes, or groundwater for public drinking water supplies. Source water protection is designed to protect drinking water sources from sources of contamination. WWU will work with Waukesha County and surrounding communities through the county effort, with Wisconsin Department of Natural Resources (WDNR) through its identified Groundwater Management Area, and with the SEWRPC regional water supply study to ensure an aggressive source water protection effort.

Source water assessments are mandated under the Safe Drinking Water Act, but protection plans are a local management issue. A Waukesha County source water protection plan will include the following components:

1. Establish a stakeholder group involving Waukesha County and its communities, developers, the State, and other interested parties to begin organizing to develop a source water protection plan.

2. Identify the critical recharge areas for the aquifers to establish overlay planning areas for source water protection. Principal recharge areas for the shallow aquifer system will be identified using previous USGS and WDNR studies, along with aerial photos and soil surveys. Because the shallow system is largely unconfined, recharge occurs throughout the region. However, some areas preferentially recharge the aquifer system, such as areas containing wetlands and hydric soils. The recharge areas will be plotted using GIS as overlays on regional topographic maps.

3. Identify existing and potential future contaminant and recharge impairment threats. The City of Waukesha's source water assessment completed by WDNR indicates that the city's groundwater supply is susceptible to contamination by volatile organic compounds, synthetic organic compounds, nitrate, antimony, and arsenic. The system is moderately susceptible to microbial contamination. The system has low susceptibility to ethylene dibromide contamination. The source water assessment report further notes that no wellhead protection plan or ordinance is in place to protect the city's main production wells. As land in the recharge areas for existing and future production wells is developed, contaminant sources are introduced into the wellhead areas and impervious cover reduces recharge of the aquifer system. The current and future threats to Waukesha County's source water areas will be identified based on current land uses and projected growth patterns. The current and projected threats will be depicted on GIS map products.

4. Set priorities for managing the threats consistent with state statute and policy. Wisconsin is developing a set of statutes and policies governing municipal growth patterns and groundwater protection. Review the statutes and policies to set priorities for management activities in terms of contaminants or development practices to be addressed.

5. Document available and needed management tools to address the threats. A variety of land use planning and management tools are available to Waukesha County communities to affect growth patterns. These include zoning and overlay districts; subdivision, health, stormwater, and other ordinances; use of planned unit developments; and other management tools such as transfer of development rights, conservation easements, and condemnation. Through these management tools, communities can steer development away from critical recharge areas and promote practices such as low impact development and retrofit applications of stormwater best management practices (BMP) to increase stormwater infiltration and groundwater recharge. Identify a suite of existing management tools and recommend additional ordinances and policies based on the experience of other communities.

6. Develop a schedule and work plan for implementing the source water protection plan. Work with the communities to identify realistic schedules for implementing changes to community planning, ordinances, zoning, and other measures. Also, provide estimates of the costs involved in making the changes and will help identify resources available to support the communities.

Enhance Stormwater Infiltration and Wastewater Reuse

When it rains or snow melts, some stormwater goes into the ground and some goes into storm sewers. As more development occurs, more hard surfaces, such as rooftops and roadways are created, meaning there are fewer places where rain water can soak into the soil, nourish plants and remain part of the natural water cycle.

If there is less greenspace to absorb water, sewer systems are forced to handle more water, increasing the risks of flooding. Stormwater sent to sewers is no longer available to irrigate lawns or recharge groundwater. This reduces the amount of water available for drinking water and water to support environmental resources.

Stormwater runoff also can pick up pollutants such as oil and grease, chemicals, nutrients, metals, and bacteria as it flows across surfaces and transports it to destinations in groundwater, streams, rivers, and lakes.

Different areas and soils lead to variability in recharge capabilities. The developed areas of southeastern Wisconsin generally have lower recharge capabilities. Western Waukesha County has areas with the highest recharge rates in the region (See Figure 8). This area recharges local shallow aquifers as well as the deep aquifer that currently serves as Waukesha's primary water source.

The City of Waukesha and Waukesha County stormwater management plans must be reviewed to ensure that rainfall and snowmelt can go back into the ground to replenish groundwater and that pollution is reduced from entering streams, rivers and groundwater. This may involve the use of urban BMP retrofits, such as the replacement of concrete stormwater channels with grass swales, installation of porous pavement on public properties, and public education to encourage the use of rain barrels, biofilters, and more advanced practices including green roofs.

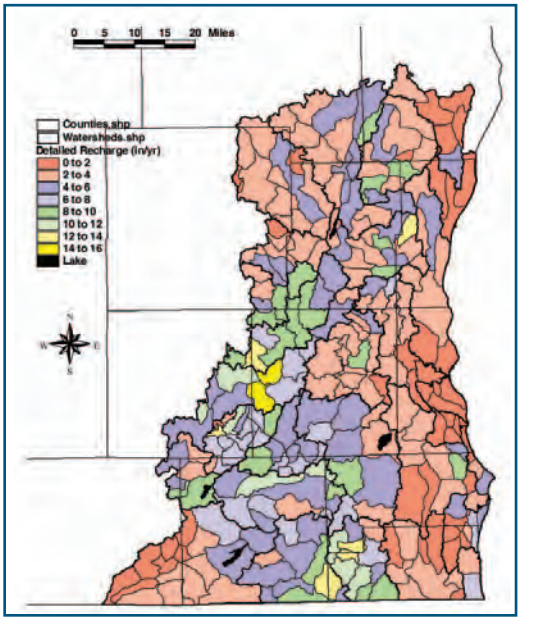


Figure 8. Groundwater Recharge (inches per year) in Southeastern Wisconsin

Source: United States Geological Survey

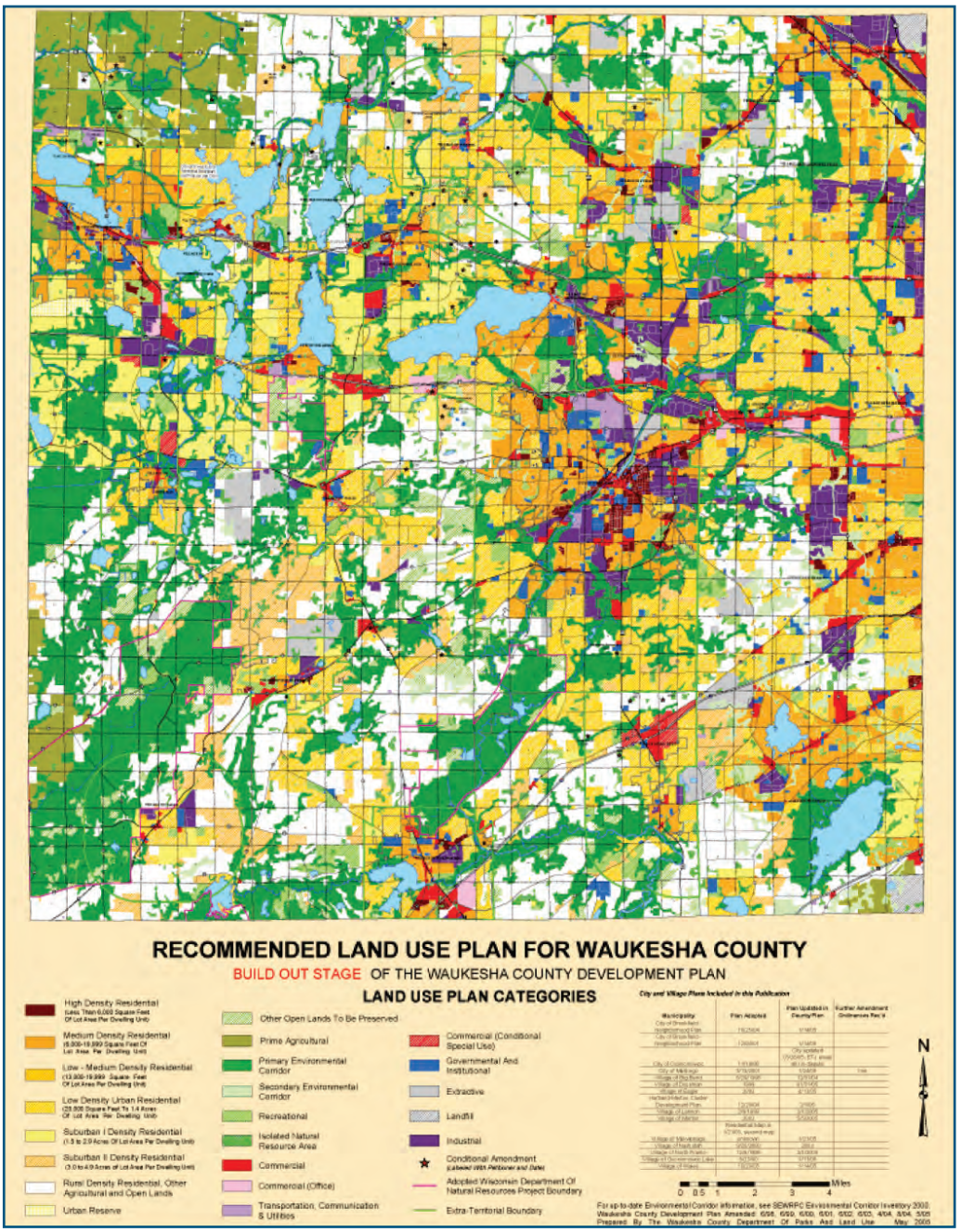


Figure 9. Recommended Land Use Plan for Waukesha County

Source: Waukesha County

Waukesha must also coordinate with Wisconsin DNR through the Groundwater Management Areas and with the SEWRPC regional water supply study to ensure that regional stormwater management supports groundwater recharge and protection.

Activities to be pursued include:

1. Identify Opportunities for Stormwater BMP Retrofits on Waukesha City property.
2. Review Proposed Retrofits with Waukesha Public Works Officials.
3. Design Two Stormwater BMP Retrofit Projects.
4. Oversee Stormwater BMP Implementation.
5. Work with Waukesha County to revise the recommended land use plan map (Figure 9) to protect critical recharge areas for shallow and deep groundwater resources (see Figure 8). In particular, land in the Kettle Moraine region is highly permeable and acts as recharge areas for shallow aquifers, the sandstone aquifer, and Lake Michigan.

Planning and Zoning

Waukesha's planning and zoning ordinances must be coordinated with its stormwater management plan to ensure that water is returned to the groundwater naturally rather than into storm sewers. New development must have minimal impact on the natural flow of water to groundwater that supports drinking water supplies and lakes, wetlands, and other environmental resources. Waukesha will consider a performance standard for all new development requiring the maintenance of pre-development hydrologic conditions.

This can be done through revision of local planning and zoning ordinances to require the use of low impact development (LID). It may be necessary to first update the local comprehensive plan to set a goal for open space and conservation planning and design. LID design integrates stormwater management and erosion and sedimentation control into natural systems that keep rainwater on site. This is different from traditional development that uses pipes and drains, ponds, and storm sewers to move water quickly off site and into streams, rivers, and lakes.

Appendix C provides model ordinance language specifically prepared for Wisconsin communities prepared by the University of Wisconsin Extension Service that is potentially appropriate for Waukesha. Appendix D is an example manual developed by the Town of Franklin, Massachusetts to assist planners and developers in implementing best management practices for low impact development.

Ordinance revisions will be completed in the following four tasks.

1. Gather and Review City and County Ordinances.
2. Meet with City and County Planners, Commission Members, and Elected Officials.
3. Evaluate Needed Ordinance Revisions.
4. Draft Ordinance Language.

Waukesha will first promulgate a city ordinance to control sprinkling. WWU will support the ordinance development in the following three tasks.

1. Calculate the peak water use reductions under different sprinkling reduction scenarios (e.g., odd/even restrictions, time-of-day restrictions, sprinkling bans).
2. Prepare draft ordinance language to achieve peak demand reductions.
3. Meet with city officials to review and revise the ordinance language.

Wastewater Reuse and Aquifer Recharge

WWU should investigate the feasibility of wastewater reuse of its wastewater in a manner that will not adversely affect groundwater resources. Waukesha's wastewater is currently discharged to the Fox River, which flows south into Illinois. Waukesha will investigate approaches for returning wastewater to recharge and replenish shallow and deep aquifer systems in compliance with Safe Drinking Water Act standards. Approaches that have been used in other parts of the country include spray irrigation, discharge to drainfields, or deep injection for aquifer storage and retrieval.

WWU will complete the following five tasks:

1. Gather Existing Data on Wastewater Characteristics and Parameters.
2. Develop Treatability Analysis to Determine Engineering Feasibility to Achieve Compliance with Drinking Water Quality Standards.
3. Conduct Bench Scale Tests to Determine Impact of Wastewater Reuse on Soil and Aquifer Materials.
4. Prepare Wastewater Reuse Proposal.
5. Support Proposal Review Process with WDNR.

Timeline for Implementing the Conservation Plan

Short Term Activities

1. **Implement Public Education Programs**
   - Website – educate the public why conservation is important and what they can do to help conserve water and, at the same time, save money. Also, provide information on rain gardens. (Completed)
   - 5th Grade Water Education - Continue working with the Waukesha School District by teaching fifth graders the water level in the aquifer, the importance of conservation and some practices that their families can implement. (in place)
   - Work with retailers to provide them with information to provide to customers on the benefits of updating indoor fixtures and outdoor watering devices.
2. **Continue Water Main & Property Replacement Effort**
   - Continue to replace old, outdated mains and service laterals. This will help to ensure a reduction in leaks. (In place)
3. **Develop Water Conserving Billing Structure**
   - Continue to work with the Public Service Commission to develop a billing structure that encourages water use conservation.
4. **Loop Water Mains**
   - Have contractors loop the water mains so that this will cut down on future hydrants to be flushed. (In place)
5. **Develop Outdoor Water Use Ordinances**
   - Create and implement ordinances that set limits on when sprinkling is allowed to reduce peak water use, reduce costs for customers, and encourage efficient outdoor sprinkling. (In process)
6. **Organize Stakeholder Group**
   - Create a stakeholder group to advise the utility on the conservation plan.
7. **Work with Housing Authority to Update Plumbing**
   - Begin working with Waukesha Housing Authority to update water fixtures at Waukesha public housing.
8. **Work with City Departments and Schools to Reduce Outdoor Water Use**
   - Identify opportunities for reduced outdoor water use in sprinkling parks and school fields.

9. **Audit Water Use in City Buildings**
   - Audit all city buildings in order to identify ways to reduce water usage.
10. **Work with the Focus on Energy Program**
   - Work with the Focus on Energy program to update showerheads at Waukesha hotels and hand sprayers at Waukesha restaurants.
11. **Coordinate Public Education Effort with Meter Change Out Program**
   - Prepare educational materials to leave with homeowners to make them more aware of water conservation effort.
   - Develop initial water audit system to identify homes that have not upgraded original plumbing.
12. **Begin Regional Source Water Protection Planning with Surrounding Communities and County**
   - Work with surrounding utilities to begin coordinating source water protection activities.

Mid-Term Activities

1. **Continue Education Programs**
   - Create Conservation Brochures & Signage.
   - Update curriculum for 5th Grade Water Education Classes.
   - Press Releases and update public outreach brochures.
   - Place water conservation information in WWU bills .
2. **Develop Incentives/Rebates Programs**
   - Evaluate rebate programs for targeted water using appliances and fixtures.
   - Evaluate rebates for the outdoor water use equipment (timers, sprayers).
   - Continue to work with the Public Service Commission to determine the feasibility and potential success of rebate programs.
   - Determine the feasibility of coordinating a residential water audit program with water meter change-out program that would link to an incentive/rebate program.
3. **Develop Water Use Restriction Ordinances**
   - Review plumbing requirements in ordinances: for new construction, remodeling, and retrofits, and Study potential for requiring plumbing updates at time of property sale.
4. **Recycle Filtered Backwash Water**
   - Implement a recycling process for Wells 8, 11, and 12.

5. **Implement city Water Audit**
    - Install water saving fixtures throughout the WWU.
    - Work with largest water users to audit facilities.
6. **Work with Commercial Sector to Encourage Water Conservation**
    - Update web site.
    - Make up brochures.
    - Mail out brochures to commercial properties.

Long Term Activities

1. **Continue and Accelerate System Leak Detection**
    - Update utility detection of leaks to identify priority areas in the system to reduce large leaks and reduce unaccounted for flow.
2. **Implement Unidirectional flushing**
3. **Implement Smart Growth – (Land Use Planning & Zoning)**
    - Work with others (surrounding communities, City, developers, etc.) to develop best management practices (Low Impact Development Practices) to prevent pollution from moving into the river. Consider revision of city plan, subdivision and zoning ordinances to encourage infiltration of stormwater into the ground.
4. **Update Storm Water Management Requirements**
    - Work with the City of Waukesha and Waukesha County to develop stronger stormwater ordinances to encourage infiltration.
5. **Work with Commercial & Industrial Sectors to Audit Water Use**
    - Work with commercial and industrial customers to identify areas to reduce water use and save customers money.

Water Conservation and Protection Plan Implementation to Date

The City of Waukesha has implemented the following water conservation and protection activities:

- ***Redefining the Residential Rate Structure.*** The Wisconsin Public Service Commission approved a conservation-based rate structure for the Waukesha Water Utility, a first for the State of Wisconsin. The new rate structure promotes water conservation by charging higher rates for residential customers using more than 30,000 gallons per billing period. Studies have shown that overall water use decreases as price increases.

- ***Outdoor Watering Ordinance.*** In April 2006, The Waukesha Common Council passed an outdoor watering ordinance that restricts lawn watering to no more than twice per week. As a result, overall water use during the summer fell approximately 10% with only one day exceeding 10 million gallons per day.

- ***City Hall Plumbing Retrofit:*** In 2006, Kohler donated toilets, urinals, and aerators for City Hall Bathroom facilities. 3.5 gallon per flush toilets were replaced with 1.6 gallon per flush toilets. Urinals were retrofitted so that they flushed by use of sensor instead of periodically flushing. Since installation, City Hall has seen water use reductions of between 15 and 25 percent over previous years.

- ***Establishment of a Waukesha County Conservation Planning Group.*** In 2006, Waukesha County and the City of Waukesha cooperated in establishing a Coalition to prepare and implement a water conservation public education strategy. The goal of the Coalition is to develop a unified message that can be used in existing and new public education materials. Presenting a water conservation message on a regional basis makes a lot of sense. Not only is it cost effective, it also sends a consistent message to residents and businesses in the Region. The Coalition will formally convene two to four times a year. The Coalition members meet quarterly.

- ***Phase II Stormwater Regulations Implementation.*** Waukesha has passed all of the Phase II Stormwater ordinances required by federal regulations:
    - ***Public Education and Outreach*** Outlined in the revised stormwater management plan.
    - ***Public Participation/Involvement*** Outlined in the revised stormwater management plan.
    - ***Illicit Discharge Detection and Elimination*** Developing and implementing a plan to detect and eliminate illicit discharges to the storm sewer system (includes developing a system map and informing the community about hazards associated with illegal discharges and improper disposal of waste). Ordinance passed 07/28/2005.
    - ***Construction Site Runoff Control*** Passed a construction site runoff control ordinance 07/28/05
    - ***Post-Construction Runoff Control***. Passed Post-Construction Runoff Control ordinance 02/16/06.
    - ***Pollution Prevention/Good Housekeeping*** Approved a revised stormwater management plan.

- ***School Education:*** The Waukesha Water Utility has partnered with the Waukesha School District to teach water education classes to fifth graders. This water program has taken place since 1990 to the present; and the Utility and the School District share the costs. Approximately 1,000 students attend these classes – its part of the students' science curriculum. There are two parts to this program. First, the students do an outdoor field investigation of the Fox River Sanctuary; and then, they visit one of our pumping stations. At the pumping station, they not only get a tour of the facility, but they also learn about the water cycle, where our water comes from, how it is treated and distributed, and future concerns dealing with quantity and quality. By the end of the lesson, students understand that water is a limited resource, human activities have a direct impact on the water quantity and quality, and that using water wisely is everyone's responsibility.

Addendum

Implementation

September 2006

April 2006: Outdoor Water Use Ordinance

CITY OF WAUKESHA
CODE BOOK INSERT

ORDINANCE NO. 20-06

CHAPTER 13
PUBLIC HEALTH
AND WELFARE

AN ORDINANCE TO CREATE CERTAIN PROVISIONS OF THE PUBLIC HEALTH AND WELFARE CODE OF THE MUNICIPAL CODE OF THE CITY OF WAUKESHA, WISCONSIN

THE COMMON COUNCIL OF THE CITY OF WAUKESHA DO ORDAIN AS FOLLOWS:

SECTION I. Section 13.11 of the Waukesha Municipal Code is hereby created to read as follows:

13.11 WATER CONSERVATION

(1) PURPOSE. The purpose of this section is to prevent overuse of the City's water resources to avoid substantial depletion of the water table and to ensure sufficient water supply is available at all times including peak usage periods. The Common Council finds that ensuring the provision of water, especially in emergency situations, is essential to the public interest.

(2) DEFINITIONS.

(a) Emergency Water Condition means a circumstance where any of the following conditions are met:

1. Water pressure to any customer cannot be sustained at a pressure greater than or equal to 20 pounds per square inch (PSI).

2. Water storage levels cannot be maintained above the preset fire reserve limits.

3. Water treatment capability cannot meet the demand placed on the system.

4. The City has declared a state of emergency pursuant to sections 5.06 (1) or (2) of the Code on the recommendation of the General Manager of the Water Utility or the General Manager's designee due to other circumstances which to a reasonable certainty shall result in a severe water shortage for the City if emergency measures are not taken.

(b) New Landscape means vegetation installed for no more than one (1) month which is: (1) installed at the time of construction of a new house, multi-family, industrial or commercial building; (2) installed as part of a governmental entity's capital improvement project; or (3) which alters more than one quarter of the area of an existing yard or which alters an area greater than 3000 square feet of an existing yard.

(c) Sprinkling means the act of applying water to outdoor vegetation for purposes of irrigating an area of land.

(3) SPRINKLING RESTRICTED. At all times between the first day of May and the first day of October, the following sprinkling restrictions shall be in effect.

(a) Properties having odd-numbered street addresses are prohibited from sprinkling lawns and gardens except on Tuesdays and Saturdays, at which time sprinkling is permitted at any time before 9:00 a.m. and after 5:00 p.m.

(b) Properties having even-numbered street addresses are prohibited from sprinkling lawns and gardens except on Thursdays and Sundays, at which time sprinkling is permitted at any time before 9:00 a.m. and after 5:00 p.m.

(c) Exceptions. Notwithstanding the prohibitions set forth in this section, the following activities are permitted at any time:

1. Sprinkling gardens, trees and shrubs through use of a hand-held watering can or other hand-held container or hose, provided, however, any such watering device must be utilized manually and cannot be left unattended.

2. Sprinkling or otherwise irrigating new landscape.

3. Sprinkling or otherwise irrigating outdoor sports complexes including but not limited to baseball diamonds.

4. Sprinkling activity conducted at cemeteries.

5. Any Sprinkling activity conducted pursuant to a Special Permit granted under sub. (5) of this section.

(4) EMERGENCY MEASURES. If an Emergency Water Condition is in effect, the General Manager of the Water Utility or a designee shall give notice to the public by posting a declaration in three (3) public places, the City website, Government Access cable channel, faxing the declaration to three area television news networks, and if possible by verbal announcement over the cable system. At the time the Water Utility Manager or a designee opines that the Emergency Water Condition has ended, the same notice procedure shall be followed to declare cessation of the emergency. During an Emergency Water Condition, the following emergency measures shall be in effect:

(a) All outdoor sprinkling or other irrigation activity is prohibited.

(b) The washing of sidewalks, driveways, parking areas, tennis courts, patios or other paved areas by the use of a pressurized source is prohibited.

(c) The washing of motor vehicles, trailers, and other self-propelled devices is prohibited except at facilities equipped with wash water recirculation systems.

(d) Outdoor use of any water-based play apparatus connected to a pressurized water source is prohibited.

(e) The filling of swimming pools, fountains, spas or other exterior water features is prohibited except on residential properties not equipped with working central air conditioning systems or when necessary to alleviate an immediate threat to a person's health or safety. As used in this section, "an immediate threat to a person's health or safety" shall include, but is not limited to, infirmities of aging, developmental, mental or physical disabilities, or like infirmities incurred at any age, or the frailties associated with being very young.

(f) Operation of outdoor misting systems used to cool public areas is prohibited unless their use is necessary to alleviate an immediate threat to a person's health or safety.

(g) Water obtained by means of a fire hydrant shall not be used for cleaning equipment of any kind.

(5) SPECIAL PERMIT. Any person may make an application for a Special Permit allowing Sprinkling during the hours prohibited by subs. (3)(a) and (3)(b) of this section.

(a) The application shall be made on a form provided by the Water Utility. The application shall indicate the address covered by the request; the time period within which sprinkling activity is requested; the name, address and contact information of a responsible party; and the reasons for the request.

(b) A Special Permit shall only be granted if the Water Utility General Manager or a designee finds that the permit is necessary to avoid an emergency condition effecting health, sanitation or fire protection of the applicant or the public; or if failure to grant the permit would substantially deprive the applicant of the applicant's financial livelihood. Conditions which reasonably relate to the goal of minimizing depletion of the water table may be placed on the time or manner of Sprinkling to be conducted under a Special Permit.

(c) The Water Utility General Manager or a designee shall grant or deny an application no later than ten (10) business days after the completed application is filed with the Utility. If an application is denied, an agent of the Utility shall so advise the applicant in writing of the denial and the reasons thereof within the ten-day period.

(d) Any person aggrieved by a decision to grant or deny a Special Permit under this subsection may appeal the decision to the Water Utility

Commission by filing a written notice of appeal with the Water Utility within twenty (20) days of receipt of notice of the decision. The Commission shall hold a hearing at its next meeting or at a reasonable time thereafter and permit the appellant to be heard and state his or her reasons for the need to overturn the decision of the Water Utility General Manager. The Commission shall then determine whether the decision of the General Manager was made consistent with the factors set forth in sub. (5)(b) and inform the appellant of its decision no later than thirty (30) days following the hearing. This hearing provision shall not be governed by the administrative review procedures provided for in Chapter 68, Wis. Stats.

(6) ENFORCEMENT AND PENALTY.

(a) Service of Notices. Whenever an employee or agent of the Water Utility determines there has been a violation or that there are reasonable grounds to believe there has been a violation of any provision of this section, said person or other Water Utility designee shall give written notice of such violation to the residents of the property by either: (1) affixing such notice onto or reasonably close to the front door of the property; or (2) depositing the notice in the U.S. Mail addressed to the person responsible for the property's water bill. Subsequent violation notices shall be served in the same manner if the violation persists for more than one (1) week. The Water Utility shall also deposit a copy or other facsimile of third and subsequent notices in the U.S. Mail addressed to the owner of the property as shown by the records on file with the Tax Assessor if the property owner is not responsible for the water bill.

(b) Referral to Police Department. If a violation of this section persists after three (3) or more violation notices have been served in the manner provided under sub. (5)(a) of this section, the Water Utility may refer the matter to the Police Department. If the Police Department determines there is sufficient evidence to proceed, a citation may be issued. Each day a violation continues constitutes a separate offense.

(c) Penalty. Any person subject to a penalty under this section shall be penalized as provided in §25.05 of this Municipal Code.

(d) Suspension of Service. The Water Utility may suspend water service to a property in violation of this section if all of the following conditions are met:

1. Five or more citations have been issued pursuant to sub. (5)(c) of this section.

2. The Water Utility Commission has adopted this ordinance as part of the Utility's rules and regulations.

3. The violation interferes with the water service of others.

4. No heat advisory, heat warning or heat emergency issued by the National Weather Service is in effect.

5. Suspension would otherwise not be prohibited by any rule of the Public Service Commission, including but not limited to Wis. Admin. Code PSC § 185.37.

SECTION II. All ordinances or parts of ordinances inconsistent with or contravening the provisions of this ordinance are hereby repealed.

SECTION III. This ordinance shall take effect and be in force from and after the date of its passage and publication.

Passed this 6th day of April, 2006.

Approved this 7th day of April, 2006.

/s/ Carol J. Lombardi
Mayor

Attest:

/s/ Thomas E. Neill
City Clerk

Appendix A

Water Conservation Example Ordinance Language

Water Conservation
Example Ordinance Language

Municipalities promote water conservation through measures in four categories:

- Restrictions,
- Incentives,
- Education, and
- Monitoring.

Restrictions are limitations on type, method, duration, frequency, or volume of water use. These requirements are established and explained in the creation of ordinances, which also detail enforcement and noncompliance penalties. Incentives typically take the form of a rate structure discouraging high water usage, or rebates and free replacements for upgrading household fixtures and appliances to more water-efficient models. Some municipalities reward conservation-minded residents in more creative ways, for example, by presenting awards to top water usage reducers. Educational approaches to water conservation range from instructing homeowners on how to check for plumbing leaks to distributing free booklets on water-wise gardening and drought-resistant plant varieties. In many municipalities, water usage monitoring is used as an opportunity to educate residents on conservation. Site evaluations by trained technicians serve a two-fold purpose of identifying leaks and aging infrastructure, and informing residents about the importance of reducing unaccounted-for flows.

Water use restrictions and requirements, as enumerated in ordinances, apply to a wide variety of residential, commercial, industrial, and municipal activities. This section provides examples of ordinances from municipalities across the country, categorized by activity:

- Water efficient plumbing requirements
- Outdoor water use restrictions
- Limitation of hydrant uses
- Water conservation for commercial consumers
- Installation of water meters
- Definitions for water conservation ordinance terminology
- Conservation signage and literature distribution
- Enforcement
- Water waste restrictions
- Conservation fees imposed
- Variance procedures
- Response to water shortage

Water Efficient Plumbing Requirements

Fixtures and appliances in the kitchen, bathroom, and laundry are the primary targets for water conservation. By setting water efficient plumbing requirements for new construction, remodeling, and/or retrofits, municipalities force residents to replace existing or potential water-wasting models. The following examples of water efficient plumbing ordinances are from Santa Monica, California[1] and Santa Fe County, New Mexico.[2]

7.18.050 Retrofit requirement upon purchase or change of ownership. (Santa Monica, California)

[1] City of Santa Monica, California, Municipal Code of Ordinances, Article 7: Public Works. http://www.epa.gov/owow/nps/ordinance/documents/SantaMonicaUR.pdf
[2] Santa Fe County ordinance addressing water conservation: http://www.co.santa-fe.nm.us/departments/land_use/water_harvesting/docs/Water_Conservation_Ordinance.pdf

No existing structure shall be sold or transferred unless all existing plumbing fixtures in the structure are retrofitted exclusively with water-conserving plumbing fixtures. Compliance with this Section shall be included as a condition of escrow. (Added by Ord. No. 1667CCS § 1 (part), adopted 2/9/93)

Retrofit requirement (Santa Fe, New Mexico)
For all new and remodeling construction and all replacements of existing plumbing fixtures, the water conservation plumbing standards set out below shall be met. In addition, with the exception of item (D), all existing water users shall retrofit their facilities such that the plumbing fixtures noted below are in place by January 1, 2005. Single and multi-family residential water users are exempt from this retrofit requirement.

A. Water closets, either flush tank, flushometer tank or flushometer valve operated, shall have an average consumption of not more than 1.6 gallons (6.1 liters) per flush. Water closets that use a "quick closing" flapper to limit the flush to 1.6 gallons shall not be used to satisfy this requirement.

B. Urinals shall have an average water consumption of not more than 1.0 gallon of water per flush, with the exception that, if approved by Santa Fe County, blowout urinals may be installed for public use in stadiums, race courses, fairgrounds and other structures used for outdoor assembly and similar uses.

C. Lavatory and kitchen faucets shall be equipped with aerators and shall be designed and manufactured so that they will not exceed a water flow rate of 2.5 gallons (9.5 liters) per minute.

D. Self-closing, metering or self-closing faucets shall be installed on lavatories intended to serve the transient public, such as those in, but not limited to, service stations, train stations, airports, restaurants and convention halls. These faucets shall deliver no more than .25 gallons of water (1.0 liters) of water per use.

E. Shower heads shall be designed and manufactured so that they will not exceed a water supply flow rate of 2.5 gallons (9.5 liters) per minute. Emergency safety showers are exempted from this provision.

F. Water-conserving fixtures shall be installed in strict accordance with the manufacturer's instructions to maintain their rated performance.

G. For all new and re-modeling construction, all of the requirements regarding water conserving devices shall be certified by a certificate of compliance by a licensed mechanical contractor or plumbing permittee before or at the time of the final plumbing inspection.

H. All outdoor timed irrigation systems must be equipped with a rain sensor so that the irrigation system does not operate when it is raining or has recently rained.

I. Exceptions to the above requirements may be permitted when necessary to maintain adequate health and safety standards.

Outdoor Water Use Restrictions

Municipalities commonly restrict outdoor water use for activities such as watering lawns and gardens or spraying driveways and sidewalks, however, the extent of these restrictions among municipalities may vary by time of day, season, current drought conditions, etc. Some municipalities employ watering rotations by precinct or street number; some make outdoor water use exceptions for installation of new landscaping and in emergency drought conditions. The following example of a water use ordinance is from Arlington Heights, Illinois[3].

[3] Arlington Heights, Illinois Water Use Ordinance. http://www.vah.com/info/Municipal_Code/CHAPTER%2021.pdf

Section 21-112: Outdoor Water Use Restrictions.

A. It shall be unlawful for any person, firm or corporation to use water from the municipal water works system for the purpose of sprinkling or watering a lawn or garden except between the hours of 8:00 A.M. and noon or between the hours of 7:00 P.M. and 9:00 P.M., Monday through Saturday. No outdoor sprinkling or watering is permitted on Sunday. Specifically exempt from the requirements of this Section are hand held hoses or sprinkling cans used for watering.

B. Any person, firm or corporation violating the terms of this Section shall be fined not less than $25 nor more than $750 for each offense.

C. Temporary 14 day sprinkling permits may be issued by the Director of Public Works to individuals who have special needs related to newly installed landscape materials.

D. In the event of an interruption to the municipal water works system water supply or in the event of an emergency, the Village President or Village Manager is hereby authorized to implement the Village's emergency water use plan and to impose immediate restrictions upon the use of water for outdoor water users, including but not limited to lawn and garden sprinkling, swimming pool filling, and ice rink activities. If deemed necessary, water service to certain users may be curtailed or terminated for the duration of the emergency.

Limitation of Hydrant Uses

Fire hydrants, as sources of vast volumes of public water, are critical for protecting communities in the event of fire. Therefore, ordinances strictly limit use of hydrants for purposes other than fire fighting, and describe specific maintenance requirements. Reducing hydrant use for non-emergency situations help conserve public water. The following example of a hydrant ordinance is from Arlington Heights, Illinois.

Section 21-111: Use and Maintenance of Fire Hydrants.

A. No person, firm or corporation shall open or draw water from any Village fire hydrant without prior permission from the Director of Public Works.

B. No person, firm or corporation shall tamper, alter, damage or interfere with any Village-owned fire hydrant.

C. All fire hydrants, public and private, shall be properly inspected, maintained and tested in accordance with AWWA and NFPA standards. Village-owned hydrants shall be painted red. Private hydrants whose flows are measured and recorded by a Village-owned meter shall be painted yellow. Private unmetered hydrants shall be painted red. All nozzle caps shall be painted with a reflectorized coating as specified by the Director of Public Works.

D. No object shall be erected, constructed, maintained or installed within four feet of a fire hydrant. This provision includes trees, bushes, shrubs, etc.

E. Water obtained from any Village-owned fire hydrant for any purpose other than fire fighting or related public safety uses shall be metered and the water consumption shall be billed at a rate to be determined by the Finance Director. Payment for such water shall be made in accordance with policies established by the Finance Director.

Water Conservation for Commercial Consumers

Many of the same conservation measures apply to residential and commercial water consumers, but in some cases, commercial water consumers have unique considerations due to the type or volume of their use. Certain industries such as hospitality and landscaping are particularly subject to reduction

in water use. The following examples of a water conservation ordinances for commercial consumers are from Santa Fe County, New Mexico and San Antonio, Texas.[4]

Water Use Restrictions for the Hospitality Industry (Santa Fe County, New Mexico)

A. All private and public eating establishments shall provide water and other beverages only upon request. This policy shall be clearly communicated to the customer in at least one of the following manners: on the menu, by use of a "table tent" or single signage on the table, or posting in a location clearly visible to all customers. All catering and banquet operations shall comply with the provisions of this subsection. The intent of this requirement is not to discourage the drinking of water but to discourage the washing of additional unnecessary glasses.

B. Lodging facilities shall not provide daily linen and towel changing for guests staying multiple nights unless the guest specifically requests each day that linens and towels be changed.

Water Use Restrictions for Various Commercial Water Users (San Antonio, Texas)

Sec. 34-272. Activities to be regulated on and after effective dates.
The following activities shall be regulated in the manner set out herein on and after the respective dates indicated in the sections and subsections. A person affected by such regulations may request a variance in the manner set out in Section 34-277. A violation of this section and subsections shall be subject to the enforcement provisions set out in Section 34-278. It shall be and is hereby declared unlawful for any person to violate, refuse or fail to implement the requirements of this Division 1.

Sec. 34-272.1 Power Washers.
A. Effective January 1, 2006, a person who uses a power washer in any commercial manner or for compensation shall register with the Director of Conservation, and obtain a certificate for such use.
B. Exempted from this requirement are persons who use power washers for personal use at their own home and homebuilders who are performing a one-time clean up at a newly constructed house.
C. Holders of NPDES / TPDES permits are deemed certified.
Comment. This comment does not have force of law, but is offered for clarification only. The intent of this registration protocol is to complement and make effective mandates necessary to "critical period' conservation rules found elsewhere in the City Code. The conservation rules in question are intended to prevent water waste under certain circumstances when "critical periods" are observed. Examples of persons subject to year round registration are those hired, employed or contracted to clean sidewalks, parking lots, commercial / public buildings and other impervious areas associated with commercial or domestic properties; professional painters; businesses using their own in-house power washers such as chain stores, grocery stores, and any other entity, public or private.

Sec. 34-272.2 Vehicle Wash Fundraisers.
Effective March 1, 2005, any vehicle wash fundraiser shall be exempted from the Vehicle Wash requirements.

Sec. 34-273. Activities to be regulated on and after January 1, 2006.
Except as provided by a specific and alternative application date, particularly systems analysis, the following activities shall be regulated in the manner set out herein on and after January 1, 2006. A person affected by such regulations may request a variance in the manner set out in Section 34-277. A violation of this section and subsections shall be subject to the enforcement provisions set out in Section 34-278. It shall be and is hereby declared unlawful for any person to violate, refuse or fail to implement the requirements of this Division 1.

Sec. 34-273.1 Minimum irrigation area and flow direction.

[4] San Antonio, Texas Water Conservation Ordinance, http://www.bexarmet.org/PDF_FILES/2005ConservationOrdinance.pdf

Newly installed irrigation systems using pop-up spray or rotor technology shall not be used in landscaped areas which have both: (a) dimensions less than five feet in length and/or width; and, b) impervious pedestrian or vehicular traffic surfaces along two (2) or more perimeters. Where pop-up sprays and rotor heads are allowed in newly installed irrigation systems, they (a) must direct flow away from any adjacent impervious surface and (b) shall not be placed within 4 (four) inches from an impervious surface.

Sec. 34-273.2 Annual irrigation system analysis for athletic fields, golf courses, and large properties.

A. An annual irrigation system analysis shall be required for all athletic fields, golf courses and large properties and shall be submitted in writing to the San Antonio Water System Conservation Department on or before May 1st of each year, beginning on May 1, 2006. Golf courses, other than those utilizing recycled water for irrigation in accordance with an agreement with SAWS, shall comply with residential irrigation requirements on areas other than tee boxes, fairways and greens.
B. Municipal tenants and lessees of golf courses, sports and athletic playing fields, and any other municipally owned properties, shall be responsible for compliance with this section and subsection. The SAWS shall look directly to such tenants and lessees for compliance unless the municipality concedes by contractual agreement with the tenant / lessee to assume the tenant / lessee's responsibility for compliance.

Sec. 34-273.3 Cooling towers (Effective January 1, 2006).

A. Cooling Towers, not utilizing; recycled water, shall operate a minimum of four cycles of concentration.
B. Newly constructed cooling towers shall be operated with conductivity controllers, as well as make-up and blowdown meters.

Sec. 34-273.4 Ice Machines.

Newly installed ice machines shall not be single pass water-cooled.

Sec. 34-273.5 Commercial Dining Facilities.

Commercial dining facilities shall:

A. Serve water only upon request.
B. Utilize positive shut-offs for hand-held dish-rinsing wands.
C. Utilize water flow restrictors for all garbage disposals.

Sec. 34-273.6 Vehicle wash facilities.

A. Vehicle wash facilities, commencing operation on or after January 1, 2006, using conveyorized, touchless, and / or rollover in-bay technology shall reuse a minimum of fifty percent of water from previous vehicle rinses in subsequent washes.
B. Vehicle wash facilities, commencing operation on or after January 1 2006, using reverse osmosis to produce water rinse with a lower mineral content, shall incorporate the unused concentrate in subsequent vehicle washes.
C. Regardless of date of operation commencement, self-service spray wands used shall emit no more than three gallons of water per minute.

Sec. 34-273.7 Vacuum Systems.

Vacuum systems shall not be water-cooled with single-pass potable water when alternative systems are available.

Sec. 34-274 Other Activities to be regulated on and after January 1,2006.

The following activities shall be regulated in the manner set out herein on and after January 1, 2006. A person affected by such regulations may request a variance in the manner set out in Section 34-277. A violation of this section and subsections shall be subject to enforcement provisions set out in Section 34-278. It shall be and is hereby declared unlawful for any person to violate, refuse or fail to implement the requirements of this Division 1.

Sec. 34-274.1 Condensate collection.
Newly constructed commercial buildings installing air conditioning systems on and after January 1, 2006, shall have a single and independent condensate wastewater line to collect condensate wastewater to provide for future utilization as (i) process water and cooling tower make-up and/or (ii) landscape irrigation water. Condensate wastewater shall not be allowed to drain into a storm sewer, roof drain overflow piping system public way or impervious surface.

Sec. 34-274.2. Rain Sensors.
Effective January, 1, 2006, rain sensors shall be installed and maintained on all irrigation systems equipped with automatic irrigation controllers.

Sec. 34-275 Landscaping Regulations generally applicable on and after January 1, 2006.
Except as specifically provided with alternative effective dates, persons affected by the regulations set out herein below shall comply on and after January 1, 2006, and may request a variance to such regulations in the manner set out in Section 34-277. A violation of this section and subsections shall be subject to the enforcement provisions set out in Section 34-278. It shall be and is hereby declared unlawful for any person to violate, refuse or fail to implement the requirements of this Division 1.

34-275.1 Xeriscape option.
Effective January 1, 2006, homebuilders and/or developers subdividing lots and/or constructing new single family residential homes shall offer a xeriscape option in any series of landscaping options offered to prospective home buyers.

34-275.2 Model.
Effective January 1, 2006, homebuilders and/or developers who construct model homes for a designated subdivision shall have at least one model home per subdivision landscaped according to a xeriscape design.

34-275.3 Zonal system.
In-ground irrigation systems installed on and after January 1, 2006, shall be zonal irrigation systems.

34-275.4 Turfgrass soil support.
A. Turfgrass installed during or associated with new construction on and after January 1 2006, shall have a minimum of four inches of soil under the turfgrass.
B. Drainage utility projects, water and power utility projects, public property maintenance or repair, and those governmental activities necessary to NPDES / TPDES compliance with federal or state rules and regulations implementing the federal Clean Water Act; or governmental actions to comply with the Americans with Disabilities Act, shall not be deemed new construction for purposes of this subsection.

34-275.5 Turfgrass dormancy qualities.
Turfgrass installed after January 1, 2007, shall have summer dormancy capabilities.
Legal comment: This comment does not have force of law, but is provided here for informational purposes only. The Texas Property Code, Chapter 202, Section 202.001, et. seq., entitled "Certain Restrictive Covenants," reflects a growing public interest in water conservation and its relationship to the public health, safety, and welfare. Texas Property Code, Chapter 202, Section 202.007, provides that a property owners association may not include or enforce a provision in a dedicatory instrument that prohibits or restricts a property owner from implementing certain efficient irrigation systems, including underground drip or other drip systems. Any dedicatory instrument provision, attempting to restrict a property owner from installing such efficient systems, is void. Therefore, such restrictions, running counter certain conservation efforts, cannot be enforced. Texas Real Property Code, Sec. 202.007(b). Added by Acts 2003. 78'h Legislature, chapter 1024. .6 1, Effective, September I, 2003.

As used within the Texas Property Code, "dedicatory instrument" means a governing instrument for the establishment, maintenance, and operation of a residential subdivision, planned unit development, condominium, townhouse regime, or any similar planned development. Texas Real Property Code, Sec. 202.007(I).

The Texas Property Code also allows that a property owners' association may restrict the type of turf used by a property owner in the planting of new turf [in the future] in order to encourage or require water conserving turf.

According to the Texas Property Code dedicatory instrument or other legal means, installation of efficient irrigation systems, including establishing visibility limitations for aesthetic purposes.

The SAWS endorses and advocates the use of dedicatory instruments and other legal obligations among private parties which understandings may support and promote a culture of water conservation.

Installation of Water Meters

Ordinances concerning the installation of water meters ensure that all customers served by the public water supply are metered by the municipality for the purpose of assessing charges. The municipality is responsible for ownership, installation, and maintenance of accurate, accessible meters. The following example of a water meter ordinance is from Arlington Heights, Illinois.

Section 21-110: Water Meters.

A. No premise shall be supplied with water from the municipal water works system until a meter is installed on the water service pipe and, where applicable, until a remote register reading device is installed on the exterior of the building being served.

B. The Village shall supply water meter devices, accessories and components for new customers. The cost of furnishing and installing each water meter and related accessories shall be paid for as part of the building permit fees for the subject premises.

C. All meters, registers, generators, vaults, interface devices, wires, cables, and appurtenances used in connection with the municipal water works system shall be supplied by the Village. Installation of the devices and components shall be accomplished in accordance with policies established by the Director of Public Works. The devices and components related to the metering system set forth above shall be owned, operated and maintained by the Village. The Village will not be responsible for maintenance of valves and/or service pipes attached to the metering devices or components.

D. The Village will be responsible for maintaining the water meter and accessories in good working order. Flow measurement accuracy and precision will be governed by applicable AWWA/ANSI standards. The property owner, occupant or tenant where the meter is installed is responsible and shall be held liable for any damage and attendant costs resulting from freezing, tampering, vandalism, etc. to the meter. The cost of repair, replacement, and/or adjustment of the meter shall be paid by the property owner, occupant, or tenant as soon as a bill is presented. The amount shall be a lien against the premises in which the meter is located to the same extent and with the same effect as delinquent water charges and sewer charges as provided for in Section 21-308 of the Code.

E. Water meters shall be installed in a location that is easily accessible. The installation of the meter shall ensure that all flows, including fire and domestic, are measured. Actual size, location and installation of the meter and accessories shall be approved by the Director of Public Works. No enclosures, cabinets, walls, etc. shall be erected that will obstruct or interfere with the reading, servicing, testing or replacement of the water meter. Property owners, occupants, or tenants constructing such obstructions around or near the water meters shall remove, remodel or relocate the obstruction to provide proper accessibility within ten days of receiving notice from the Village. Failure to provide reasonable accessibility for maintenance, servicing, testing, repair or replacement of water meters shall be cause for water service termination and water shut off.

Water service will be restored only after proper access to the water meter has been obtained to the satisfaction of the Director of Public Works.

F. Water meters and/or remote reading devices shall be read on a frequency determined by the Finance Director. Authorized representatives of the Village shall be allowed to enter buildings and/or premises at reasonable hours to make meter readings. In the event water meter readings cannot be obtained consistent with the established billing schedule, the Finance Director shall prepare estimated bills, based on historical usage data during similar billing periods from the preceding year(s).

G. The water meter installed on the water service is the meter of record and shall govern all bill calculations. The water meter register reading prevails over all other devices and readings. The remote register readings will be used for convenience in obtaining readings. It is the responsibility of the water customer, property owner, occupant or tenant to periodically verify agreement between the water meter reading(s) and the remote register reading(s). Any discrepancy between the meter readings and the remote register readings shall be immediately reported to the Village. Whenever a difference in readings exists, the water meter register reading will be used to determine consumption and to calculate the water bill.

H. Whenever any water meter fails to properly measure, record and register water passing through the meter, the customer shall be charged at the rate of consumption consistent with historical usage data during similar billing periods from preceding years. If no historical data exists, the Finance Director shall estimate the amount of water consumed during the period of meter failure. It shall be the responsibility of the water customer to pay for the amount of water consumption estimated by the Finance Director.

I. Water meters shall be tested and replaced on a frequency determined by the Director of Public Works. Normal repairs and replacement of meters shall be made by the Village at no cost to the property owner, occupant, or tenant. Costs of repair or replacement of meters necessitated as a result of freezing, neglect, carelessness or other improper conditions shall be charged against and collected from the water customer.

J. The Director of Public Works or authorized representative shall be allowed access during all reasonable hours to all water meters and backflow prevention devices for the purpose of testing meters for accuracy and testing other devices for satisfactory operation. Tests shall be conducted annually by the Village on all backflow prevention devices. The fee for testing Village-owned and maintained backflow prevention devices shall not exceed the charges in the contract for these services approved by the Board of Trustees and shall be paid by the users of the backflow prevention devices. All water meters shall be tested at the discretion of the Director of Public Works and in accordance with the manufacturers' suggested testing schedules. Additional testing may be required whenever erroneous or erratic meter readings are registered or when mechanical defects are observed. There shall be no charge for routine testing of water meters or for testing done at the Village's initiative.

Any water meter shall also be tested upon a customer’s complaint or request. Prior to the test, the customer shall agree in writing to pay testing fees if the meter is certified to be within three percent of being accurate. There shall be no testing fee if the water meter is certified as not being within three percent of being accurate. In such cases, the meter shall either be replaced with a properly certified meter or repaired so that the meter is within three percent of being accurate. Fees for testing meters at a customer's request and found to be within three percent of being accurate shall not exceed the charges in the contract for these services approved by the Board of Trustees.

All testing charges for water meters and backflow prevention devices shall be added to the water bill on a billing frequency approved by the Finance Director. If such charges and fees are not paid within 20 days from billing, penalties shall be added in accordance with the applicable Code provisions.

Definitions for Water Conservation Ordinance Terminology

Many ordinances preface restrictions with a section that defines terms used in the context of water conservation. The first example below of definitions for water conservation ordinance terminology is from the San Antonio Water System, Texas. The second example below is from the City of Santa Monica, California.

Sec. 34-271. Definitions. (San Antonio Water System, Texas)

As used in this article, the following terms shall have the following meanings:

Air conditioning system(s). A mechanical system generally consisting of a compressor, thermostat and duct work permanently installed in a building for the purpose of controlling humidity and temperature. For the purposes of this division, an air conditioning system does not include window units.

Automatic irrigation controller. A device that automatically activates and deactivates an irrigation system at times selected by the operator.

Blowdown meter. A meter that tracks the amount of water discharged from a cooling tower system.

Commercial dining facility. A business that serves prepared food and beverages to be consumed on the premises.

Concentration. Re-circulated water that has elevated levels of total dissolved solids as compared to the original make up water.

Conservation Department. The Conservation Department of the San Antonio Water System.

Conductivity controller. A device used to measure the conductivity of total dissolved solids in the water of a cooling system and control the discharge of water in order to maintain efficiency.

Cooling Tower. An open water recirculation device that uses fans or natural draft to draw or force air to contact and cool water through the evaporative process.

Director of Conservation. The Director of the Department of Conservation of the San Antonio Water System.

Impervious surface. Patios, pathways and other areas where firm footing is desired, constructed in such a way that does not allow water to penetrate the around. Examples include but are not limited to concrete slab patios, sidewalks and driveways, asphalt streets or pavers set with mortar.

Irrigation system. A system with fixed pipes and emitters or heads that apply water to landscape plants or turfgrass, including, but not limited to, in-ground and permanent irrigation systems.

Irrigation system analysis. A zone-by-zone analysis of an irrigation system that, at a minimum, includes a review of the following elements:

1. Design appropriateness for current landscape requirements
2. Irrigation spray heads and valves
3. Precipitation rates expressed in inches per hour
4. Annual maintenance plan that includes irrigation system maintenance, landscape maintenance, and a basic summer and winter irrigation scheduling plan.

Large property. A land tract owned by a general customer that equals or exceeds five acres in size and has an irritation system.

Low-flow toilet. A tank toilet that uses 1.6 gallons or less of water per flush.

Make-up Meter. A meter that measures the amount of water entering a cooling tower system.

NPDES / TPDES permit holders. Those entities that have valid state or federal permits commonly referred to as NPDES or TPDES [National Pollutant Discharge Elimination System / Texas Pollutant Discharge Elimination System] permits to satisfy requirements of the federal Clean Water Act.

Person. Any individual, corporation (including a government corporation), organization, state or federal governmental subdivision or agency, political subdivision of a state, interstate agency or body, business, trust, partnership, limited partnership, association, firm, company, joint stock company, joint venture, commission or any other legal entity.

Pervious Hardscape. Patios, pathways and other areas where firm footing is desired, constructed in such a way that allows for water to penetrate the ground. Examples include flagstone set in sand and wood plank decks, but exclude concrete slab patios and sidewalks or pavers set with mortar.

Positive shut-off. A valve that is held in a closed position by system pressure until overridden by an outside force.

Power washer. A machine that uses water or a water-based product applied at high pressure to clean impervious surfaces.

Rain sensor. A device designed to stop the flow of water to an automatic irrigation system when rainfall has been detected.

Recycled Water. Domestic or municipal wastewater which has been treated to a quality suitable for a beneficial use in accordance with applicable law.

Requestor. A customer who requests a variance under this Division.

Residential Customer. A single or multi-family dwelling unit containing two (2) or fewer family units.

Summer dormancy. The ability of turfgrass to survive without water for a period of sixty consecutive days during the months of May through September. Turfgrass with summer dormancy capabilities approved for use are set forth in the approved low water use plant list. The approved low water use plant list, as may be amended from time to time, shall be available from SAWS and located at www.saws.org/conservation.

Turfgrass. Perennial ground cover plants and grasses that are adapted to regular mowing and traffic through management.

Vacuum system. A system, often consisting of a pump, chamber, and tubes, that is used to create a vacuum for any of a variety of purposes, including but not limited to medical, dental and industrial applications.

Variance Administrator. Staff person in the Department of Conservation responsible for administering and hearing variance requests under this Division 1.

Vehicle wash facility. A permanently-located business that washes vehicles with water or water-based product, including but not limited to self-service car washes, full-service car washes, roll-over/in-bay style car washes, and fleet maintenance wash facilities.

Vehicle wash fundraiser. Any special-purpose vehicle wash event for which a fee is charged or donation accepted.

Water flow restrictor. An orifice or other device through which water passes at a restricted rate.

Xeriscape. A landscape consisting of a maximum of 50% turfgrass, with the remaining percentage of landscape incorporating low water use plants and/or pervious hardscape. The approved low water use plant list, as may be amended from time to time, shall be available from SAWS and located at www.saws.org/conservation.

Zonal irrigation system. An irrigation system that segregates by station areas of shrubs, ground cover, bedding plants, and turf to accommodate a diversity of watering requirements.

7.10.030 Definitions. (City of Santa Monica, California)

The following words and phrases shall have the following meanings when used in this Chapter:

Area Susceptible to Runoff. Any non-permeable surface directly exposed to precipitation or in the path of runoff which leads directly to neighboring properties or to the public right-of-way.

Best Management Practices ("BMP"). Practices principally applicable to construction sites and new developments that reduce the toxicity contained in, and the volume of, water which runs into storm drains, treatment facilities and the Santa Monica Bay. The Los Angeles Regional Water Quality Board ("Regional Board") has an approved list of BMPs and a list of technical resources and reference materials. Any BMP not specifically approved by the Regional Board may be used if they have been recommended in one of the listed technical resources and reference materials. The City Urban Runoff Management Coordinator and Engineering Department shall maintain updated copies of these lists and shall provide them upon request.

Good Housekeeping Requirements ("GHR"). Urban runoff pollution control practices applicable to existing properties, which have been demonstrated to significantly reduce and control urban runoff pollution that runs into storm drains, treatment facilities and the Santa Monica Bay.

New Development. For purposes of this Chapter, new development shall constitute any of the following:

1. Any construction project on a vacant site or on a site where fifty percent or more of the square footage of the structures is removed prior to construction.
2. Any construction project where an existing building or structure has been damaged, or is in need of repairs, or the owner desires to make repairs, alterations, or rehabilitation in an amount exceeding fifty percent of the replacement cost of the building or structure. For purposes of this subsection, the City's Building Officer shall determine the replacement cost of the building or structure and may use the most current building valuation table published by the International Conference of Building Officials. The Building Officer shall also determine the fair market value of any necessary repairs and may calculate the fair market value of repairs based on three responsible bids from properly licensed contractors.
3. Any construction project that (a) results in improvements to fifty percent or greater of the square footage of a building, (b) creates or adds at least five thousand square feet of impervious surfaces, or (c) creates or adds fifty percent or more of impervious surfaces.
4. Any construction project undertaken by the City where the runoff controls required by this Chapter are feasible and economical, as determined by the Director of the Department of Environmental and Public Works Management, but which would not otherwise constitute new development as defined by subdivisions (1), (2) or (3) of this subsection (D).

Source Control BMP. Non-structural activities, practices, and procedures that are designed to prevent urban runoff pollution.

Storm Event. 0.75 inches of rainfall within a consecutive twenty-four-hour period that is separated from the previous storm event by at least seventy-two hours of dry weather.

Structural BMP. Any structural facility designed and constructed to mitigate the adverse impacts of storm water and urban runoff pollution (e.g. canopy, structural enclosure). The category may include both Source Control and Treatment Control BMPs.

Treatment Control BMP. Any engineered system designed to remove pollutants by simple gravity settling of particulate pollutants, filtration, biological uptake, media adsorption or any other physical, biological or chemical process.

Urban Runoff or Urban Runoff Pollution. Water and suspended or dissolved materials deposited on surfaces and washed by storms or other sources of flowing water, through the flood control system to the ocean. Research studies have shown that urban runoff contributes many pollutants to receiving waters. Contamination includes bacteria and viruses, solid waste, and toxics such as heavy metals and petroleum-based compounds.

Urban Runoff Mitigation Plan. A plan that shall be submitted and approved in connection with any new development. (Added by Ord. No. 1992CCS § 1 (part), adopted 11/28/00)

Conservation Signage and Literature Distribution

Educating water consumers is a critical goal for municipalities. To this end, they often require public notices to instruct and encourage conservation. The following example of a conservation signage and literature distribution ordinance is from Santa Fe County, New Mexico.

A. Public, semi-public and governmental restrooms and shower facilities shall post not less than one (1) water conservation sign in each restroom and shower facility, the size of which shall not be less than eight and one-half inches (8.5) by eleven (11) inches. Such entities may use a sign provided by Santa Fe County or develop their own sign using text provided by Santa Fe County.

B. Hotels, motels and other lodgings shall provide a water conservation informational card or brochure in a visible location in each guest room. Such literature may be provided by Santa Fe County or the establishment itself using text provided by Santa Fe County.

C. Retail plant nurseries shall provide their “end-use” customers with County provided low water-use landscape literature and water efficient irrigation guidelines at the time of sale of any perennial plant. An “end-use customer” is the person or persons who will ultimately own the plant material. A landscape contractor or architect is not an end-use customer. In order to facilitate the purchasing of low water-use plants, nurseries are strongly encouraged to tag or sign their plants that require little or not supplemental water once established. For the sale of all turf or grass seed or sod, the customer shall be given County provided literature indicating the restrictions to planting water consumptive turf.

D. Landscape contractors, maintenance companies and architects shall provide their prospective clients with County-provided low water-use literature and water efficient irrigation guidelines at the time of presenting a service contract to the prospective client. Landscape professionals are strongly encouraged to educate their customers regarding the operation of their timed irrigation systems.

E. Title companies and others closing real estate transactions shall provide the entity purchasing a home, business or property with County-provided indoor and outdoor conservation literature at the time of closing.

F. The County departments shall provide indoor and outdoor conservation literature to all persons applying for a building permit and all persons initiating new water service to the County Water Utility.

G. The domestic well metering program applies to only those residents of Santa Fe County living or operating businesses on lots where restricted water usage and water meter reporting requirements were voluntarily accepted as a condition of the plat approval. All other residents of the County are exempt from this program.
    1. All properties that are required to report water meter readings as a condition of plat approval shall have the name and address of the property owner entered into the database when the building permit is issued.
    2. The final inspection field report shall require that the water meter be installed in order for final inspection approval.
    3. All properties that are required to have water meters shall also be required to test their water meter for reading accuracy every ten (10) years and replace if necessary.
    4. Each property that is required to report water meter reading will receive a mailing from Santa Fe County containing a post card that can be filled out with the meter reading and returned to Santa Fe County.
    5. Failure to submit the meter reading will result in the same penalties as outlined for other water violations.
    6. When water is used in excess of the amount allocated to the property, the first year a letter with educational/informational materials on how to reduce water use will be sent to the water user and they will be required to submit water meter readings every six months to track their progress. All subsequent water usage violations will result in the same penalties as outlined for other water violations.

Enforcement

Ordinance enforcement methods vary from warnings and citations to monetary fines to discontinuation of water service. The following examples of enforcement ordinances are from Santa Fe County, New Mexico; Santa Monica, California; San Antonio, Texas; and Durham, North Carolina.[5]

Enforcement and Penalties (Santa Fe County, New Mexico)

A. *Enforcement*. The Santa Fe County Utilities Department, the County Code Enforcement Officers, the Santa Fe County Sheriff's Department and the Santa Fe County Fire Department may enforce any and all of the County Water Conservation regulations. To the extent that the Board of County Commissioners may find it desirable to vest specific enforcement authority in other County personnel or other governmental agency, those individuals so vested shall also have the authority and responsibility to enforce regulations adopted County water conservation.

   The following schedule of fines shall be used for violations of this Ordinance. All violations on a single date at a single address constitute a single offense for purposes of enforcement.
   First violation: $50.00
   Second violation: $100.00
   Third violation: $200.00
   Fourth and all subsequent violations: $400.00

B. *Penalties*. Any person who violates the provisions of this Ordinance shall be prosecuted in a court of competent jurisdiction and penalized to the maximum extent allowed by law.

C. *Severability*. The provisions of this Ordinance shall be severable. If, any provision of this Ordinance is ruled to be invalid by a court of competent jurisdiction:

[5] The City of Durham Code, Article VI. Water Conservation. http://www.ci.durham.nc.us/departments/environ/ordinance.cfm

1. The effect of such judgment shall be limited to the specific provision or provisions that are expressly stated in the judgment to be invalid; and
2. Such judgment shall not affect, impair or nullify the validity of application of the remainder of this Ordinance that shall continue in full force and effect.

7.10.070 Enforcement and Penalties (Santa Monica, California)

A. The Director of the Department of Environmental and Public Works Management, or his or her designee, is authorized to enforce Sections 7.10.040, 7.10.050 and 7.10.060 as follows:
    1. For the first failure to comply with any provision of Sections 7.10.040, 7.10.050 and 7.10.060, the Department of Environmental and Public Works Management shall issue to the affected person a written notice that includes the following information:
        a. A statement specifying the violation committed;
        b. A specified time period within which the affected person must correct the failure or file a written notice disputing the notice of failure to comply;
        c. A statement of the penalty for continued noncompliance.
    2. For each subsequent failure to comply with any provision of Sections 7.10.040, 7.10.050 and 7.10.060 following written notice pursuant to this Section, the Director of the Department of Environmental and Public Works Management may levy a penalty not to exceed five hundred dollars. Any statement informing a violator of a citation shall include a notice setting forth the hearing rights provided in subsection (a)(3) below.
    3. Any person assessed a penalty pursuant to subsection (a)(2) may dispute the penalty by requesting a hearing on a form provided by the City within the time and manner set forth in Section 6.16.030, provided that no hearing request shall be deemed timely filed and no hearing shall be held unless, within the time period to request a hearing, the person deposits with the City Treasurer money in the amount of any unpaid penalty due under this Section. If as a result of the hearing it is determined that the penalty was wrongly assessed, the City shall refund any money deposited to the person. The decision of the Hearing Examiner shall be final except for judicial review and shall not be appealable to the City Council.
    4. It shall not be a defense to the assessment of any penalty or to any other civil enforcement action provided for under this Section for a person to assert that any violation of Sections 7.10.040, 7.10.050 and 7.10.060 was caused by the actions of a person other than the person assessed except if the violation was caused by the criminal or negligent action of a person who was not an agent, servant, employee or family member of the person.
    5. Any penalty collected hereunder shall be deposited in the City's Stormwater Fund to be used as reimbursement for the Department of Environmental and Public Works Management's costs and expenses of administration and enforcement of this Chapter.
B. Any violation of this Chapter shall constitute an infraction punishable by a fine of five hundred dollars. Each day that a violation occurs shall constitute a separate offense.
C. A violation of any provision of this Chapter is declared to be a public nuisance and may be abated pursuant to Santa Monica Municipal Code Chapter 8.96 or by means of a civil action.
D. The City may enforce the provisions of this Chapter by means of a civil action. The burden of proof in such cases shall be preponderance of the evidence.
E. Any person who commits an act, proposes to commit an act, or engages in any pattern and practice which violates this Chapter may be enjoined therefrom by any court of competent jurisdiction.
F. The penalties and remedies established by this Chapter are not exclusive, and nothing in this Chapter shall preclude any person from seeking any other remedies, penalties or procedures provided by law. (Added by Ord. No. 1992CCS § 1 (part), adopted 11/28/00)

Sec. 34-277 Enforcement (San Antonio, Texas)

Sec. 34-277.1 The President/CEO or his designee of the San Antonio Water System is hereby authorized to enforce this Division in the manner and to the extent allowed by law, including, but not limited to, filing complaints with the city municipal prosecutor's office for such violations, serving

notices of violations of this Division and filing civil enforcement actions. Such authorization does not diminish the City Attorney's authority in regard to enforcement of Chapter 34 provisions.

Sec. 34-277.2 Presumption and Exception. For purposes of this Division, it shall be presumed that the person, in whose name a water meter connection is registered with the water purveyor servicing the property, is the responsible party who has made, caused, allowed, or permitted a violation of the provisions of Article IV, Division 1. Proof that the particular premises had a water meter connection registered in the name of the defendant cited in a criminal complaint filed pursuant to this division shall constitute a prima facie presumption that the defendant is a person who made, caused, allowed or permitted a violation pursuant to the provisions of this Division. [Exception to this presumption is found in subsection 34-273.2 above, wherein a city, whose premises are used by a tenant / lessee, is generally not responsible for the tenant / lessee's compliance. In such cases the tenant / lessee of the city is responsible for compliance and the city shall have no duty to enforce against the tenant / lessee except to the extent the city's municipal courts may be fully utilized by the SAWS enforcement officers or other duly authorized governmental personnel charged with enforcement duties.

Sec. 34-277.3 The President/CEO or his or her designee is authorized and instructed to commence any action, in law or in equity, including the filing of criminal charges, deemed necessary for the purpose of enforcing this Division. The San Antonio Water System President/CEO or the designee may seek civil penalties, as may be allowed by statute, and any other legal or equitable relief available under common law, Chapter 54 of the Texas Local Government Code as it may be amended to address the subject matter of this Division, or any other applicable city, state or federal code or statute.

Sec. 34-277.4 Criminal. Any person violating any provision of this Division 1 of Article IV shall be guilty of a Class C misdemeanor and upon citation and conviction , shall be punished by a fine not less than fifty dollars ($50.00) and not more than one hundred dollars ($100.00) for the first offense; a fine not less than two hundred and fifty dollars ($250.00) and not more than five hundred dollars ($500.00) for the second offense; a fine of not less than one thousand dollars ($l,000.00) and not more than two thousand dollars ($2,000) for the third and additional offenses. Each violation of a particular section of this Division shall constitute a separate offense, and each day an offense continues shall be considered a new violation for purposes of enforcing this Division.
Civil. Civil penalties, imposed by courts of competent jurisdiction in Civil Actions for violations of this division, may also be assessed as may be allowed by applicable state law in any amount to be authorized by the State of Texas. Under Chapter 54 of the Texas Local Government Code, the SAWS and the Office of the City Attorney may presently pursue civil enforcement for injunctive relief and the imposition of $1,000.00 per day civil penalties appropriately imposed by the Court. This statutory remedy is in addition to the City's common law right to bring Civil Actions for injunctive relief to stop harmful acts, independent of authority found in the Texas Local Government Code.

Sec. 34-277.5 If, for any reason, any section, sentence, clause or part of this Division is held legally invalid, such judgment shall not prejudice, affect, impair or invalidate the remaining sections of this Division, but shall be confined to the specific section, sentence, clause, or part of this Division held legally invalid.

Sec. 23-166. Violation of article prohibited; enforcement. (Durham, North Carolina)

A. *Violation*. In the event that the manager shall declare one or more stages of water conservation as set forth herein, it shall be unlawful for any person to use or permit use of water supplied by the city in violation of any mandatory restrictions instituted.
B. *Enforcement*. It shall be the duty of the director of environmental resources to investigate violations of the mandatory restriction and issue orders consistent with the purpose and intent of this article. All customers shall cease any violation of the mandatory restrictions upon the order of the director of environmental resources. Any customer who violates any provision of the article, or who shall violate or fail to comply with any order made hereunder shall be subject to penalty or a combination of the penalties as follows:
    1. *Discontinuance of service*. The city may discontinue water service to any structure(s) or parcel(s) when the director of environmental resources gives written notice of any

violation of mandatory restrictions and intent to discontinue service. Water service shall be discontinued within twenty-four (24) hours unless the violation shall cease voluntarily.

When service is discontinued pursuant to the provisions of this section, service shall not be reinstated unless and until the director of environmental resources determines that the risk to the city water supply has been alleviated.

The customers shall have a right of appeal to the manager, upon serving written notice of appeal on the city manager within five (5) days after receiving notice of any violation and intent to discontinue service. The appellant will be notified by the city manager of the time and place for the hearing of the appeal. The manager shall act on the appeal as expeditiously as possible and shall notify the appellant in writing not later than two (2) days after the final decision.

2. *Equitable relief*. The provisions of this article may be enforced by an appropriate remedy, including a mandatory or prohibitory injunction, issuing from a court of competent jurisdiction.

C. *Penalty not a substitute remedy*. The imposition of one or more penalties for any violation shall not excuse any violation or permit it to continue. (Ord. No. 7028, 1, 7-28-86, revised 12-03-01)

Water Waste Restrictions

Wasting water is explicitly defined and prohibited in some municipalities. The following example of a water waste restriction ordinance is from Santa Fe County, New Mexico.

No person, firm, corporation, county, state, federal or municipal facility or operation shall cause or permit to occur any water waste. In general the occurrence of unforeseeable or unpreventable failure or malfunction of plumbing and irrigation system hardware shall not be deemed sufficient grounds for issuance of a citation or other enforcement proceedings unless and until the County issues a formal written notice.

Water waste means any non-beneficial use of water. Waste includes but is not limited to leaks from indoor and outdoor plumbing systems in excess of 0.25 gallons per minute.

For unforeseeable or unpreventable outdoor violations, the County shall generally issue a formal warning notice prior to taking enforcement action. Prior to taking formal enforcement action the County may instruct the water user not to operate the faulty system until it is appropriately repaired. If operating the system is integral to the operation of the facility the County may at its own discretion provide a period of time in which to remedy the violation prior to commencing formal enforcement action. Once a warning notice or an official citation has been issued for an outdoor occurrence, subsequent water waste events shall be subject to strict enforcement. Strict enforcement may include the issuance of citations and other such activities as the County deems necessary to bring the water user into compliance. For indoor water waste events and for those water waste events outdoors caused by a faulty system which is integral to the operation of the facility, the waste must be abated within 15 calendar days of the issuance of a warning notice or initiation of enforcement action. Enforcement action shall be taken if the waste continues beyond the 15-day period.

Water waste does not include:

A. Flow resulting from fire fighting or other routine inspection of fire hydrants or other training activities,
B. Water applied to abate spills of flammable or otherwise hazardous materials,
C. Water applied to prevent health, safety or accident hazards when alternate methods are not available,
D. Water that reaches or flows onto adjacent property or public or private right-of-way when caused by vandalism, wind, emergencies or acts of God,
E. Flow resulting from a routine inspection or maintenance of a water utility system,

F. Water used by Santa Fe County in the installation, maintenance, repair or replacement of public facilities and structures such as traffic control devices, storm and sanitary sewer structures and road or street improvements,
G. Water used by contractors or utilities including but not limited to sawcutting and pavement, compaction or other use required under terms of their contract,
H. Any water that is discharged as a result of well development or a pumping test.

Conservation Fees Imposed

Conservation fees can be used to penalize residents who waste water, reward residents who conserve it, and offset municipalities' costs for conservation programs. The following example of a conservation fee ordinance is from Santa Monica, California.

Conservation Fee

Environmental Resource Protection Fee Ordinance[6]

A. Communities near Santa Monica Bay pay a fee to protect and restore the Santa Monica Bay in Southern California. The Bay Saver Fee is a conservation incentive fee assessed to any residential water customer in the event that the property has not been retrofitted with water conserving fixtures. (SMMC 7.12.030)
B. How Much is the Bay Saver Fee?
   - Single-family dwellings: $4.00 per bill
   - Multi-family dwellings: $2.60 per unit per bill (includes apartments, condominiums, town homes)
C. How is the Fee Removed?
   Replace water wasting fixtures with water conserving ones, then have a free home assessment performed by a City Water Resources Specialist. Upon verification that all fixtures are in compliance, the fee will be removed. Call (310) 458-8459 to set-up an inspection.
D. What are Compliant Fixtures?
   - Toilets use a maximum of 1.6 gallons per flush or less (also known as ultra-low flow toilets or any toilet manufactured after 1992).
   - Showerheads and Faucets must use a maximum of 2.5 gallons per minute. Showerheads and faucets made after 1992 should be compliant.

7.12.030 Residential water conservation incentive fee program.[7]

A. The City Council by resolution may impose a conservation incentive fee on the charges for supplying water service to any residential consumer in the event the consumer has not installed any water conservation measure set forth in the resolution imposing the surcharge.
B. No person who has been relieved of the obligation to pay a conservation incentive fee because of the installation of any water conservation measure shall remove such water conservation measure without first notifying the City of such removal. In the event of such removal, the City may reimpose the conservation incentive fee. (Prior code § 7200B; added by Ord. No. 1505CCS, adopted 12/12/89)

Variance Procedures

The following example of a variance procedure is from San Antonio, Texas.

Sec. 34-276 Variances.
The authority to grant a variance and an appeal from such variance to the provisions of Article IV, Division 1, is hereby delegated to the San Antonio Water System in the manner described herein. A determination by the San Antonio Water System pursuant to this section shall be deemed final for purposes of appeal. Appeal procedures are detailed below.

[6] Bay Saver Fee Ordinance. http://santa-monica.org/epd/residents/Water/bay_saver_fee.htm
[7] Residential Water Conservation Incentive Fee Program. http://codemanage.com/santamonica/index.php?topic=7-7_12-7_12_030

Sec. 34-276.1 Variance. A person who is affected by these provisions may seek a variance in the manner set out herein. A person shall request a variance within thirty (30) days of the date a provision becomes apparently applicable to that person's activities and/or properties. For example, a person will have standing to seek a variance within thirty (30) days following receipt of a formal (citation) or informal notice of violation; prior to a notice of violation; or at the discretion of the variance administrator when, in the administrator's judgment to pursue a variance would clearly deny the applicant an opportunity to have justice and equity done for the applicant's case. In the latter situation, for purposes of justice and equity, the standard for allowing a variance application to be heard or considered are the common notions of rightness and fair play.

Sec. 34-276.2 Time, date, place. A person seeking a variance under these provisions shall make such request in writing to the Conservation Department. Such request shall be reviewed by the variance administrator. If the application, on its face, warrants a variance, the administrator may grant the request without hearing. Otherwise, the administrator shall review such request within thirty (30) days of receipt and shall inform the requestor in writing of the time, date and place for variance hearing, if necessary.

Sec. 34-276.3 Representation and notice of SAWS' response. First Hearing. The requestor may be represented by a duly authorized representative and may introduce such evidence as the requestor believes to be relevant. The administrator and appropriate Conservation Department personnel shall hear the request. The requestor shall receive written notification by the administrator within thirty (30) days of the date of the hearing whether such variance is granted or denied.

Sec. 34-276.4 Appeal. In the event the variance is granted, the decision of the administrator shall be final. Should the variance be denied, however, the requestor shall have ten (10) days from receipt of the denial of the variance to seek an appeal in writing. Within thirty (30) days of the written request for an appeal from the denial of a variance, the Director shall hear the appeal.

The requestor shall be informed in writing of the time, date and place where such appeal shall be heard. The requestor and/or his authorized representatives may present evidence to the Director why such appeal should be granted. The Director shall inform the requestor within thirty (30) days of the date of the hearing of the appeal whether the appeal has been granted or denied. The determination of the Director shall be final and shall be in writing. If a judicial appeal is pursued, applicant must take such appeal to District Court or other court of competent jurisdiction within 30 days of the Director's final determination, which further appeal shall be pursued under appropriate standards of the substantial evidence rule.

Sec. 34-276.5 Variance qualifications. Variances to the regulated activities in this Division 1 may be issued through the Department of Conservation's variance administrator provided that the general intent of Article IV, Division 1 has been met, and compliance with Article IV, Division 1, is proven to be impracticable to accomplish and to cause unnecessary hardship. The criteria to determine hardship shall include, but not be limited to, a showing of level of capital outlay and technical complexity in relation to conservation benefit to be derived, and time and effort required to accomplish compliance with this Division.

Sec. 34-276.6 The SAWS Director of Conservation shall also develop specific criteria to be used for the granting of variances from the provisions of Article IV, Division 1, which are appropriate to the provision for which a variance is being sought. Such criteria shall be applied equally to each request for variance under a particular provision. A requestor shall be furnished with the criteria to be utilized by the administrator and/or Director prior to his/her variance application and/or appeal being heard.

Response to Water Shortage

Municipalities typically develop ordinances to dictate the extent of conservation measures in the event of drought. In the following example of a water conservation ordinance in response to a water

shortage, Durham, North Carolina lays out a five-stage plan that incrementally reduces water consumption.

Sec. 23-167. Water conservation stages; recommendations; mandatory measures.[8]

Stage I. Continuing Voluntary Conservation Practices. Customers shall be encouraged to observe water conservation measures to reduce the wasting of water as follows:

a. Check plumbing and toilets for leaks annually, and if necessary repair.
b. Repair leaking faucets whenever they develop
c. Store drinking water in the refrigerator to avoid trying to run it cool at the tap.
d. Use shower for bathing purposes or reduce the depth of water used for tub baths. Limit showers to four (4) minutes where possible.
e. Refrain from running faucets while shaving, rinsing dishes or brushing teeth.
f. Install water flow restrictive devices in shower heads.
g. Install water-saving devices such as plastic bottles or commercial units in toilet tanks.
h. Wash full loads in clothes washers and dishwashers.
i. Review water uses and where feasible install recycle systems, particularly commercial and industrial customers.

Stage II. Voluntary Conservation. Customers shall be encouraged to observe the recommendations of Stage I and to increase the level of conservation effort as follows:

a. Limit the use of clothes washers and dishwashers, and when used, to operate fully loaded.
b. Reduce the flushing of toilets to the minimum whenever practical.
c. Limit lawn watering to only when grass shows signs of withering and apply water as slow as possible to achieve deep penetration.
d. Limit shrubbery watering to the minimum reusing household water when possible.
e. Limit car washing to the minimum.
f. Limit wash downs of outside areas such as sidewalks, patios, driveways, or other similar purposes.
g. Limit hours of operation of water-cooled air conditioners possible.
h. Use biodegradable disposable dishes and utensils, both for residential and commercial purposes, where feasible.

Stage III. Moderate Mandatory Conservation. Customers shall be encouraged to observe the recommendations of Stage I and II, and the level of the conservation effort shall be increased to require the following mandatory measures. No person shall:

a. Water lawns, grass, trees, shrubbery, flowers, golf greens or vegetable gardens except during the hours specified by the City Manager. Those hours shall, unless otherwise varied by the Manager, be between 5:00 am and 9:00 am OR 5:00 pm and 9:00 pm on Wednesdays and Saturdays. On each designated day, customers shall water during only one of the allowed periods. When adjustments are made by the Manger to the above times, they shall be published in the local newspapers of general circulation, and set forth on the City's web site, where appropriate.
b. Introduce water into wading pools or swimming pools except to the extent necessary to replenish losses due to evaporation or spillage, and maintain operation of chemical feed equipment.
c. Use water to wash down outside areas such as sidewalks, patios, driveways, or for other similar purposes.
d. Introduce water into any decorative fountain, pool or pond except where the water is recycled.
e. Serve water in a restaurant or similar establishment except upon request.
f. Use water for any unnecessary purpose or intentionally waste water.
g. Wash the exterior of a motor vehicle except where a private well system is used, or where 50% or more of the water is recycled or where it can be demonstrated that 30 gallons of water or less are used to wash the vehicle.

[8] The City of Durham Code, Article VI. Water Conservation. http://www.ci.durham.nc.us/departments/environ/ordinance.cfm

Provided, however, any customer may secure a written license from the city manger or his designee to use water contrary to the Stage III mandatory conservation measures where it can be shown to the manager's satisfaction that use of water pursuant to conditions prescribed by the city manager in the license will result in a thirty (30) percent of greater saving of water. Any license issued pursuant to this provision: (1) must be in the possession of the licensee whenever water is used contrary to the Stage III mandatory conservation measures; and (2) is subject to amendment or revocation by the city manager at any time for good cause.

All industrial, manufacturing and commercial enterprises shall reduce consumption with a goal reduction of at least 30%. Such enterprises shall document the specific efforts they have made to reduce consumption. (Ord. No. 7028, 1, 7-28-86, revised 2-4-02)

Stage IV - Severe Mandatory Conservation. Customers shall be encouraged to observe the conservation measures in Stages I and II and required to continue observing the mandatory requirements in Stage III except to the extent such mandatory requirements are modified by the restrictions regarding Stage IV conservation. The level of the conservation effort shall increase to require the following additional mandatory measures. No person shall:

a. Water or sprinkle any lawn, grass, trees, golf greens or flowers. Provided, however, that a person regularly engaged in the sale of plants shall be permitted to use water for irrigation of their commercial stock in trade, using the minimal amount for survival. State, County and City licensed landscape contractors may continue to water plantings which are under written warranty by hand-held hose, container or drip irrigation.
b. Water any vegetable garden or ornamental shrubs except by hand-held hose, container, or drip irrigation system, during hours specified by the City manger. Those hours shall, unless varied by the Manger, be between the hours of 5:00 am and 9:00 am OR 5:00 p.m. and 9:00 p.m. on Wednesdays and Saturdays. On each designated day, customers shall water during only one of the allowed periods. When adjustments are made by the Manager to the above times, they shall be published in local newspapers of general circulation, and set forth on the City's website, where appropriate.
c. Fill any wading pool or swimming pool or replenish any filled pool except to the minimum essential for operation of chemical feed equipment.
d. Make nonessential use of water for commercial or public use.
e. Operate water-cooled air conditioners or other equipment that do not recycle cooling water, except when health and safety are adversely affected.
f. Wash any motor vehicle or other type of mobile equipment. Provided, however, that any person regularly engaged in the business of washing motor vehicles and any commercial car wash facility shall be permitted to use water for such purposes, when 50% water savings are documented.

Provided, however, any customer may secure a written license from the city manager or his designee to use water contrary to the Stage IV mandatory conservation measures where it can be shown to the manager's satisfaction, and in the manager's sole discretion, that use of water pursuant to conditions prescribed by the city manager in the license will result in a 50% or greater saving of water. Any license issued pursuant to this provision: (1) must be in the possession of the licensee whenever water is used contrary to the Stage IV mandatory conservation measures; and (2) is subject to amendment or revocation by the city manager at any time for good cause.

All industrial, manufacturing and commercial enterprises shall reduce consumption with a goal reduction of at least 50%. Such enterprises shall document the specific efforts they have made to reduce consumption. (Ord. No. 7028, 1, 7-28-86, revised 2-4-02)

Stage V - Stringent Mandatory Conservation. Customers shall be encouraged to observe the conservation measures in Stages I and II and required to continue observing the mandatory requirements in Stages III and IV. The level of the conservation effort shall increase to require the following additional mandatory measures. No person shall:

a. Use water outside a structure except in an emergency involving fire.
b. Operate evaporative air conditioning units which recycle water except during the operating hours of the business.

c. Use any swimming pool or wading pool.
d. Wash any motor vehicle, including commercial washing unless a private well is used.

In addition to the conservation measures enumerated above, customer shall use plates, glasses, cups and eating utensils that are disposable and biodegradable.

Stage VI - Rationing. Customers shall be encouraged to observe the conservation measures in Stages I and II and require to continue observing the mandatory requirements of Stages III, IV and V. The level of the conservation effort shall increase to require the following mandatory measures:

a. Fire protection will be maintained, but where possible, tank trucks shall use raw water.
b. All industrial uses of water shall be prohibited.
c. All other uses of water will be limited to those necessary to meet minimum health and safety needs of the customers as determined by the city manager upon consultation with the director of environmental resources in light of conditions present.

Failure to act in accordance therewith or use of water in any manner or attempt to evade or avoid water rationing restrictions, shall be unlawful. (Ord. No.7028, 1, 7-28-86)

Illinois Water Conservation Requirements for Communities Using Lake Michigan Supplies

The following examples demonstrate rules for allocation of water across multiple municipalities. The first example, from the Illinois Department of Natural Resources, provides general rules governing the allocation of water from Lake Michigan.[9]

Section 3730.307 Conservation Practices and Other Permit Conditions (Illinois DNR)

A. The Department shall condition allocations within a user category upon required conservation practices for each user category as specified in subsections (B) and (C). Failure by any permittee to meet the conservation requirements applicable to it within a reasonable period of time will, upon notice, hearing and determination of such failure, constitute a violation of a Department order.
B. As a condition of receiving an allocation of Lake Michigan water, all permittees will agree to submit to the Department proposals designed to reduce or eliminate wasteful water use and to reduce unaccounted-for flows to 8% or less, based on net annual pumpage, and procedures used to determine efficiency of water metering or accounting in permittee's system.

The second example, from the Performance Standards Guidance publication for the Massachusetts Interbasin Transfer Act[10], governs water conservation requirements for interbasin transfer.

Must have implemented all practical water conservation measures:

1. A full leak detection survey should have been completed within the previous two years of the application. The proponent should provide documentation of their leak detection survey and of the repair of leaks identified during the survey. Leak detection surveys should be completed by methods at least as comprehensive as those described in the MWRA's leak detection regulations (360 CMR 12.00).

2. The water supply system should be 100% metered, including public facilities served by the proponent. A program of meter repair and/or replacement must be in place. Documentation of annual calibration of master meters and a description of the calibration program should be included in the application.

[9] Illinois Department of Natural Resources, Office of Water Resources, Division of Water Resource Management. General rules for the allocation of water from Lake Michigan. http://dnr.state.il.us/owr/resman/3730RULE.htm
[10] Massachusetts Department of Conservation and Recreation, Interbasin Transfer Act: Application Material. http://www.mass.gov/dcr/waterSupply/intbasin/download.htm

3. Unaccounted-for water should be 10% or less. The proponent should provide documentation of unaccounted-for water, in both gallons and percentage of the total water pumped and withdrawn, for each of the past five years. The definition of accounted-for and unaccounted-for water for use in Interbasin Transfer applications is given in Appendix C. The plan by which the community intends to maintain or reduce this level should be included in the water resources management plan required under Criterion #7.

4. The proponent should provide documentation to show that there are sufficient sources of funding to maintain the system, including covering the costs of operation, proper maintenance, planned capital improvements, and water conservation. The rate structure must encourage water conservation. Appendix D provides guidance on developing rate structures to encourage water conservation.

5. The proponent should bill its customers at least quarterly based on actual meter readings. Bills should be easily understandable to the customer (e.g. providing water use in gallons and including comparison of the previous year's use for same period).

6. A drought/emergency contingency plan, as described in 313 CMR 4.02, should be in place. This plan should include seasonal use guidelines, measures for voluntary and mandatory water use restrictions and describe how these will be implemented. There should be a mechanism in place to tie water use restrictions to streamflow and/or surface water levels in the affected basin(s) where this information is available. The plan should become part of the Local Water Resources Management Plan required under Criterion #7.

7. All government and other public buildings under the control of the proponent should have been retrofit with water saving devices.

8. Proponents should provide records of water audits conducted on public facilities. The most recent audit should have occurred within two years prior to the application for Interbasin Transfer approval.

9. If the community's residential gallons per capita/day is greater than 65, the proponent should be implementing a comprehensive residential conservation program that seeks to reduce residential water use through a retrofit, rebate or other similarly effective program for encouraging installation of household water saving devices, including faucet aerators, showerheads and toilets and through efforts to reduce excessive outdoor water use.

10. A broad-based public education program which attempts to reach every user at least two times per year, through such means as mailings, billboards, newspaper articles, cable television announcements or programs, or the use of other media, should be in place. Water suppliers should refer to the WRC's 1992 "Water Conservation Standards for the Commonwealth of Massachusetts" and the Massachusetts Water Works Association for recommended public education measures.

11. A program which identifies, ranks and works with all commercial, industrial and institutional customers according to amount of use in order to determine areas where the greatest potential for water savings exists, should be in place. The water supplier should make regular contact with these users to promote water conservation. Materials on water reuse and recirculation techniques should be provided, where appropriate.

12. A program of land use controls to protect existing water supply sources of the receiving area that meet the requirements of the Department of Environmental Protection.

13. As part of the local water resources management plan, there should be a long-term water conservation program, which complies with the 1992 Water Conservation Standards for the Commonwealth of Massachusetts, in place. This plan should reflect the goal of maintaining unaccounted-for at 10% or less of all water used, and of reducing future residential water use

through a comprehensive residential water conservation program, if residential gpcd is greater than 65. The water conservation program should also have a goal of operating the system to balance water supply with other environmental needs. If the transfer is approved, the proponent will need to submit a copy of its Public Water Supply Annual Statistical Report (required by DEP) to the Commission annually to demonstrate the continued effectiveness of the program.

Appendix B

Incentive programs

Overview of Example Incentive Programs for Water Conservation

Fixture / appliance / location	*Type of incentive (Examples)*	*Eligibility*	*Incentive value*	*Conservation level required / delivered*	*Application process*	*Savings*
Showerheads	Rebate for replacement with water-conserving model (A)	Residential and commercial customers	Range from $25 to up to $150 or 75% of the total cost (whichever is less) for each showerhead retrofitted with an ultra-low flow model	Required maximum of 2.5 gallons per minute per showerhead.	Application forms and specific information can be obtained by contacting a Water District representative by phone or email. Rebates are available until funds are depleted.	Depends on inefficiency of current showerheads.
	Free replacement with water-conserving model (A, B, D)	Residential and commercial customers	Value of replacement showerhead.	Delivers 2.5 gallons per minute; has adjustable settings and a non-aerating spray with less temperature loss.	Contact a Water District representative by phone to request a free showerhead.	Depends on inefficiency of current showerheads.
Toilets	Rebate for replacement with water-conserving model (A, B)	Residential and commercial customers; no limit on the number of reimbursed toilets per household or commercial building.	Range from $25 up to $150 or 75% of the total cost (whichever is less) for each toilet retrofitted with an ultra-low flow model	Required maximum of 1.6 gallons per flush per toilet.	Application forms and specific information can be obtained by contacting a Water District representative by phone or email. Rebates are available until funds are depleted.	Save over 10 gallons of water per person per day
	Free dye tablets for determining leaks in toilets (A, B, D)	Residential and commercial customers	Value of dye tablets	N/A	Visit the Water District office in person to pick up free dye tablets or call to request them by mail.	Depends on extent of leaking.
Clothes washing machines	Rebate for replacement with water-conserving model (A, B)	Residential customers	$100 for all qualifying level 1 clothes washers; $150 for all qualifying level 2 clothes washers.	Required to be a Level 1 or 2 clothes washers, as listed and posted online at a region-specific website.	Applications are available online and where high-efficiency clothes washers are sold.	On average annually, a household will save 5,100 gallons of water (approx. $13), $80 to $100 in electricity, and $54 in detergent costs.
Bathroom faucets	Free aerator attachment (A, B, D)	Residential and commercial customers	Value of aerator	Delivers a flow rate of 1.5 gallons per minute.	Contact a water district representative by phone to request a free faucet aerator.	Depends on inefficiency of current faucets.
Kitchen faucets	Free aerator attachment (A, B, D)	Residential and commercial customers	Value of aerator	Delivers a flow rate of 2.2 gallons per minute (2.0 gpm in some cases).	Contact a water district representative by phone to request a free faucet aerator.	Depends on inefficiency of current faucets.
Pre-rise spray valves	Free replacement with water-conserving model (A)	Commercial customers (food service industry). Existing pre-rinse sprayers must use hot water to clean dishes.	Value of the new, high-efficiency, high-velocity spray valve.	N/A	Call the Water District toll-free to request more information and apply.	A typical restaurant can save up to $1,000/yr in energy, water, and waste water costs. Savings range from $300-$1,300 depending on hours of usage per day. The high-efficiency spray valve conserves an average of 50 gallons of water

Fixture / appliance / location	*Type of incentive (Examples)*	*Eligibility*	*Incentive value*	*Conservation level required / delivered*	*Application process*	*Savings*
						and waste water per hour in comparison to pre-existing models.
Lawns and gardens	Rebates for converting high-water-use gardens into water-conserving landscapes (B)	Single-family homeowners. All changes must be made to an area that is currently being irrigated (not for an area that is not currently irrigated or to install landscaping at a new home or where no landscaping previously existed.)	Up to $1,000 for a portion of the cost of irrigation system parts and landscape materials, including permeable hardscape. Projects that involve replacing lawn with permeable hardscape may qualify for an additional bonus rebate of up to $2,500. Labor costs are not rebated.	Customers living on the west side of the Tunnel must use >300 gallons of water per day during a billing period that includes August. Customers living east of the Tunnel must use >500 gallons of water per day during a billing period that includes August.	Participation in the program is on a first-come first-served basis. In order to qualify for a rebate, all projects must be pre-approved and there are minimum water use requirements. The first step to participating in the program is to attend an informational meeting.	Depends on the size of the garden and specific conservation measures implemented.
	Free irrigation and rain gauge (C)	Residential customers	Value of gauge	N/A	Contact the Water District to request a free kit.	Save up to 50% on landscape water use
Entire household / organization / company	Graduated rate structure (C)	All residential customers are subject to charges.	Depends on households' total water usage.	Residential customers are charged under an "increasing block rate" system. Within each block each Ccf costs the same. The cost per Ccf increases with each higher block (e.g., the 16th Ccf costs more than the 15th Ccf).	N/A	Depends on households' total water usage. If residents' water use goes up in the summer (which it usually does), their water bill could go up even faster than their usage, if their usage enters the next higher rate block. This rate structure has the effect of charging high volume customers more per unit than low volume users.
	Water conservation awards (D)	All customers are eligible. One award given annually in each category: commercial entity, private consumer, and partner.	Value of recognition	Private consumer award in 2005 went to residents who reduced summertime water use by 53% from 2003 to 2004.	Selection is determined by the local Water & Sanitation District and the Regional Water Authority	Depends on household's or company's total water usage and percentage decrease year-to-year.

Sources:
(A) Coastside County Water District (Half Moon Bay, California) http://www.coastsidewater.org/water-conservation.html
(B) East Bay Municipal Utility District (San Francisco Bay Area, California) http://www.ebmud.com/conserving_&_recycling/
(C) Tucson Water Department (Tucson, Arizona) http://www.ci.tucson.az.us/water/conservation.htm
(D) The Eagle River Water & Sanitation District (Eagle/Vail, Colorado) http://www.erwsd.org

Benchmarks for Savings Due to Implementing Water Conservation Measures

Per Capita Comparison of Water Use Before and After Retrofit

	BASELINE *No conservations measures in place*					*POST-RETROFIT* *After implementing conservation measures*					*CHANGE DUE TO RETROFIT* *Post-retrofit - Baseline*					*% CHANGE* *Change due to retrofit / Baseline*				
Source	*Amy Vickers (1)*	*Tampa (2)*	*Bay Area (3)*	*Seattle (4)*	*Avg.*	*Amy Vickers (1)*	*Tampa (2)*	*Bay Area (3)*	*Seattle (4)*	*Avg.*	*Amy Vickers (1)*	*Tampa (2)*	*Bay Area (3)*	*Seattle (4)*	*Avg.*	*Amy Vickers (1)*	*Tampa (2)*	*Bay Area (3)*	*Seattle (4)*	*Avg.*
Use	*gpcd*	*gpcd*	*gpcd*	*gpcd*	*gpcd*	*gpcd*	*gpcd*	*gpcd*	*gpcd*	*gpcd*	*gpcd*	*gpcd*	*gpcd*	*gpcd*	*gpcd*	*gpcd*	*gpcd*	*gpcd*	*gpcd*	*gpcd*
Toilets	18.5	17.9	19.9	18.8	18.8	8.2	7.8	9.8	7.9	8.4	-10.3	-10.1	-10.1	-10.9	-10.4	-55.7%	-56.4%	-50.8%	-58.0%	-55.2%
Clothes washer	15.0	14.7	13.9	14.8	14.6	10.0	7.8	8.8	9.2	9.0	-5.0	-6.9	-5.1	-5.6	-5.7	-33.3%	-46.9%	-36.7%	-37.8%	-38.7%
Showers	11.6	12.7	12.0	9.0	11.3	8.8	9.1	10.7	8.7	9.3	-2.8	-3.6	-1.3	-0.3	-2.0	-24.1%	-28.3%	-10.8%	-3.3%	-16.7%
Faucets	10.9	9.4	10.5	9.2	10.0	10.8	6.2	10.5	8.0	8.9	-0.1	-3.2	0.0	-1.2	-1.1	-0.9%	-34.0%	0.0%	-13.0%	-12.0%
Leaks	9.5	18.8	25.7	6.5	15.1	4.0	3.7	8.9	2.2	4.7	-5.5	-15.1	-16.8	-4.3	-10.4	-57.9%	-80.3%	-65.4%	-66.2%	-67.4%
Baths	1.2	2.6	3.0	3.7	2.6	1.2	2.4	2.8	2.7	2.3	0.0	-0.2	-0.2	-1.0	-0.4	0.0%	-7.7%	-6.7%	-27.0%	-10.3%
Dishwasher	1.0	0.6	1.0	1.4	1.0	0.7	0.5	0.9	1.2	0.8	-0.3	-0.1	-0.1	-0.2	-0.2	-30.0%	-16.7%	-10.0%	-14.3%	-17.7%
Other domestic	1.6	0.5	0.1	0.2	0.6	1.6	1.2	0.4	0.1	0.8	0.0	0.7	0.3	-0.1	0.2	0.0%	140.0%	300.0%	-50.0%	97.5%
Indoor total	**69.3**	**77.2**	**86.1**	**63.6**	**74.1**	**45.3**	**38.7**	**52.8**	**40.0**	**44.2**	**-24.0**	**-38.5**	**-33.3**	**-23.6**	**-29.9**	**-34.6%**	**-49.9%**	**-38.7%**	**-37.1%**	**-40.1%**
Outdoor total	**31.7**	**25.8**	**59.6**	**n/a**	**39.1**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**
GRAND TOTAL	**101.0**	**103.0**	**145.7**	**n/a**	**116.6**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**
Avg. res/HH	**n/a**	**2.91**	**2.56**	**2.54**	**2.67**	**n/a**	**2.81**	**2.52**	**2.51**	**2.61**	**n/a**	**-0.10**	**-0.04**	**-0.03**	**-0.06**	**n/a**	**-3.4%**	**-1.6%**	**-1.2%**	**-2.1%**

Sources:

(1) Amy Vickers, Handbook of Water Use and Conservation, Waterplow Press, Amherst MA. 2001. Data from Mayer, P.W., Residential End Uses of Water. 1999.

(2) Tampa Water Department Residential Water Conservation Study, January 2004. http://www.cuwcc.org/Uploads/product/Tampa-Final-Report.pdf

(3) East Bay Municipal Utility District (EBMUD) Residential Indoor Water Conservation Study, July 2003. http://www.cuwcc.org/Uploads/product/EBMUD-Final-Report.pdf

(4) Seattle Home Water Conservation Study, December 2000. http://www.cuwcc.org/Uploads/product/Seattle-Final-Report.pdf

Reference:

Waukesha 2004 water use was 63.6 gallons per capita per day.

The following example illustrates the requirements and application process for a clothes washing machine rebate program administered by Bay Area (California) Water Agencies.[1]

High-Efficiency Clothes Washer Rebate Program
Participating Bay Area Water Agencies are offering rebates from $50-$250 to residential customers who purchase and install a new, qualifying High-Efficiency Clothes Washer. Not only will you save water, energy and money, but you'll get cash back as well.

How to qualify:
To be eligible for the clothes washer rebate, just follow these simple steps:

1. Purchase a new, high efficiency clothes washer between July 1, 2005-December 31, 2005. See list of qualifying models.
2. Purchase must be installed at a site served by one of the nine participating Water Agencies.
3. Submit a rebate application form, within 60 days of installing your clothes washer, via mail or apply online now. Copies of the form are available at retail locations. You may also download the form in pdf format from www.conservationrebates.com and print it, then submit it by mail.
4. Submit a copy of your dated sales receipt with either the application form provided by your retailer or with the confirmation page you print after applying online.
5. Please read application form for complete program details or contact the Program Administrator, EGIA, at 800-587-3442 for further details or for the status of your rebate.

Online application forms requires the following information:

1. Date purchased
2. Water provider (i.e., city, district, company, etc.)
3. Store name (by location)
4. Appliance brand
5. Model number
6. Date installed
7. Purchase price
8. First name
9. Last name
10. Email
11. Utility account number
12. Installation address
13. Unit number
14. City
15. State
16. Zip code
17. Telephone number
18. Is the mailing address the same? (yes/no)
19. Qualifications:
    - Only the purchase of a new, eligible high-efficiency clothes washer, installed at a site served by one of the nine participating water agencies, will qualify for a rebate. Note for EBMUD customers: The clothes washer you purchase must be on the list of Qualifying Clothes Washers on the day you purchase the washer.
    - Purchases must be made between July 01, 2005 - December 31, 2005, or until funds are depleted, whichever comes first.
    - Submit a copy of your dated sales receipt with either this application form or with the confirmation page you print after applying online.
    - Sales receipt must include purchaser name and installation address, purchase date, installation date, purchase price, brand and model number.
    - Applications must be postmarked or received online within 60 days of installation.
    - Qualified clothes washer must remain at the installation site for a minimum of six (6) months after installation date.

[1] Clothes washer rebate program offered by participating Bay Area Water Agencies.
http://www.conservationrebates.com/programs/wat/ClotheswasherRebate.aspx

- Limit one (1) rebate per household within a five (5) year period except EBMUD customers who are limited to one (1) rebate per household.

Checkbox: "I agree to the above qualifications."

20. Please Note:
    - For questions regarding the program or for rebate status, please contact the Program administrator, EGIA, at 800-587-3442, Monday through Friday, 8:30 a.m. to 5:00 p.m.
    - Visit www.conservationrebates.com to submit your rebate online.
    - Please remember to submit a copy of your sales receipt after you have completed the application.
    - After your new clothes washer is installed, do not wait to submit your rebate application. All rebate applications must be postmarked no later than 60 days after installation.
    - List of Qualifying Clothes Washers and their rebate values are subject to change. For the most recent List visit www.conservationrebates.com or call 800-587-3442.
    - All customers, including online applicants, must mail a copy of their receipt or the rebate will not be processed.
    - Please allow up to 12 weeks for your completed application to be processed. Incomplete applications cannot be processed.
    - Participating water agencies and EGIA are not responsible for rebates lost or delayed in the mail.
    - Offer void where prohibited or restricted by law.

    Checkbox: "I have read the above notes."

21. Rebate Confirmation:

    Thank you for your participation in the Clothes Washer Rebate Program.
    Your Rebate number is: D600269
    Your Rebate was received on: 07/28/2005
    Upon verification of information submitted, your application will qualify for a $100.00 rebate, if funds have not yet been depleted.
    Please print a copy of this confirmation, and include with a copy of your sales receipt and utility bill for the address where appliance is installed and mail or fax to:

    Mail:
    EGIA/Water Rebates
    3800 Watt Ave., Suite 105
    Sacramento, CA 95821

    Fax:
    (800) 506-9073 Or (916) 609-5350

    Your rebate will not be processed until we receive a copy of your sales receipt and your confirmation page.
    The requested information must be postmarked by Sep 19, 2005.
    Your Receipt must include the following information:
    - Purchaser name.
    - Date of purchase.
    - Date of installation.
    - Address where appliance is to be installed.
    - Manufacturer Brand and Model number.
    - Purchase price of appliance.

    If you are unable to print a copy of this Confirmation page you must include the following information.
    - Receipt Copy
    - Utility Bill
    - Rebate Number
    - Applicant Name
    - Account
    - Brand
    - Model

    Once your information has been received and verified please allow 6 to 8 weeks for rebate check to arrive.

IMPORTANT:
Please have your Rebate number available when inquiring about your rebate.
Rebate questions should be directed to EGIA at (800) 587-3442.
Discrepancies can invalidate the rebate application.

The following appendix (Appendix D) from the Performance Standards Guidance publication for the Massachusetts Interbasin Transfer Act describes considerations for developing a rate structure that promotes water conservation.

Guidance on the Development of Rate Structures That Encourage Water Conservation

The Interbasin Transfer regulations require proponents to implement a rate structure which reflects the costs of operation, proper maintenance, proposed capital improvements, and water conservation and which encourage the same (313 CMR 4.05(3)(c)).

Guidance:
Proponents should refer to the American Water Works Association's Manual of Water Supply Practices: Water Rate Structures and Pricing, Seventh Edition (AWWA M34) and the 1992 WRC Water Conservation Standards for the Commonwealth of Massachusetts to help demonstrate that the portion of this criterion dealing with rate structures has been met.

Rate development principals:

1. Rate structures, including the elements of a rate structure that are intended to encourage conservation, should reflect the particular situation and needs of the community.
2. Rates that encourage conservation can also achieve other objectives, such as lifeline rates or low-income affordability rates.
3. Rates are only one component of a comprehensive water conservation program and should be designed to support and work with other elements of the program.

Funding Sources:

1. Is your water supply funded through an enterprise account or is some other accounting procedure used? If some other accounting procedure is used, describe. Are water supply revenues dedicated for water supply system use?
2. List the major cost categories covered by your rate revenues. Does it reflect the cost of operation, proper maintenance, proposed capital improvements, source protection and water conservation?
3. What elements of your water supply program are not covered by rates? How are these elements funded?

Rate Structure:

1. Provide your current rate structure.
2. Provide date of your most recent rate structure revision and a short description of the changes made.
3. Are there separate rates for different types of customers (residential, commercial, industrial, etc.)?
4. Describe how your rate structure encourages conservation. If your rate structure includes any of the following elements, describe their effectiveness.
    - Increasing block rates and number of customers in each block
    - Seasonal rates; include the number of residential customers which are billed at a higher use category due to seasonal water use and an average cost differential in a water bill for a customer whose seasonal use results in being billed at a higher use category.
    - Excess use rates
    - Goal-based rates
    - Drought rates
    - Second meter rates

Likewise, these standards and recommendations published in the Water Conservation Standards for the Commonwealth of Massachusetts[2] detail the benefits and requirements of full-cost pricing.

Water Conservation Standards and Recommendations: Pricing

Goals: To charge the full cost of providing water and to adopt a rate structure that encourages water conservation.

Background:
Full-cost pricing refers to price levels which recover all the direct and indirect costs associated with providing water. For all sectors of water use, knowing the costs associated with providing water and sewer services creates an appreciation of the importance of conserving water and promotes greater understanding of the direct relationship and environmental implications of individual water use and community water resources, especially during seasonal or drought shortages.

Standards:
1. The water pricing structure should include the full-cost of operating the water supply system, including but not limited to:
   - Pumping, maintenance, electricity/fuel
   - Treatment and associated treatment plant costs
   - Distribution system operation, repair, and maintenance
   - Watershed purchase/protection, well site purchase/protection, aquifer land acquisition
   - Capital replacement fund, capital depreciation account, and debt service
   - Purchase and installation of water conservation/retrofit devices
   - All aspects of a public education program including purchase and distribution of educational materials and related staff time
   - Hiring staff to run the water supply system, staff benefits package, and staff training and professional development
   - Leak detection and repair
2. Water supply system operations should be fully funded by water supply system revenues.
3. Each water supplier should regularly evaluate existing rate structures, including any peak demand and seasonal pricing components. In addition, the water supplier should consider all possible pricing options, such as increasing block rates, to enhance system reliability by encouraging efficient water use by consumers, particularly during periods of supply limitation.
4. Water and sewer rates, where applicable, should be billed so as to inform customers of their actual use and the cost of each; billing should be carried out at least quarterly (see Metering). The cost of reading and billing should be shared between the water and sewer operations.

Recommendations:
- Each water supplier should establish an enterprise account for water.
- Water suppliers should consider adopting increased seasonal rates to moderate peak demands and/or to protect/maintain supply levels.

[2] Available at http://www.mass.gov/dcr/waterSupply/intbasin/download.htm

EDUCATION

The published Water Conservation Standards for the Commonwealth of Massachusetts[3] provides guidelines for establishing the objectives and content of a public education program for water conservation.

Water Conservation Standards and Recommendations: Public Education

Goal: To promote public awareness of the long-term economic and environmental benefits of conserving water as a basis for the adoption of measures to achieve greater efficiency in using water and conservation of water resources.

Background: Public education is more than simply information dissemination; it is a key to getting public support by providing the basic understanding of sound water resources management and planning and explaining the associated economic and environmental benefits. In addition to the general public, the Conservation Coordinator should provide education to Boards of Selectmen, Water Commissioners or Superintendents, and others in policy-making positions or with line responsibility for carrying out the water conservation programs. Materials for education programs should be sought from the Massachusetts Water Works Association and the New England Water Works Association and other organizations and be funded by local water revenues.

Because public education depends on accurate data, the WRC supports a review of existing mechanisms for obtaining water use statistics from water withdrawers and other measures to develop/collect, disseminate, and interpret water resources data and provide technical assistance to communities.

Three main areas of emphasis for an educational program are:

- Explaining to water users all the costs involved in providing water, including planning, engineering, construction, operation, maintenance, treatment, wastewater facilities costs, piping, leak detection, compliance costs, salaries, protection costs, pensions, health care, staff training, public education, and other costs.
- Showing that investments in efficiency and conservation will provide water users with long term savings compared to a utility's costs of having to develop and treat new water supply sources and develop wastewater treatment facilities. For example, through a domestic device retrofit program, including follow-up visits or mailings, water suppliers can make customers aware that making a few simple changes can provide tangible savings.
- Highlighting the environmental benefits of reducing water demands, including the relationship of groundwater to surface water and the potential impacts of withdrawals on instream uses, such as habitats for fisheries and other wildlife and water-based recreation; the relationship between pumping and salt water intrusion for coastal areas; and the relationship between water quality and streamflow.

Standards: Because an almost infinite number of specific methods for information dissemination are available, no specific standards are stated, except that each community should develop and implement an education plan which should include most, if not all items in the following basic list. Water users and agencies should choose from these and other resources to create and implement programs best suited for their particular situation.

- The largest users should be targeted early on to realize the greatest potential savings and to demonstrate the benefits of a conservation program.
- Public Education should reach to the schools; develop/use media that will appeal to children, including getting them involved with environmental/ water resources projects and field trips.
- Bill Stuffers and/or bills should have a work sheet on the reverse to enable customers to track water use and conservation efforts and figure the dollar savings
- Public space advertising/media stories on successes (and failures)
- Conservation information centers, perhaps run jointly with electric or gas company.
- Speakers for community organizations

[3] Available at http://www.mass.gov/dcr/waterSupply/intbasin/download.htm

- Public service announcements; radio/T.V./audio-visual presentations on supply sources and current status
- Joint advertising with hardware stores to promote conservation devices.
- Use of civic and professional organization resources
- Special events such as Conservation Fairs
- Multilingual materials should be available as needed
- Contests and recognition for innovation could be incorporated into the public education program.
- Information on xeriscaping, gardening, and lawn care practices.

Examples of educational programs for water conservation:

General plumbing
- Free instructions on checking for water leaks. Repairing leaks may lower a household's water bill, sewage bill, and cost of heating water.

Lawns and gardens
- Free booklets on water-wise gardening.

MONITORING

The water department in Tucson, Arizona developed a survey program to provide residents with a free, comprehensive analysis of their water use and opportunities for further conservation.[4]

Residential Water Use Analysis
Tucson Water has resurrected the role of the Zanjero, the community water manager of the "old" Old Pueblo, to help Tucsonans manage the water use in their homes. The Zanjero Program offers residential customers with high historic water use an opportunity to have a free individualized water-use survey done at their home. The program is designed to help customers reduce water waste and lower their water bills. Here is a glimpse of the steps the Zanjero will take to identify water savings in a home.

Beginning the Survey
An inventory will be taken of all fixtures, such as the dishwasher, clothes washer, water treatment condition systems, and cooler. The water meter will be located and the volume recorded. The resident will be taught how to read the meter and use it to help detect leaks.

1. Record household information.
2. Inventory fixtures and record:
   - dishwasher
   - clothes washer
   - garbage disposal
   - air conditioner
   - bottled water
   - graywater
   - water softener
   - cooler
   - hot water recirculator
   - carbon or reverse osmosis water filter
3. Locate meter, record information on audit form, and teach resident how to read meter.

The Indoor Survey
Next, bathrooms and the kitchen and utility room will be inspected for leaks. The flow rate of the toilet, faucets, and showerheads will be measured. Showerheads and aerators will be replaced free of charge if needed. Leaking toilet flapper valves will also be replaced.

1. Inspect bathrooms.
   - Drop a dye tablet into toilet tank to test for leaks.

[4] Available at http://www.ci.tucson.az.us/water/zanjero_analysis.htm

- Estimate gallons per flush of toilet and record.
- Measure flow rates of showers and faucets and record.
- Observe for leaks and record.

2. Inspect kitchen/utility room.
   - Measure flow rate(s) of faucet(s) and record.
   - Observe for leaks and record.
3. Conclude interior inspection.
   - Return to bathroom and observe for toilet leaks; record information.
   - Review and discuss interior inspection results with homeowner.
   - Replace showerhead(s) and aerator(s) as appropriate.

The Outdoor Survey

An inventory will be taken of features such as pools, misting systems, evaporative cooler, and greenhouses. An assessment of the landscape and an evaluation of any lawn areas will include measuring the flow rate of irrigated areas, checking pressure, and reading the meter.

1. Review General Characteristics with customer. Inventory and record:
   - pool
   - misting system
   - pets/animals
   - evaporative cooler
   - spa
   - fountain/pond
   - greenhouse
   - water treatment/softener
2. Inspect front/back yards.
   - Provide assessment of landscape type:
     - planting density
     - high/medium/low water use
   - Measure landscaped areas and record:
     - prepare sketch map of site
   - Assess irrigation methods and record.
   - Conduct flow test for each valve/station and record.
   - Conduct visual inspection for leaks, breaks, missing plants, runoff, etc., and record.
   - Evaluate lawn area(s) and record:
     - soil probe
     - rooting depth
     - soil type
     - measure flow rate for turfed areas
       - check pressure
       - flag sprinkler heads
       - conduct visual inspection
     - set up cups (if visual inspection OK)
     - run spray irrigation system
     - collect cup data
   - Record meter reading.

Concluding the Survey

The auditor will go over the survey results with the customer, suggest steps they can take, and leave a conservation information Packet.

1. Review landscape audit findings with homeowner.
   - Discuss irrigation scheduling theory.
   - Review irrigation system deficiencies.
2. Complete water audit review checklist.
3. Leave printed materials/information packet.
4. Conclude meeting with customer: record time out on form.

Scheduling an Appointment
Conservation surveys are available to residential Tucson Water customers. You must be present during the two-hour survey. To schedule an appointment, call the Tucson Water Customer Service Office at (520) 791-3242.

Massachusetts, in its published Water Conservation Standards, emphasizes the importance of monitoring water use by detecting and repairing leaks and metering all users of the public water supply system.[5]

Water Conservation Standards and Recommendations: Leak Detection and Repair

Goals: To perform regular leak detection and promptly repair all leaks.

Background:
Detecting and fixing leaks can provide one of the largest returns on investment, especially in older systems, and should be carried out by all water suppliers. This should be a key ingredient in public educational programs, using crews in the street as a point of attention by media.

Standards:
1. A full leak detection survey of the distribution system should be completed every two years.
2. Leak detection and repair should be recognized as expenses of the water supply system and included in a full-cost pricing structure.

Recommendations:
- Because leak detection requires substantial skill, regularly trained, in-house teams are recommended; communities should investigate the advantages of sharing leak detection equipment and personnel to reduce costs.
- NEWWA and MWWA should be approached by DEP to consider providing standardized training and certification in leak detection and repair.
- Pressure reduction should be considered by suppliers for implementation where technically feasible and consistent with public health and safety considerations.
- There should be consideration given to assuring the penalty for water theft equals that of gas or electric theft.

Water Conservation Standards and Recommendations: Metering

Goals: To meter all residential, commercial, institutional, agricultural and municipal users of water supply systems and to bill them or otherwise account for their water use at least quarterly.

Background:
Complete system metering lets customers know how much water they are using, provides the supplier with valuable knowledge of customer use patterns, assists in demand management programs, and enables the supplier to bill the customer accurately. With accurate knowledge about current demand, the supplier can more effectively identify potential water savings, assist specific users to implement water saving measures, thereby providing the opportunity to reduce overall system demand and plan efficiently for system growth. Metering costs should be recovered through water rates.

Standards:
1. Each public water supplier should develop a program to implement 100% metering of all public sector and private users with meters of proper size and accuracy to ensure full registering of water flow.
2. The metering program should include regular meter maintenance, including testing, calibration, repair, replacement and checks for tampering to identify and correct illegal connections.

[5] Available at http://www.mass.gov/dcr/waterSupply/intbasin/download.htm

3. The metering program should include regular meter reading of all public sector users and regular accounting of their use (see Public Sector Water Use).
4. Meter reading and billing for domestic accounts should be done quarterly, with the understanding that customers should be billed on actual meter readings.
5. Master meters (which register the flows in the municipal system) should be calibrated annually.

Recommendations:

- Meter reading and billing for the largest users should be done more frequently than domestic accounts (for instance, billing should be monthly for the largest users); and meter maintenance should be more frequent.
- Exterior meter reading devices should be installed to improve the efficiency of meter readings.
- Meter reading and billing frequency would be most effective if done on a monthly basis, but unless a community has or develops the means to read the meters remotely, it may not prove cost-effective to read meters on a monthly basis.
- Suppliers should consider a 10-15 year period for meter replacement

Appendix C of the Performance Standards Guidance publication for the Massachusetts Interbasin Transfer Act details the contributors to accounted-for and unaccounted-for water use.

Accounted-For and Unaccounted-For Water Uses

For the purposes of Interbasin Transfer review, water uses should be broken down by specific category, as designated in the DEP Public Water Supply Annual Statistical Report.

Accounted-for water includes:

- Residential use
- Agricultural use
- Commercial use
- Industrial use
- Municipal use, including fire fighting, street cleaning, hydrant maintenance, and hydrant use for sewer flushing, where these uses can be confidently estimated. In the case of water use that is "confidently estimated" documentation of how the estimate was arrived at will need to be provided.
- Sales to other public water suppliers
- Process water, including bleeders, water main flushing (including new water mains), new water main filling, filter backwash, etc. where these uses can be confidently estimated. In the case of water use that is "confidently estimated" documentation of how the estimate was arrived at will need to be provided.
- Institutional/Tax exempt uses

Unaccounted-for water is the difference between water pumped or purchased and water that is metered or confidently estimated.

Unaccounted-for water should include:

- Master Meter Inaccuracies
- Domestic and Non-Domestic Meter Underregistration
- Errors in estimating for stopped meters
- Overregistering revenue meters
- Unauthorized hydrant openings
- Unavoidable leakage
- Recoverable leakage
- Illegal connections
- Standpipe overflows
- Data processing errors

Water suppliers may want to estimate the amount of unaccounted-for water by category, as required in Section D6 of DEP's Public Water Supply Annual Statistical Report (1998). This is will enable them to target suspected sources of unaccounted-for water for reduction.

Examples of monitoring programs for water conservation:

General plumbing

- Free site visit by a field staff member for leak location and assessment.

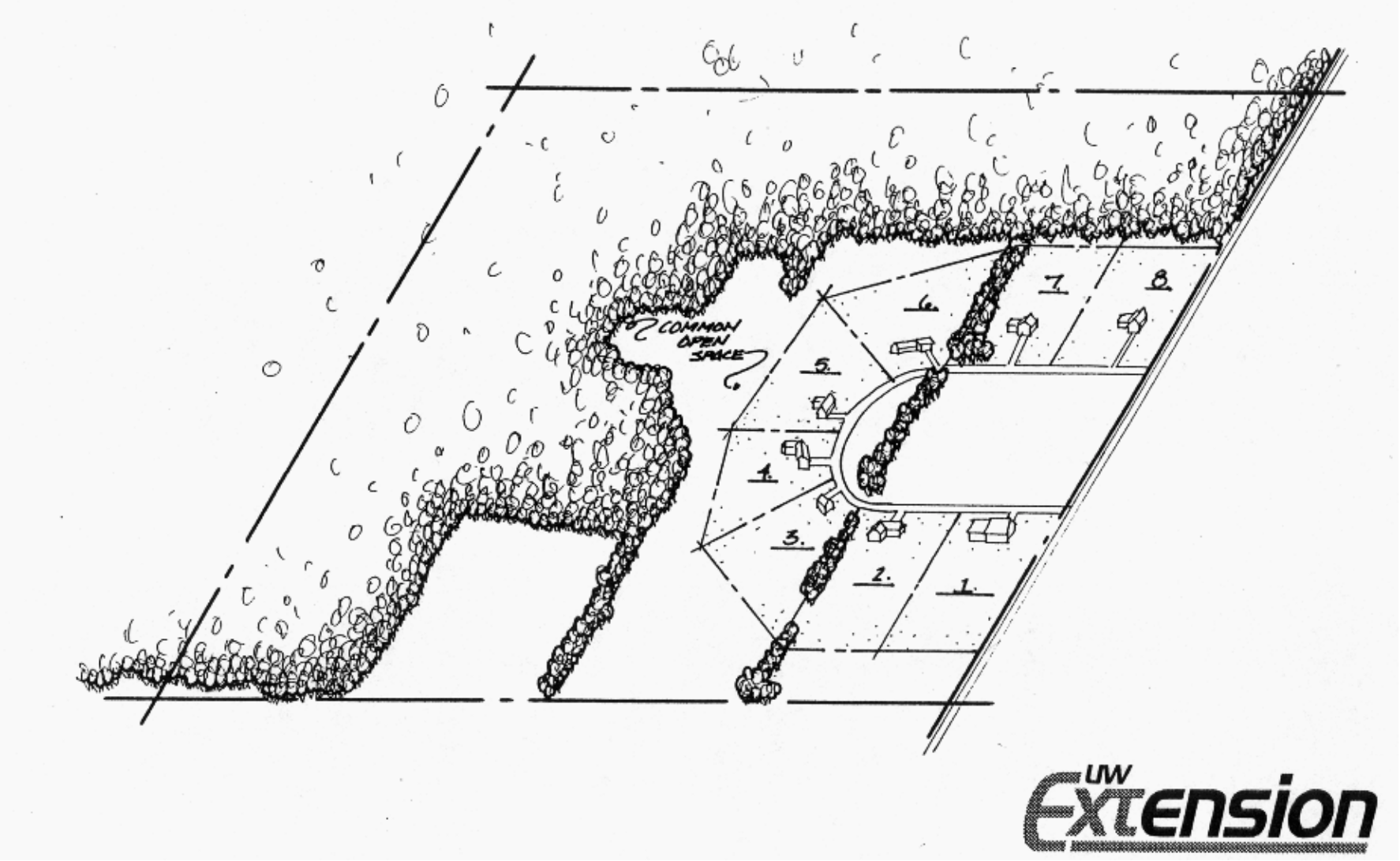
Large landscapes

- Free large landscape water surveys to evaluate a landscape's irrigation efficiency. A trained technician visits the site and evaluates the irrigation system. The technician will check for sprinkler and design inefficiencies, create a site-specific watering schedule, and make recommendations for improving the irrigation system.

Appendix C

Model Conservation Subdivision Ordinance

Ordinance for a Conservation Subdivision



Section 66.1027 of the Wisconsin Statutes, part of Wisconsin's recent "smart growth" law, requires that the University of Wisconsin Extension prepare "an ordinance for a conservation subdivision." This ordinance was prepared in response to that law. When Wisconsin's comprehensive planning and "smart growth" law was enacted in October 1999, as part of 1999 Wisconsin Act 9, the law required that cities, villages and towns with a population of at least 12,500 needed to adopt an ordinance for a conservation subdivision. That requirement was subsequently eliminated by 1999 Wisconsin Act 148. Local governments are not required to adopt this ordinance. It is provided for educational purposes only.

Acknowledgments

This document was prepared by Brian W. Ohm, J.D., Associate Professor in the Department of Urban & Regional Planning at the University of Wisconsin-Madison and land use law specialist with the University of Wisconsin-Extension, with assistance from Carrie Hirsch, project assistant funded through the College of Agricultural and Life Sciences, University of Wisconsin-Madison, and graduate student in the Department of Urban & Regional Planning, and Jim Lagro, PhD, RLA, Associate Professor in the Department of Urban & Regional Planning. The drawings were prepared by Tom Rogers, a student in the Department of Landscape Architecture, University of Wisconsin-Madison.

The following individuals reviewed drafts of the ordinance and provided comments on the ordinance: Geoffrey M. Gyrisco, State Historical Society of Wisconsin; staff, Wisconsin Department of Transportation; Travis Olson, Wisconsin Coastal Management Program, Department of Administration; Ted Koch, Wisconsin State Cartographer's Office, University of Wisconsin-Madison; Anna Haines, University of Wisconsin-Stevens Point/Extension; Mike Slavney, Vandewalle & Associates; Ruekert-Mielke; Land use team members, Department of Natural Resources; staff, East Central Wisconsin Regional Planning Commission; Applied Ecological Services; Paul Benjamin, Department of Agriculture, Trade, and Consumer Protection; Robert Langstroth, Department of Commerce; Richard Lehmann, Boardman Law Firm; Jerry Deschane, Wisconsin Builders Association; Tom Larson, Wisconsin Realtors Association; Thomas Harnish, Wisconsin Towns Association; Jerold Braatz, University of Wisconsin Extension-Calumet County; Mike Dresen, University of Wisconsin Extension; Jay Tappen, West Central Wisconsin Regional Planning Commission.

December 31, 2000

Contents

Introduction To The Ordinance

This publication provides a brief introduction to the concepts, advantages and limitations of conservation subdivisions. The publication also includes an ordinance for a conservation subdivision. The text of the ordinance begins on page 7. The ordinance also includes a commentary on the ordinance text. The commentary is intended to make the document easier to read and understand while guiding local officials and others interested in pursuing conservation subdivisions for their communities.

The ordinance is meant as a guide and **is not** intended to be adopted "as is." **Each community must adapt the language and concepts of the ordinance to fit the unique circumstances found in that community.** The ordinance is written as a **subdivision ordinance** that can be adopted by cities, villages, towns with village powers, and counties under section 236.45 of the Wisconsin Statutes. It is not written as a **zoning ordinance**. Since many communities may not have an existing subdivision (or land division) ordinance, this ordinance includes standard language for the platting of land under the process established in Chapter 236 of the Wisconsin Statutes. That language appears in *italics* in the text. The language that pertains more directly to the concept of conservation design appears in a regular font. Communities that have an existing subdivision or land division ordinance should examine the design process and standards of that ordinance in comparison to this ordinance. Communities can change those standards to reflect the conservation design concepts our they could include a separate section in their subdivision ordinance providing for conservation subdivisions. As with any subdivision ordinance, local governments must have a plan commission (in the case of cities, villages, and towns with village powers) or a plan committee (in the case of counties) to recommend adoption of this ordinance and to help in the administration of this ordinance. Communities also may need to adapt other applicable ordinances (such as zoning), to ensure they are consistent with principles of conservation development. For general information on subdivision regulations see Chapter 7 in Brian W. Ohm, *Guide to Community Planning in Wisconsin* published by the University of Wisconsin-Extension in 1999.

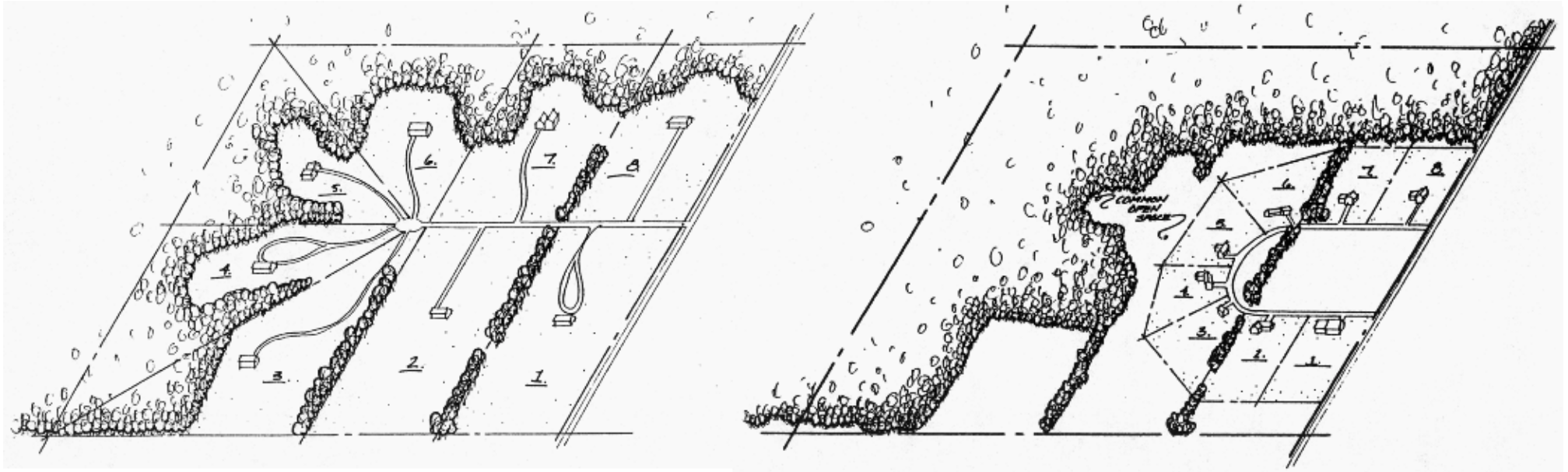
To better understand the context and build support for the use of conservation subdivisions, communities should provide the basis for a conservation subdivision ordinance through a comprehensive planning process. Through this planning process, local governments can understand how to craft their conservation subdivision ordinances to conserve the unique qualities of the Wisconsin landscape found in their community.

Brief Overview of Conservation Subdivisions

Conservation subdivisions can occur in a variety of settings, such as in urban areas, in a transition area between clearly rural and urban areas or in rural settings. Wisconsin's "smart growth" law defines a "conservation subdivision" as: "a housing development in a rural setting that is characterized by compact lots and common open space, and where the natural features of land are maintained to the greatest extent possible." This ordinance follows that definition of a conservation subdivision. There are also other ways to define and develop conservation subdivisions for other settings. Conservation design principles can also be incorporated in other local ordinances to help ensure that developments that do not constitute a "subdivision" meet conservation design principles.

Generally, conservation subdivisions allow for an adjustment in the location of residential dwelling units on a parcel of land so long as the total number of dwelling units does not exceed the number of units otherwise permitted in the zoning district. The dwelling units are grouped or "clustered" on only a portion of a parcel of land. The remainder of the site is preserved as open space, farmland, or as an environmentally and culturally sensitive area. This clustering of the dwellings into a small area is made possible by reducing the individual lot sizes. The open space is permanently protected and held in common ownership. Sometimes additional dwelling units may be permitted if certain objectives are achieved. Conservation subdivisions are an alternative approach to the conventional lot-by-lot division of land in rural areas which spreads development evenly throughout a parcel with little regard to impacts on the natural and cultural features of the area. See Figure A. Conservation subdivisions enable a developer to concentrate units on the most buildable portion of a site, preserving natural drainage systems, open space, and environmentally and culturally sensitive areas.

Figure A.



Conventional subdivision

Conservation subdivision

In order to determine the possible benefits of conservation subdivisions, while at the same time recognizing their limitations, it is important to understand their locational context. Comprehensive planning is essential for helping a community better understand the landscape, the unique issues affecting the community, and determining where conservation subdivisions are applicable and appropriate. Some of the issues communities need to think about include rural character and lifestyles, environmental protection, historic preservation, transportation, and compatibility with agriculture. This ordinance should **not be** used as a substitute **for comprehensive planning which can help determine the overall pattern of development in the community and the direction of growth. The conservation** subdivision is only one tool out of a mixture of different tools that communities can use to achieve the objectives of their comprehensive plan.

- Open Space

Public concern has grown over the loss of open space and rural character that seems to inevitably accompany development. Conservation subdivision design concepts promote and encourage the clustering of homes so as to create an interconnected network of permanent open space. The open space and common facilities, such as joint septic and water systems, are generally managed through a homeowners association, non-profit conservation organization such as a land trust, a local unit of government, or an individual who complies with the permanent conservation restrictions.

Some of the advantages of using conservation subdivisions for these purposes are (1) fostering a sense of community through carefully sited smaller lots and shared spaces; (2) protecting and restoring significant resources such as prime farmland, historic buildings, archaeological sites, mature woodlands, streams, ponds or wetlands, and scenic views, and (3) preserving rural character, which has an external effect of increasing land values.

- Farmland

As development pressures increase, property values of agricultural lands near developing areas have steadily increased. In many areas, the value of agricultural land for development is greater than the value of the land for agriculture. Land values, combined with the general uncertainties of the agricultural economy, create disincentives for farmers to stay in agriculture. Growth pressures have led to development in agricultural areas outside urban areas. As residential development encroaches on ongoing agricultural operations, conflicts arise between farmers and these new residents. These conflicts include: the generation of noise, lights and odor from farm operations; and traffic conflicts resulting from increased automobile traffic on narrow country roads.

Conservation subdivisions may not be the best means of protecting large blocks of agricultural land, nor are they the best measures to protect farming as a viable lifestyle. In order to sustain an agricultural community and ensure farming as a viable lifestyle, large blocks of contiguous land need to be protected and maintained. This would reduce the potential conflicts mentioned above. Conservation subdivisions can, however, protect small blocks of agricultural land and promote areas where agricultural and residential activities can co-

exist. This is significant for particular types of agricultural practices that have some economic and aesthetic benefits. This might include pick-your-own operations, community supported agricultural programs, organic vegetable production, hay and straw production and other specialty products and activities that use low chemical and low intensity production.

- Shoreland and Environmentally Sensitive Areas

The clustering of homes can direct development to areas more suitable for development and away from areas that are more environmentally sensitive, such as wetlands. Clustering can also provide for the preservation of archaeological sites, including Indian mounds and burial sites--which often occur near water--in the protected open space. In shoreland areas where residential development is permitted, conservation subdivisions can be instrumental in protecting and restoring desirable natural features, particularly scenic views of the water body concerned, and minimize negative environmental effects. Rather than providing a waterfront view for a limited number of very expensive homes, through the stringing out of houses along a lakefront or river's edge, the view can be preserved as a community amenity for all to enjoy, while still maintaining desired overall development densities. Scenic views from the waterway are also preserved. Finally, conservation subdivisions can help protect water quality through the maintenance of waterway buffers and better management of run off.

Conclusion

The challenge for landowners and local officials is how to continue to effectively meet the demand for rural housing in a way that respects and conserves the rural character, maintains natural resources, and protects environmental amenities. Conservation subdivisions are one tool that can be used to achieve these goals.

Additional Resources

In order to develop this ordinance, various *conservation, cluster,* and *open space* ordinances were collected from around Wisconsin and the Midwest from communities that have created and adopted a similar ordinance or are currently developing one. In addition, various regional, state and local organizations were contacted in order to develop a model that can easily be tailored to accommodate individual communities. Other reference materials on conservation subdivisions were also consulted.

The following ordinances and other materials were reviewed in preparation of this ordinance. These materials should be consulted for more detailed explanation and/or description of conservation subdivision principals and design guidelines.

Arendt, Randall, G., *Conservation Design for Subdivisions: A Practical Guide to Creating Open Space Networks* (1996).

Arendt, Randall, G., *Growing Greener: Putting Conservation into Local Plans and Ordinances* (1999).

East Central Wisconsin Regional Planning Commission, *Rural Development Guide for East Central Wisconsin Governments andLandowners*

(1999).

Freilich, Robert H. and Shultz, Michael M., *Model Subdivision Regulations* (1995).

Listokin, David and Walker, Carole, *The Subdivision and Site Plan Handbook* (1989).

Minnesota Planning, *From Policy to Reality. Model Ordinances for Sustainable Development* (2000).

Portage County (Wisconsin) Planning and Zoning Department, *Final Draft Portage County Subdivision Ordinance Amendment. Open Space Design Option* (2000).

Southeastern Wisconsin Regional Planning Commission, *Rural Cluster Development Guide* (1996).

Town of Greenville (Outagamie County, Wisconsin),*Subdivision Ordinance* (2000).

Town of Mt. Pleasant (Racine County, Wisconsin), *Zoning Ordinance.*

Town of Wayne (Washington County, Wisconsin), *Zoning Ordinance* (1999 Revisions).

Washington State Department of Community Development, *Evaluating Innovative Techniques for Resource Lands, Partl: Clustering* (1992).

Washington County (Minnesota) Planning and Administrative Services, Metropolitan Council, BRW, Inc., *Open Space Design Development:*

A Guide for Local Governments (1997).

Wisconsin Department of Natural Resources, *Department Position on Cluster Development* (1999).

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1. General Provisions

1.1 ***Title.*** *These regulations shall officially be known, cited, and referred to as the* Conservation Subdivision Ordinance *of [name of local government], Wisconsin (hereinafter "ordinance").*

Ordinances are often given an abbreviated title for reference purposes. This ordinance may be part of a larger set of ordinances governing land use.

1.2 **Purposes.** This ordinance is adopted for the following purposes:

1. To guide the future growth and development of the community consistent with the [name of city, village, town, county]' s adopted comprehensive plan.
2. To guide the detailed analysis of the development parcel so as to locate and coordinate appropriate areas for development and conservation.
3. To preserve the rural character through the permanent preservation of meaningful open space and sensitive natural resources.
4. To preserve scenic views by minimizing views of new development from existing roads.
5. To preserve prime agricultural land by concentrating housing on lands that have low agricultural potential.
6. To provide commonly-owned open space areas for passive and/or active recreational use by residents of the development and, where specified, the larger community.
7. To provide for a diversity of lot sizes, housing choices and building densities to accommodate a variety of age and income groups.
8. To provide buffering between residential development and non-residential uses.
9. To protect and restore environmentally sensitive areas and biological diversity, minimize disturbance to existing vegetation, and maintain environmental corridors.
10. To preserve significant archaeological sites, historic buildings and their settings.
11. To meet demand for housing in a rural setting.

All references in the ordinance appearing between brackets [ ] *are to be filled in with the appropriate reference by the jurisdiction adopting the ordinance.*

The purposes statement should incorporate language contained in the community's comprehensive plan.

1.3 ***Statutory Authorization.*** *This ordinance is adopted pursuant to the authority contained in section 236.45 of the Wisconsin Statutes.*

Cities, villages, towns with village powers and counties all have the authority to adopt subdivision regulations.

1.4 Jurisdiction. *[For cities and villages] Jurisdiction of this ordinance shall include all lands within the corporate limits of the [City, Village of_____ Wisconsin, and those lands within the extraterritorial jurisdiction of the [city/village] as established in Sections 61.35 [include for villages] and 62.23(2), 66.32, and 236.10 of the Wisconsin Statutes.*
[For towns/ Jurisdiction of these regulations shall include all lands within the corporate limits of the Town of_____ , Wisconsin.
[For counties] Jurisdiction of these regulations shall include all lands within the unincorporated areas of the County of _____, Wisconsin, and those lands within the jurisdiction of cities and villages to determine if the county has an objection to a p/at on the basis of planned public improvements under section 236.12 of the Wisconsin Statutes.

The ordinance does not apply to:

1. *Transfers of interests in land by will or pursuant to court order.*
2. *Cemetery plats under section 157.07 of the Wisconsin Statutes.*
3. *The sale or exchange of parcels of land between owners of adjoining property if additional lots are not thereby created and the lots resulting are not reduced below the minimum sizes required by this ordinance or other applicable laws or ordinances.*
4. *Assessors'plats made under section 70.27 of the Wisconsin Statutes, but such assessors' plats shall comply with sections 236. 15(1)(a)--(g) and 236.20(1), (2)(a)--(c), of the Wisconsin Statutes.*

1.5 Applicability and Compliance. The conservation subdivision standards apply to all divisions of a parent parcel of[20] acres or more by a subdivider where the division creates at least [four] new parcels. The number of new parcels that can be created shall be consistent with the applicable zoning ordinance for the parent parcel. The overall development density for the parent parcel is the same a would be allowed for a conventional subdivision in the existing zoning district except for those conservation subdivisions which qualify for a development bonus under section 4.2. The provisions of this ordinance apply to residential development within the following districts established in the [city, village, town, county] zoning ordinance: [identify zoning districts within which the

The minimum size of the conservation subdivision must be large enough to allow for creative site design and the protection of open space. The minimum size and number of parcels needs to be tailored to the unique circumstances of each community. This ordinance uses 20 acres. Other ordinances use a minimum size ranging from 5 to 40 acres. It may be possible to not use a minimum size. A

conservation subdivision ordinance should apply, such as agricultural and rural residential districts]. Conservation subdivisions shall not be permitted in the following districts established in the [city, village, town, county] zoning ordinance: [identify zoning districts within which the conservation subdivision ordinance should not apply (if any), such as higher density residential districts, Industrial districts and commercial districts].

community could also make the application of this ordinance optional.

The overall density of development needs to be established by the local comprehensive plan and the local zoning ordinance.

1. *No person shall divide any land under the provisions of this ordinance without compliance with all requirements of this ordinance and the following:*
   a. *The provisions of Wis. Stats. ch. 236 and Wis. Stats. § 80.08.*
   b. *The rules of the Wisconsin Department of Commerce, contained in Chapter COMM 83 and related chapters of the Wisconsin Administrative Code for land divisions not served by public sewer.*
   c. *The rules of the Division of Transportation Infrastructure Development, Wisconsin Department of Transportation, contained in Chapter TRANS 233 of the Wisconsin Administrative Code for subdivisions that abut a state trunk highway or connecting street.*
   d. *The rules of the Wisconsin Department of Natural Resources contained in Chapters 116, 117 [for cities and villages only], and 118 of the Wisconsin Administrative Code for shoreland, shore/and-wetland, and floodplain management.*
   e. *The comprehensive plan adopted by [name of city, village, town, county].*
   f. *All applicable local and county regulations, including zoning, sanitary, building and official mapping ordinances.*
   g. *All other applicable rules contained in the Wisconsin Administrative Code.*

1.6 Condominium Plats. A condominium p/at prepared under Chapter 703 of the Wisconsin Statutes, creating at least four units with a parent parcel size of 20 acres of more, shall be reviewed by the [city, village, town, county] in the same manner as a conservation subdivision as set forth in this ordinance and shall comply with the applicable design standards and required improvements of this

Condominium plats are not subject to the requirements of Chapter 236 of the Wisconsin Statutes. Rather they are governed by Chapter 703 of the Wisconsin Statutes.

ordinance.

1.7 Abrogation and Greater Restrictions

When other regulations provide "dual" standards, the more stringent pro visions should govern.

1. ***Public Provisions.*** *These regulations are not intended to interfere with, abrogate, or annul any other ordinance, rule or regulation, statute, or other provision of law except as provided in these regulations. Where any provision of these regulations imposes restrictions different from those imposed by any other provision of these regulations or any other ordinance, rule or regulation, or other provision of law, the provision which is more restrictive or imposes higher standards shall control.*
2. ***Private Provisions.*** *These regulations are not intended to abrogate any easement, covenant or any other private agreement or restriction, provided that where the provisions of these regulations are more restrictive than such easement, covenant, or other private agreement or restriction, the requirements of these regulations shall govern. Where the provisions of the easement, covenant, or private agreement impose duties and obligations more restrictive than these regulations, and the private provisions are not inconsistent with these regulations, then the private provisions shall be operative and supplemental to these regulations and the determinations made under the regulations.*

1.8 Interpretation*. In their interpretation and application, the provisions of these regulations shall be held to be the minimum requirements for the promotion of the public health, safety, and general welfare. These regulations shall be construed broadly in favor of the [city, village, town, county] to promote the purposes for which they are adopted.*

In limited instances, special site conditions may require more stringent pro visions to protect the public health, safety and we/fare.

1.9 Separability. *If any part or provision of these regulations or the application of these regulations to any person or circumstances is adjudged invalid by any court of competent jurisdiction, the judgment shall be confined in its operation to the part, provision, or application directly involved in the controversy in which the judgement shall be rendered. It shall not affect or impair the validity of the remainder of these regulations or the application of them to other*

A separabillty provision is often included in an ordinance to protect the whole if a section is declared invalid.

persons or circumstances. The [governing body of the city, village, town, county] hereby declares that it would have enacted the remainder of these regulations even without any such part, provision, or application which is judged to be invalid.

1.10 Enforcement, Violations, Penalties.

This pro vision is intended to ensure that subdivision standards are enforced by stating dearly that there will be penalties for violations and outlining the available appeals processes.

1. ***Violations.*** *It shall be unlawful to build upon, divide, convey, record, or monument any land in violation of this ordinance or state law, and no person shall be issued a building permit by the [city, village, town, county] authorizing the building on or improvement of any subdivision within the jurisdiction of this ordinance not of record as of the effective date of this ordinance until the requirements of this chapter have been filly met. The [city, village, town, county] may institute appropriate action or proceedings to enjoin violations of this ordinance or applicable state law.*
2. ***Penalties****. Penalties for violation of this ordinance shall be as follows:*
   a. *Any person who fails to comply with this chapter shall, upon conviction, be subject to the penalties as provided by the [city, village, town, county].*
   b. *Recordation improperly made has penalties provided in section 236.30 of the Wisconsin Statutes.*
   c. *Conveyance of lots in unrecorded plats has penalties provided for in section 236.31 of the Wisconsin Statutes.*
   d. *Monuments disturbed or not placed have penalties as provided for in section 236.32 of the Wisconsin Statutes.*
   e. *Assessor's p/at made under section 70.27 of the Wisconsin Statutes may be ordered by the city, village, town, county] as a remedy at the expense of the subdivider when a subdivision is created by successive divisions.*
3. *Appeals. Any person aggrieved by an objection to a p/at or a failure to approve a p/at under this ordinance may appeal therefrom, as provided in sections 236.13(5) and 62. 23(7)(e) 10, 14, and 15, of the Wisconsin Statutes, within 30 days of notification of the rejection of the p/at. Where failure to approve is based on an unsatisfied objection, the agency making the*

Ordinance Language | Commentary

objection shall be made a party to the action. The court shall direct that the p/at be approved if it finds that the action of the approving or objecting agency is arbitrary, unreasonable, or discriminatory.

1.11 Modifications.

1. Authority; application.

a. Where, in the judgment of the [governing body of the city, village, town, county], it would be inappropriate to apply literally the provisions of this ordinance because exceptional or undue hardship would result, the [governing body or plan commission of the city, village, town, county] may waive or modify any requirements to the extent deemed just and proper.

b. Application for any such modification or waiver shall be made in writing by the subdivider at the time when the preliminary p/at is filed for consideration, stating filly all facts relied upon by the petitioner, and shall be supplemented with maps, plans, or other additional data that may aid the [governing body or plan commission] in the analysis of the proposed project.

Subdivision ordinances should include a provision for modifications from the ordinances for unique situations that may impose a hardship on the applicant. The modification provision for subdivision ordinances should not be confused with the process and law governing variances from zoning ordinances.

***2. Conditions for granting**. The [plan commission or governing body of the city, village, town, county] shall not grant modifications or waivers to this ordinance unless it shall make findings based upon the evidence presented to it in each specific case that:*

a. The granting of the modification will not be detrimental to the public safety, health, or welfare or injurious to other property or improvements in the neighborhood in which the property is located.

b. The conditions upon which the request for a modification is based are unique to the property for which the modification is sought and are not applicable generally to other property.

c. Because of the particular physical surroundings, shape, or topographical conditions of the spec4/ic property involved, a particular hardship to the owner would result, as distinguished from a mere inconvenience, financial hardship, or self-imposed hardship, if the strict letter of this ordinance were carried out.

The term "plan commission" is used in this ordinance to universally refer to city, village, town plan commissions, and county plan committees, etc.

Ordinance Language | Commentary

d. Such modification is necessary for the preservation and enjoyment of substantial property rights possessed by other similar properties in the vicinity.

3. Granting by [plan commission or governing body].

a. The [plan commission or governing body], if it approves of the modification to this ordinance, shall do so by motion or resolution and shall instruct the [planning department or zoning administrator] to notify the subdivider.

b. Such relief shall be granted without detriment to the public good, without impairing the intent and purpose of this chapter or the desirable general development of the [city, village, town, county] consistent with the [city, village, town, county] comprehensive plan or this ordinance.

c. Any modification granted can only provide the minimum relief needed to alleviate the unnecessary hardship or obtain reasonable use of the property.

4. A majority vote of the entire membership of the [plan commission or governing body of the city/village/town/county] shall be required to grant any modification of this ordinance, and the reasons shall be entered in the minutes.

***1.12 Fees.** The [governing body of the city, village, town, county] may, by resolution, establish reasonable fees for the administration of this ordinance.*

In general, a fee schedule will be accepted by the courts if the community can demonstrate the charges bear a reasonable relationship to the costs of administering the ordinance.

2. Definitions

The following definitions shall be observed and applied, except when the context clearly indicates otherwise. Words used in the present tense shall include the future tense. Words used in the singular form shall include the plural form. Words used in the plural form shall include the singular. The word "shall" is mandatory and the word "may" is permissive.

Definitions are intended to clarify the meaning of certain terms included in the ordinance.

2.1 Common open space. Undeveloped land within a conservation subdivision that has been designated, dedicated, reserved, or restricted in perpetuity from further development and is set aside for the use and enjoyment by residents of the development. Common open space shall not be part of individual residential lots. It shall be substantially free of structures, but may contain historic structures and archaeological sites including Indian mounds, and/or such recreational facilities for residents as indicated on the approved development plan.

2.2 Condominium. A community association combining individual unit ownership with shared use or ownership of common property or facilities, established in accordance with the requirements of the Condominium Ownership Act, Chapter 703 of the Wisconsin Statutes. A condominium is a legal form of ownership of real estate and not a specific building type or style.

2.3 Conservation easement. The grant of a property right or interest from the property owner to a unit of government or nonprofit conservation organization stipulating that the described land shall remain in its natural, scenic, open or wooded state, precluding future or additional development.

Wisconsin's law governing conservation easements is found at section 700.40 of the Wisconsin Statutes.

2.4 Conservation subdivision. A housing development in a rural setting that is characterized by compact lots and common open space, and where the natural features of the land are maintained to the greatest extent possible.

2.5 Development envelops. Areas within which grading, lawns, pavement and buildings will be located.

This definition is from Wisconsin "smart growth "law, Wis. Stat. § 66.1027(1) (a).

Ordinance Language | Commentary

2.6 **Gross acreage.** The total area of a parcel including the area of perimeter street rights-of-way to the center line of the street.

2.7 **Homeowners association.** A community association incorporated or not incorporated, combining individual home ownership with shared use or ownership of common property or facilities.

2.8 **Nonprofit conservation organization.** Any charitable corporation, charitable association or charitable trust (such as a land trust), the purposes or powers of which include retaining or protecting the natural, scenic or open space values of real property, assuring the availability of real property for agricultural, forest, recreational or open space use, protecting natural resources, maintaining or enhancing air or water quality, or preserving the historical, architectural, archaeological or cultural aspects of real property.

This definition is from Wisconsin's conservation easement law. Wis. Stat. § 700.40(1) (b)2.

2.9 **Parent parcel.** The existing parcel of record, as identified by individual tax parcel numbers, as of the effective date of this ordinance.

2.10 **Subdivider.** Any person, corporation, partnership, association, individual, firm, trust or agent dividing or proposing to divide land resulting in a conservation subdivision.

Ordinance Language | Commentary

3. Application Procedure and Approval Process

A similar application procedure and approval process should be required for all subdivisions in the community or it will be a disincentive for conservation subdivisions.

3.1 Initial Conference. Before submitting an application for a conservation subdivision, the subdivider shall schedule an appointment and meet with the [planning department, plan commission, other administrative staff] to discuss the procedure for approval of a conservation subdivision, including submittal requirements and design standards.

The basic purpose for the initial conference is to inform the applicant of the conservation subdivision approval procedures. The process outlined in this section is a collaborative process between the developer and the community which begins with this initial discussion. The community may also want to include staff from state agendas such as the Departments of Transportation and Natural Resources.

3.2 Initial Application. After the initial conference, the subdivider shall submit a series of maps and descriptive information to the [planning department, plan commission, other administrative staff] according to the following. Mapping for the initial application can be done in any combination of features as long as individual map components can be distinguished and the relationship between map components can be determined.

1. **Inventory and mapping of existing resources** including the following mapped at a scale of no less than one inch 50 feet:
   a. Topographic contours at 2-foot intervals.
   b. United States Department of Agriculture, Natural Resource Conservation Service soil type locations and identification of soil type characteristics such as agricultural capability, depth to bedrock and water table, and suitability for wastewater disposal systems. Type and stability of bedrock should also be noted, particularly in karst areas and areas with high potential for groundwater contamination due to fractured bedrock or the presence of arsenic and mercury.
   c. Hydrologic characteristics, including surface water bodies, floodplains, groundwater recharge and discharge areas, wetlands, natural swales, drainage ways, and steep slopes.
   d. Land cover on the site, according to general cover type (pasture, woodland, etc.), and stand-alone trees with a caliper of more than [24] inches measured four feet off the ground. The inventory shall include comments on the health and condition of the vegetation.
   f. Current and past land use, all buildings and structures on the land, cultivated areas, brownfields, waste sites, and history of waste disposal

The resource inventory identifies the land's features, including natural and cultural resources, scenic views, and other physical characteristics. The purpose of requiring the resource inventory is to ensure that the subdivision design takes into account the site's significant resources and to provide the plan commission with information to evaluate the subdivision's impact on those resources.

Communities with computerized land information systems may want to ask that the information be submitted in a digital format compatible with the local community's geographic information system.

practices, paved areas, and all encumbrances, such as easements or covenants.

g. Known critical habitat areas for rare, threatened or endangered species.

h. Views of the site, including views onto the site from surrounding roads, public areas and elevated areas, including photographs with a map indicating the location where the photographs were taken.

i. Unique geological resources, such as rock outcrops and glacial features.

j. Cultural resources: brief description of historic character of buildings and structures, historically important landscapes, and archeological features. This includes a review of existing inventories, including those the State Historical Society of Wisconsin maintains for historic buildings, archaeological sites, and burial sites.

2. Development yield analysis. The subdivider shall submit a table showing the maximum number of dwelling units that would be permitted under the [city, village, town, county] zoning ordinance, consistent with the minimum lot size, lot widths, set backs, and other provisions of the zoning ordinance and compare it to the number of dwelling units proposed. Land that is undevelopable because of other laws and ordinances that prohibit development in certain areas (e.g. floodplains, wetlands, steep slopes, and drainage ways) shall be excluded from the development yield analysis.

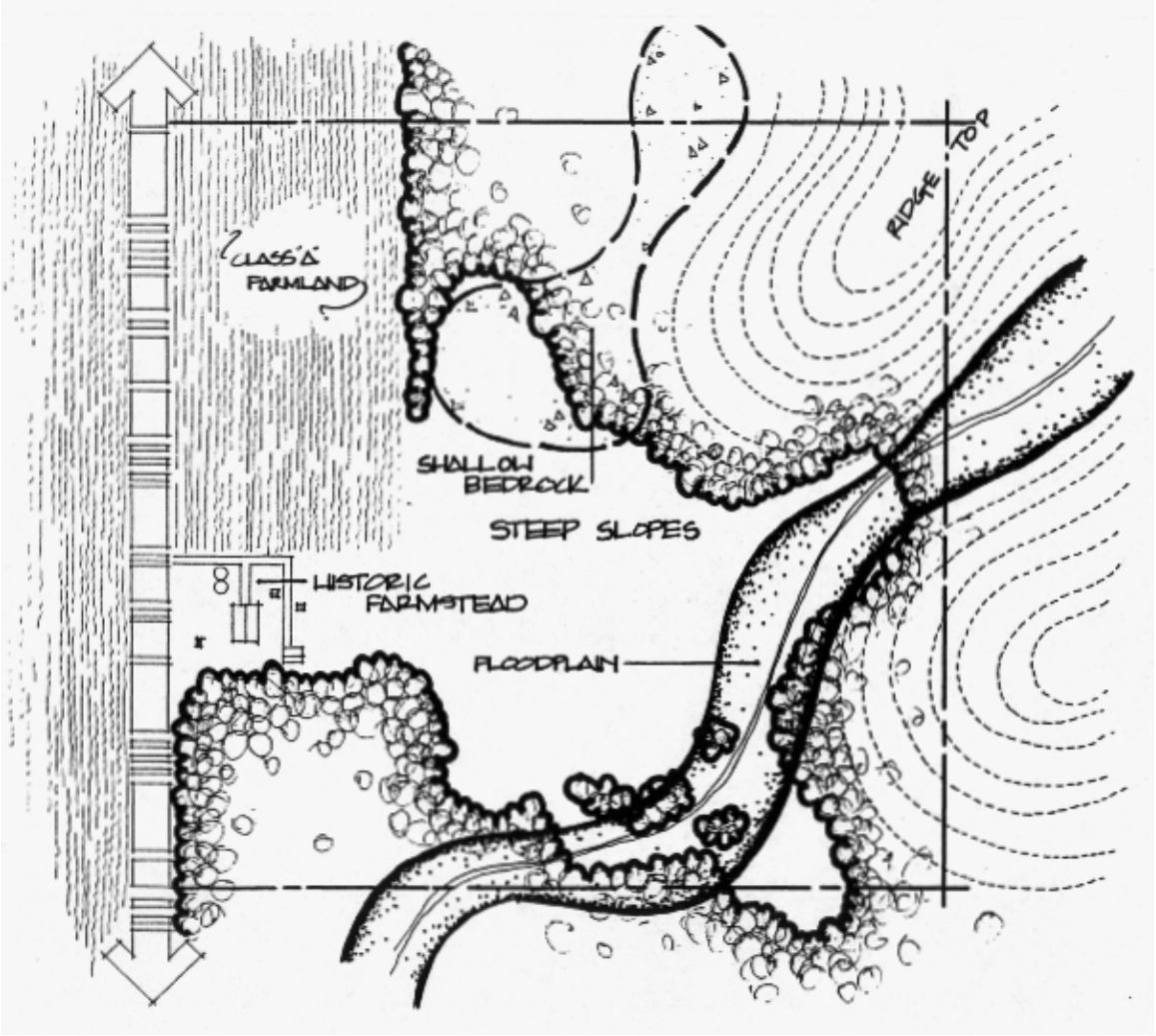
The development yield analysis shows the maximum number of dwelling units that would be permitted on a parcel under the applicable zoning ordinance. This analysis is used to ensure that conservation subdivisions are "development-neutral"--the number of units developed is the same as what would be permitted for conventional development.

3. Site analysis and concept plan. Using the inventory provided in section 3.2(1), the development yield analysis provided in section 3.2(2), and applying the design standards specified in section 4 of this ordinance, the subdivider shall submit a concept plan including at least the following information at a scale of no less than one inch = 50 feet:

a. Open space areas indicating which areas are to remain undeveloped and trail location.

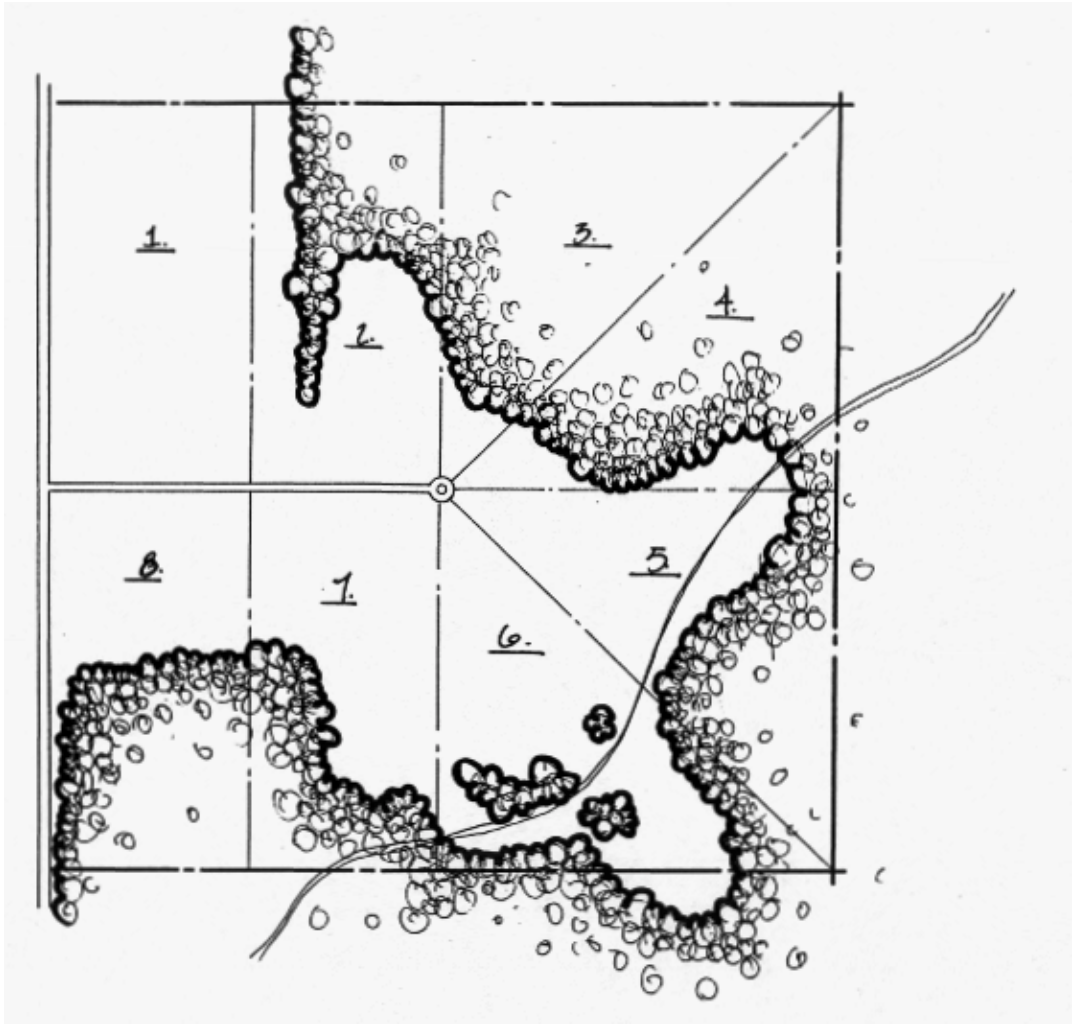
b. Boundaries of areas to be developed and proposed general street and lot layout.

c. Number and type (i.e., single-family, multi-family) of housing units proposed.

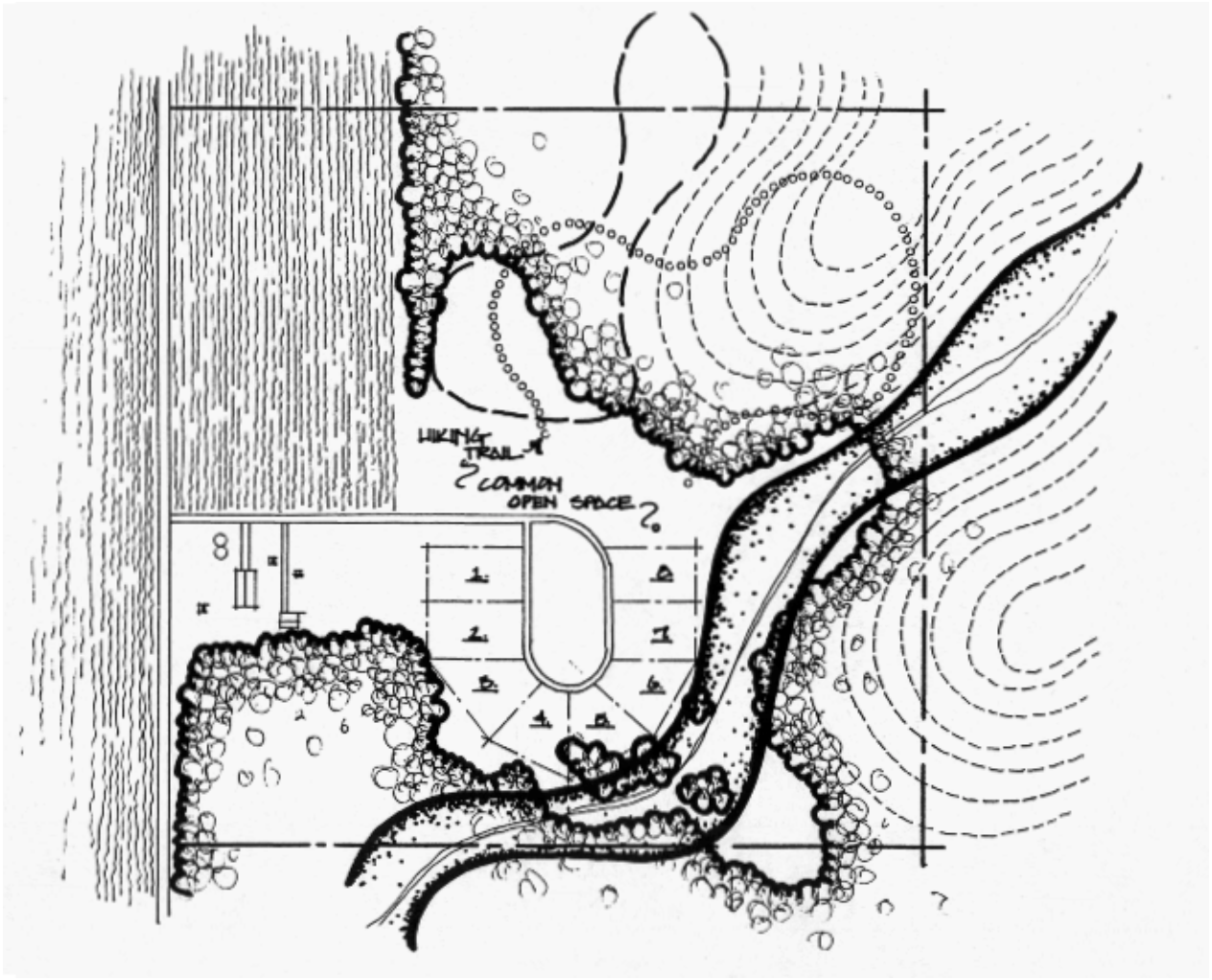


Step 1: *Inventory and mapping of existing resources for a hypothetical 40 acre site.*

Ordinance Language | Commentary



Step 2: *Development yield as permitted under existing ordinances (zoning, etc.) for the 40 acre site assuming a 5 acre minimum lot size zoning standard. 8 lots would be permitted under this scenario.*



Step 3:

Concept map of the conservation subdivision showing the 8 lots that would be permitted, p/us the historic farmhouse, which would be preserved, for a total of 9 dwelling units.

Ordinance Language	Commentary

d. Proposed methods for and location of water supply, stormwater management (e.g., best management practices), and sewage treatment.
e. Inventory of preserved and disturbed natural features and prominent views.
f. Preliminary development envelops showing areas for lawns, pavement, buildings, and grading.
g. Proposed methods for ownership and management of open space.

It is important to know how surface drainage will be managed (e.g., swales, detention ponds, etc.) And how wastewater will be managed (e.g. individual on-site private systems--mounds, conventional, on-site cluster systems, or publicly owned wastewater treatment facility).

4. **General location map.** The subdivider shall submit a map showing the general outlines of existing buildings, land use, and natural features such as water bodies or wooded areas, roads and property boundaries within 500 feet of the tract. This information may be presented on an aerial photograph at a scale of no less than 1 inch: 400 feet.

3.3 **Review of Initial Application.** Within 30 days following the filing of a complete initial application the [planning department, plan commission, other administrative staff] shall meet with the subdivider to review the initial application. Staff from appropriate state agencies may also be requested by the [city, village, town, county] to review the application. The [planning department, plan commission, other administrative staff] shall make the determination of whether the initial application is complete. The [planning department, plan commission, other administrative staff] may also schedule a visit to the site with the subdivider to review the existing features of the site and the concept plan. The visit shall occur prior to or as part of the meeting. Within 30 days following the meeting, the [planning department, plan commission, other administrative staff] shall provide a written report informing the subdivider of any additions, changes, or corrections to the concept plan submitted as part of the initial application.

3.4 ***Preliminary Plat Review and Approval Procedures.*** *Following review and comment of the plan commission on the initial application, the subdivider or subdivider agent shall file an application for review and approval of the plan commission of a preliminary p/at with the [planning department, zoning administrator].*

The purpose of preliminary p/at approval is to enable the p/an commission to review all substantive aspects of the subdivision without forcing the developer to prepare a final set of p/at maps which will then be expensive to change. Preliminary plats are not required by state law.

Ordinance Language	Commentary

1. ***Referral.*** *Administrative staff and utility commission reviews. The [planning department, zoning administrator] shall provide copies of the preliminary p/at to [city, village, town, county] department heads, to the appropriate objecting agencies under Wis. Stat. § 236.12, and to the appropriate utilities for their review and comment. The [city, village, town, county] staff and utility comments will be forwarded to the plan commission and [governing body] for consideration during the review process.*

2. ***Plan commission recommendation****. After review of the preliminary p/at and negotiations with the subdivider on changes and the kind and extent of public improvements that will be required, the plan commission shall recommend to the [governing body] disapproval, approval, or conditional approval of the preliminary p/at within 60 days of the filing date.*

3. ***Public hearing.*** *The [planning department, zoning administrator] shall schedule a public hearing on the preliminary plat before the [plan commission, governing body]. The [planning department, zoning administrator] shall give notice of the [governing body's] review and public hearing on the preliminary p/at by listing it as an agenda item in the [governing body]'s meeting notice published in the official local government newspaper. The notice shall include the name of the applicant, the address of the property in question, and the requested action. Property owners within 200 feet of the proposed land division shall receive written notice of the public hearing.*

Though not required by statute, it is important to hold a public hearing at the preliminary plat stage to ensure broader participation by citizens and other interested agencies.

4. ***Board action.*** *After receipt of the plan commission's recommendation, the [governing body] shall, within 90 days of the date the p/at was filed with the [planning department, zoning administrator], approve, approve conditionally, or reject such p/at and shall state, in writing, conditions of approval or reasons for rejection, unless the time is extended by agreement with the subdivider. Failure of the [governing body] to act within 90 days or extension thereof shall constitute an approval of the preliminary p/at, unless other authorized agencies object to the p/at. The [planning department, zoning administrator] shall communicate to the subdivider the action of the village board. If the preliminary p/at is approved, the*

The local governing body could also authorize the plan commission to take final action on the preliminary plat without referring it to the governing body.

Ordinance Language | Commentary

[planning department, zoning administrator] shall endorse it for the [governing body].

5. ***Effect of approval.*** *Approval of a preliminary p/at shall be valid for six months from the date of approval. Approval or conditional approval of a preliminary p/at shall not constitute automatic approval of the final p/at. The preliminary p/at shall be deemed an expression of approval or conditional approval of the layout submitted as a guide to the preparation of the final p/at, which will be subject to further consideration by the plan commission and [governing body] at the time of its submission.*

6. ***Amendment.*** If the subdivider desires to amend the preliminary p/at as approved, the subdivider may resubmit the amended plat, which shall follow *the same procedure, except for the fee, unless the amendment is, in the opinion of the [plan commission, governing body], of such scope as to constitute a new p/at, in which case it shall be refiled.*

To eliminate uncertainties surrounding submission requirements for the preliminary plat, this subsection sets out the specific items that the applicant must submit to the government.

3.5 ***Preliminary Plat Requirements****. The preliminary p/at shall be prepared by a licensed land surveyor or engineer at a convenient scale not less than one (1) inch equals one hundred (100) feet. More than one (1) sheet may be used to present the information required in this section and shall include the following:*

To eliminate uncertainties surrounding submission requirements for the preliminary plat, this subsection sets out the specific items that the applicant must submit to the government.

1. ***Name of the Proposed Subdivision.*** *The proposed name of the subdivision shall not duplicate or be alike in pronunciation of the name of any p/at previously recorded in the County.*

2. ***Project Ownership and Development Information.***
   a. *Name, address, and telephone number of the legal owner and, if applicable, agent of the property.*
   b. *Name, address, and telephone number of the professional person(s) responsible for subdivision design, for the design of public improvements, and for surveys.*
   c. *Date of preparation.*

Ordinance Language	Commentary

3. Existing Site Conditions. Provide this information on a property survey map.

a. Boundary line of the proposed site and all property to be subdivided. Include all contiguous land owned or controlled by the subdivider.

b. Location, width, and names of all existing platted streets and rights-of-way to a distance of 100 feet beyond the site.

c. Show the type, width and condition of street improvements; railroad or major utility rights-of-way; parks and other public open spaces; location and widths of existing snowmobile or other recreation trails; and permanent buildings and structures to a distance of 100 feet beyond the site, if any.

d. Location, widths, and names of all existing public and private easements to a distance of 100 feet beyond the site.

e. Identify by name and ownership boundary lines of all adjoining lands within 100 feet of the proposed plat.

f. Topographic data including contours at vertical intervals of not more than 2 feet. Elevation values shall be based on the National Geodetic Vertical Datum of 1929 (NGVD 29) or the North American Datum of 1988 (NAVD 88) or future adjustments to NAVD 88 as defined by the National Geodetic Survey and should also be so noted on the plat.

g. Significant natural resource features on the site, i.e. wetlands, floodplains, watercourses, existing wooded areas, steep slopes, drainage ways, rare, threatened and endangered species, and other natural resource features, views and other prominent visual features.

h. Burial sites categorized under Wis. Stat. § 157.70, Indian mounds, national and state register listed properties, and locally designated historic properties.

i. Existing soil classifications, including hydric soils.

j. Legal description of the property.

k. Existing zoning classifications for land in and abutting the subdivision.

1. Total acreage of the proposed site.

m. Provide graphic scale, north arrow, and date.

4. **Subdivision Design Features.** Provide this information on the Preliminary Plat.
   a. Layout of proposed streets, showing right-of-way widths, types of improvements, street surface widths, and proposed street names.
   b. Locations and type of proposed public easements (i.e. drainage, utility, pedestrian, public access to waterways, etc.); and all conservation easements.
   c. Layout of proposed blocks and lots within the plat.
   d. Basic data regarding proposed and existing (if applicable) lots and blocks, including numbers, dimensions, area.
   e. Minimum front, side and rear yard building setback lines for all lots.
   f. Indication of the use of any lot.
   g. Location and size of all proposed and existing sanitary sewer lines and water mains, proposed community sewer and water system, or individual on-site septic systems and potable water sources.
   h. Location and size of all proposed and existing storms sewers (lines, drain inlets, manholes), culverts, retention ponds, swales, infiltration practices and areas, and other stormwater facilities within the plat and to a distance of 100 feet beyond the site.
   i. Development envelopes showing areas for grading, lawns, pavement and buildings.
   j. Open space areas, other than pedestrian ways and utility easements, intended to be dedicated or reserved for public use, including the size of such area or areas in acres. Provide information on the conditions, if any, of the dedication or reservation.
   k. Management plan for restoration and long-term management of the open space areas.

5. Preliminary Construction Plans. Provide information on one or more sheets.
   a. Plan and Profile. Proposed street centerline profile grades, showing the existing and proposed profile grade lines.
   b. Grading and Erosion Control Plan. A plan showing existing and proposed grades, drainage patterns, and stormwater facilities. The plan

shall show the location and extent of grading activities in and adjacent to the plat, overall area of the site in acres, total impervious surface area of project, total pervious area, stockpile locations, erosion and sediment control facilities, and a schedule for erosion and sediment control practices including site specific requirements to prevent erosion at the source. Major trees to be preserved, with a diameter of [24] inches or more measured twelve (12) inches above ground level, shall be shown on the preliminary grading and erosion control plan. Adequate measures for protecting major trees shall be shown on the plan.

c. Provisions for sewage disposal, water supply, stormwater management, and flood control.

3.6 Final Plat Review and Approval Procedures. *A final subdivision p/at shall be filed in accordance with the following:*

1. Final Plat. *The subdivider shall prepare a final p/at and a letter of application in accordance with this ordinance and shall /fi/e 20 copies of the p/at and the application with the [planning department, zoning administrator] at least 21 days prior to the meeting of the plan commission at which action is desired. The owner or subdivider shall file the final p/at not later than six months after the date of approval of the preliminary plat; otherwise, the preliminary plat and final plat will be considered void unless an extension is requested in writing by the subdivider and for good cause granted by the [city, village, town, county]. The subdivider or subdivider's agent shall also submit at this time a current certified abstract of title or such other evidence as the [city, village, town, county] may require showing ownership or control in the applicant.*

2. Objecting Agencies. *The subdivider or the subdivider's agent shall submit the original plat to the Plat Review Section, Wisconsin Department of Administration, which shall forward two copies to each of the agencies authorized to object under section 236.12(2) of the Wisconsin Statutes. The department shall have the required number of copies made at the subdivider's expense.*

Review by the "objecting agencies is required under the original p/at to the Plat Review Section, Wisconsin Department of Chapter 236 of the Wisconsin Statutes.

3. ***Final Construction Plans.*** *Simultaneously with the filing of the final p/at, the owner shall file with the [planning department, zoning administrator] four copies of the final construction plans and specifications of public improvements required by the [city, village, town, county/.*

4. ***Installation, Protection and Maintenance Plans.*** *The subdivider shall also submit plans for areas to be protected and/or introduced native vegetation.*

5. ***Referral of Final Plat.*** *The [planning department, zoning administrator] shall provide copies of the final p/at to [city, village, town, county] department heads and to the appropriate utilities for their review and comment. The [city, village, town, county] staff and utility comments will be forwarded to the p/an commission and [governing body] for their consideration during the review process.*

6. ***Plan commission review.*** *The p/an commission shall examine the final plat as to its conformance with the preliminary p/at; any conditions of approval of the preliminary p/at; this chapter; and all applicable ordinances, rules, regulations, and comprehensive plan elements that may affect it and shall recommend approval, conditional approval, or rejection of the p/at to the [governing body].*
   a. *The p/an commission shall, within 30 days of the date of filing of the final p/at with the [planning department, zoning administrator], recommend approval, conditional approval, or rejection of the p/at and shall transmit the final p/at and application along with its recommendations to the [governing body]. The plan commission may hold the matter in abeyance if there is incomplete or inadequate information.*

7. ***[Governing body] review and approval.*** *The [governing body] shall, within 60 days of the date of filing the original final p/at with the [planning department, zoning administrator], approve or reject such plat unless the time is extended by agreement with the subdivider. If the plat is rejected, the reasons shall be stated in the minutes of the meeting and a written*

Chapter 236 of the Wisconsin Statutes also allow the governing body to delegate final plat approval to the plan commission.

statement of the reasons forwarded to the subdivider. The [governing body] may not inscribe its approval on the final p/at unless the [planning department, zoning administrator] certifies on the face of the p/at that the copies were forwarded to objecting agencies as required in this section, the date thereof and that no objections have been filed within 20 days or, if *filed, have been met.*

a. The [governing body] shall, when it determines to approve a final p/at, give at least ten days' prior written notice of its intention to the municipal clerk of any municipality within 1,000 feet of the final p/at.

b. If the [governing body] fails to act within 60 days, without a time extension and no unsatisfied objections having been filed, the p/at shall be deemed approved.

c. Recordation. After the final p/at has been approved by the [governing body] and required improvements either installed or a contract and sureties ensuring their installation is filed, the [planning department, zoning administrator] shall cause the certificate inscribed upon the p/at attesting to such approval to be duly executed and the p/at returned to the subdivider for recording with the county register of deeds along with all conservation easements and deed restrictions. The register of deeds cannot record the p/at unless it is offered within six months from the date of last approval.

d. Copies. The subdivider shall file eight copies of the final p/at with the [planning department, zoning administrator] for distribution to the approving agencies, affected sanitary districts, and other affected agencies for their files.

The Wisconsin Department of Transportation should receive a copy of the final p/at if the property is adjacent to a state trunk highway.

***3.7 Final Plat Requirements**. A final p/at prepared by a registered land surveyor shall be required for all subdivisions. It shall comply with the requirements of Wis. Stats.* § *236.20 and this ordinance.*

1. Additional information. The final p/at shall show correctly on its face, in addition to the information required by Wis. Stats. § *236.20, the following:*

a. Exact length and bearing of the centerline of all streets.

b. Exact street width along the line of any obliquely intersecting street.
c. Exact location and description of utility and drainage easements.
d. Railroad rights-of-way within and abutting the p/at.
e. All lands reserved for future public acquisition or reserved for the common use of property owners within the p/at, including public access to waterways.
f Restrictions relating to access control along public ways.
g. Setback or building lines.
h. Restrictive covenants, deed restrictions, conservation easements for *the proposed subdivision shall be filed with the final p/at.*
i. The legal instruments detailing the ownership of the common open space, as required in section *5,* which shall be filed with the final plat.
j. All final plats shall meet all the surveying and monumenting requirements of section 236.15 of the Wisconsin Statutes.
k State plane coordinate system. Where the p/at is located within a quarter section, the corners of which have been relocated, monumented, and coordinated by the [city, village, town, county], the p/at shall be tied directly to one of the section or quarter corners so relocated, monumented, and coordinated. The exact grid bearing and distance of such tie shall be determined by field measurements, and the material and state plane coordinates of the monument marking the relocated section or quarter corner to which the p/at is tied shall be indicated on the p/at.
1. Certificates. All final plats shall provide all the certificates required by section 236.21 of the Wisconsin Statutes. In addition, the surveyor shall certify that the surveyor has fully complied with all sections of this chapter.
m. Recording. The final p/at shall be recorded within 30 days of its approval by the [name of governing body].

3.8 Certified Survey Maps. Conservation subdivisions shall not be created by certified survey maps under section 236.34 of the Wisconsin Statutes.

Certified survey maps could be used if the same process and analysis of this ordinance is used.

4. Requirements for Design and Improvements

4.1 Land Suitability. No land shall be developed which is held to be unsuitable for any proposed use if identified as being environmentally sensitive. Areas identified as being environmentally sensitive include, but are not limited to:

1. All areas mapped as Floodplain by the Federal Emergency Management Agency (FEMA), Wisconsin Department of Natural Resources, or other public or private entity.
2. All wetlands as defined in NR 103.02(5) of the Wisconsin Administrative Code, including a *[75]* foot buffer.
3. All areas within *[75]* feet of the ordinary high-water mark of navigable streams and lakes, as identified by Wisconsin Department of Natural Resources Water Management Specialists.
4. All areas having slopes greater than [12] percent.
5. Areas that are known to provide habitat for rare, threatened or endangered species.
6. Burial sites and Indian mounds.
7. Drainage ways that contain running water during spring runoff, during storm events or when it rains. A [25] foot buffer from the edge of the drainage way shall be included.

Areas determined to be environmentally sensitive may be included as common open space in a conservation subdivision but shall not be included in the development yield analysis in section 3.2. These lands shall be identified as an outlot or other designation that indicates the land is not available for development.

These are areas where development is normally prohibited under conventional ordinances. Local ordinances that prohibit development in certain areas (such as floodplain, shore/and zoning, and wetland ordinances) should be cited in this section of the ordinance. Communities especially interested in the goal of protecting significant natural resources may choose to add to this fist of areas that should not be developed.

Not all counties use the 75 foot setback. Some counties have established more stringent set back provisions.

Protection of steep slopes is a local choke. In communities that prohibit development on steep slopes, the percent of slope protected ranges from 1 to 25 percent.

4.2 Development Yield. The number of residential units for a parcel shall be determined in accordance with the following:

1. The development yield analysis in section 3.2 shall establish the base development yield for the parcel.
2. The base development yield may be increased if the development complies with one or more of the following standards. Each standard provides a

The purpose behind development bonuses is to provide an incentive for achieving certain public policies objectives.

development yield bonus of [5]% in addition to the base development yield. The maximum bonus permitted is [20%].

a. Creating an endowment where the principal would generate sufficient annual interest to cover the conservation easement holder's yearly costs (taxes, insurance, maintenance, enforcement, etc.).
b. Providing for access by the general public to trails, parks, or other recreational facilities, excluding golf courses.
c. Providing affordable housing, to include a minimum of[25] percent of all units that would be affordable to moderate-income households, as defined by the U.S. Department of Housing and Urban Development.
d. Reusing historical buildings and structures, including those sites inventoried by the State Historical Society of Wisconsin. The U.S. Secretary of the Interior's Standards for Rehabilitation of Historic Properties shall apply.

Affordable housing needs should be addressed in the context of the housing element of the local government's comprehensive p/an

4.3 Performance Standards

1. General considerations

a. Conservation subdivisions shall identify a conservation theme or themes. This theme shall be identified at the time of the initial application. Conservation themes may include, but are not limited to, forest stewardship, water quality preservation, farmland preservation, natural habitat restoration, viewshed preservation, or archaeological and historic properties preservation. The plan commission shall have the ability to specify which areas shall be preserved.
b. The residential lot shall be large enough to accommodate a house and two car garage.

The goals of any conservation subdivision ordinance will likely differ in each jurisdiction and may differ from development to development.

2. Residential Lot Requirements

a. Minimum Lot Size
- Septic on-site: [1] acre.
- Septic off-lot: [1/4 acre].

b. Principal Building Setbacks
- Front lot line: [30] feet

The dimensions used here are one set. Other dimensions may be more appropriate for other communities.

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- Side lot line: [10] feet
- Rear lot line: [20] feet

c. Accessory Building Setbacks
- Side lot line: [15] feet
- Rear lot line: [10] feet

d. Lots shall be configured to minimize the amount of impervious surfaces. Maximum Lot Coverage: *[35]%* (includes buildings and other impervious surfaces).

e. Maximum Building Height: [35] feet

f. Most lots shall take access from interior local streets. Existing farmsteads to be preserved will have a driveway as part of the historic landscape that does not access a local street but should be preserved.

g. Lots shall be configured to minimize the amount of road length required for the subdivision.

The challenge of providing standards is to foster creative design and protect key resources without "strait jacketing" the developer with too many requirements.

h. Development envelopes shall be configured to minimize loss of woodlands.

i. If agricultural uses are being maintained, lots shall be configured in a manner that maximizes the usable area remaining for such agricultural uses with appropriate buffers between agricultural uses and residential structures.

j. All lots within a neighborhood shall abut open space on at least one side. A local street may separate lots from the open space.

k. Lots shall be oriented around one or more of the following:

i. A central green or square.

ii. A physical amenity such as a meadow, a stand of trees, or some other natural or restored feature.

1. Development envelopes should not be located on ridges, hilltops, along peripheral public roads or in other visually prominent areas.

m. Residential structures shall be oriented to maximize solar gain in the winter months.

n. A 30 foot native vegetation buffer shall be maintained around open water areas, unless a specific common beach or grassed area is identified.

o. Stormwater management [BMIPs]

i. Minimize the use of curb and gutter and maximize the use of open swales.

ii. Roof down spouts should drain to porous surfaces.

iii. Peak discharges during the 2 and 10 year storm events shall be no more than predeveloped conditions.

iv. The development should capture 80% of the sediments/pollutants from the 1 year storm event.

v. Landscape plantings should be used to increase infiltration and decrease runoff.
vi. Natural open drainage systems shall be preserved.

3. Residential Cluster Siting Standards

a. All residential lots and dwellings shall be grouped into clusters. Each cluster shall contain no more than [20] dwelling units and no less than [5] units.
b. Residential clusters shall be located to minimize negative impacts on the natural, scenic and cultural resources of the site and conflicts between incompatible uses.
c. Residential clusters shall avoid encroaching on rare plant communities, high quality sites, or endangered species identified by the Department of Natural Resources.
d. Whenever possible, open space shall connect with existing or potential open space lands on adjoining parcels and local or regional recreational trails.
e. Residential clusters should be sited to achieve the following goals, to the extent practicable.
   i. Minimize impacts to prime farmland soils and large tracts of land in agricultural use, and avoid interference with normal agricultural practices.
   ii. Minimize disturbance to woodlands, wetlands, grasslands, and mature trees.
   iii. Prevent downstream impacts due to runoff through adequate on-site storm water management practices.
   iv. Protect scenic views of open land from adjacent roads. Visual impact should be minimized through use of landscaping or other features.
   v. Protect archaeological sites and existing historic buildings or incorporate them through adaptive reuse.
f. Landscaping around the cluster may be necessary to reduce off site views of residences.

The ordinance should set a maximum number of lots that can be grouped/n a "cluster" to ensure development of a compact neighborhood of a manageable size.

4. Open Space Design

a. Common Open Space. The minimum open space required shall be owned and maintained under one of the alternatives listed in section 5, as approved by the [city, village, town, county]. The uses within the open space shall be accessible to the residents of the development. These uses may also be available to the general public providing the proper approvals are received. The required open

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space shall be undivided and restricted in perpetuity from future development, as specified in Section 5.	
b. Open space shall be designated as part of the development. The minimum required open space is 60 % of the gross acreage.	
c. Open Space Conservation Ranking (in order of significance). The areas to be preserved shall be identified on a case-by-case basis in an effort to conserve and provide the best opportunities to restore and enlarge the best quality natural features of each particular site.	
i. First priority will be given to intact natural communities, rare and endangered species, environmental corridors, natural and restored prairies, significant historic and archaeological properties, and steep slopes.	*The ordinance should prioritize which resources the community seeks to protect. With the except/on of resources protected by federal and state regulations, this is largely a local decision.*
ii. Second priority will be given to areas providing some plant and wildlife habitat and open space values.	
iii. Third priority will be given to areas providing little habitat but providing viewshed, recreation, or a sense of open space.	
d. The following areas or structures may be located within the open space area and shall be counted toward the overall open space percentage required:	
i. parking areas for access to and use of the open space developed at a scale limited to the potential users of the open space.	*Some impact on resources is probably unavoidable. The objective is to fry to minimize those impacts.*
ii. privately-held buildings or structures provided they are accessory to the use of the open space.	
iii. Shared septic systems and shared potable water systems.	
e. Road rights of way shall not be counted towards the required minimum open space.	
f No more than 50 percent of the required open space may consist of water bodies, ponds, floodplain, or wetlands.	
g. That portion of open space designed to provide plant and animal habitat shall be kept as intact as possible. Trails shall be designed to avoid fragmenting these areas.	*The calculation of open space should not include the acreage of existing natural waterways. The existing open waterways are protected under the Public Trust Doctrine and would be open space regardless if a p/at was developed or not. The open space should be located adjacent to existing natural waterways and include floodplain, wetlands, and uplands.*
h. Accessible open space in upland areas shall be available for recreational uses such as trails, play fields, or community gardens but should be designed in a manner that avoids adversely impacting archeological sites.	
i. A pathway system connecting open space areas accessible to neighborhood residents, and connecting these areas to neighborhood streets and to planned or	

developed trails on adjacent parcels shall be identified in the plan.

5. **Street Standards**

a. Neighborhood streets may take the form of a two-way street, a pair of one-way streets on either side of a landscaped median, or a one-way loop street around a small neighborhood green. Streets shall be developed according to the following standards that promote road safety, assure adequate access for fire and rescue vehicles, and promote adequate vehicular circulation:

b. The applicant must demonstrate that access to the development has the capacity to handle traffic generated by the proposed project, and will not endanger the safety of the general public.

c. Streets shall have the following design standards:

i. Right-of-way widths. The right-of-way width for each road shall be wide enough to provide for all public services, including roadway drainage, sidewalks, trails, and walkways, utilities, and snow storage. The minimum right-of-way shall be provided in accordance with the following:

Right-of-Way	ADT less than 250	ADT over 250
One-way roadway	20’	30’
Two-way roadway	40’	50’

ii. Travel land widths for local roads shall be determined by the expected average daily traffic (ADT) and shall be within the following ranges:

Travel Lanes	ADT < 100	100-250 ADT	>250
Two-way roadway*	18’-24’	20’-26’	22’-28’
One-way roadway*	11’-13’	11’-13’	11’-14’
(curbed sections**)	13’	13’	13’
Shoulder or gutter Pan width	2’-4’	2’ – 4’	2’ – 4’

*Does not include shoulder or gutter pan.

**Measured from curb face to curb face.

This subsection discusses subdivision street standards. The design standards included in this subsection are merely one alternative. The transportation element of a local comprehensive plan should help each community define its own standards for the design of streets and how streets within the conservation subdivision conned to the local and regional roadway system.

Street widths and alignments should be carefully scaled to neighborhood size. The goal of a compact, pedestrian-friendly neighborhood can be undermined if the typically wider road and right-of-way standards of conventional suburban development are used. Wide streets can also contribute to stormwater runoff problems. The ordinance provides a range of right-of-way and roadway dimensions, depending on the expected levels of daily traffic.

In calculating average daily traffic (ADT), traffic engineers assume that a single-family detached house generates about 10 (one-way) vehicle trips per day, with lower numbers for attached and multi-family dwellings.

d. Additional Standards:
   i. Design Speed: Maximum 25 miles per hour.
   ii. Vertical Curves: Minimum 50’ (when grade difference less than 1%, no curve is needed).
   iii. Horizontal Curves: Minimum radius of 125’
   iv. Road Grades: Maximum grade 8%
   v. Super-elevation: Maximum e= 0.04 feet/feet
   vi. Pavement Strength: 7 ton minimum
   viii. Clear Zones:
      - Shoulder sections: 10’ from edge of travel lane
      - Curbed sections: 2’ from face of curb

   ix. Bridges: Width shall be traveled way, plus 2’ each side. Design Loading for Structural Capacity HS-20, plus 5’ sidewalk necessary to maintain pedestrian crossing.
   x. Cul-de-sacs should be designed as semi-circular and circular loop roads. Minimum 30’ outside radius around a landscaped island with an minimum 10’ radius. Open space internal to these road features can be counted toward the open space requirements.
   xi. Sidewalks, trails, and other walkways. Minimum 5 feet width.

e. If determined necessary by the [zoning administrator, planning department] shade trees shall be planted on both sides of the street.
f. Street connections to adjacent parcels shall be provided in logical locations to avoid creating landlocked parcels and provide for connecting street patterns.
g. Streets that serve as collectors, interconnecting subdivisions and other major traffic generators, shall be designed according to the [city/village/town/county]’ s standards for collector roads.
h. Where streets will connect with streets having differing standards, the street dimensions shall be the same as those of the connecting street. All street widenings shall occur at the nearest intersection.
i. The developed area should have sidewalks on at least one side of the street.

6. Sewage and Water Facilities

a. Water for a conservation subdivision shall be provided by individual on-site wells or by one or more community wells meeting the permit requirements of the State of Wisconsin and the [city, village, town, county]. The use of shared or community wells is encouraged. Plans for shared or community wells should include a wellhead protection plan with separation distances for the zone of influence and sources of pollution.

Water and sewer facilities should be developed consistent with the local community's utilities and community facilities element of its comprehensive plan.

b. All conservation subdivisions shall be provided with adequate sewage treatment facilities meeting the standards of the [city, village, town, county] and the permit requirements of the Wisconsin Department of Commerce and the Department of Natural Resources. Where sewage treatment is not provided by a publicly owned wastewater treatment works, a common sewage treatment and disposal unit located on the common open space lands is encouraged.

The ability to use shared or community wells rather than individual ones is one advantage of conservation subdivisions. Community wells can be sited in the most suitable locations on each parcel, with maximum separation from wastewater disposal treatment facilities. This feature is especially beneficial in areas where groundwater is highly sensitive to contamination.

4.4 Financial Guarantee. *A financial guarantee ensuring the construction and completion of the common facilities shall be submitted to the [planning department, zoning administrator].*

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5. Ownership and Maintenance of Open Space and Common Facilities

This section outlines the options available for ownership and maintenance of the common open space.

5.1 **Alternatives.** The designated common open space and common facilities may be owned
and managed by one or a combination of the following:

1. A homeowners' association.
2. A condominium association established in accordance with the Condominium Ownership Act, Chapter 703 of the Wisconsin Statutes.
3. A nonprofit conservation organization.
4. The [name of city, village, town, county] or another governmental body empowered to hold an interest in real property.
5. An individual who will use the land for open space purposes as provided by a conservation easement.

5.2 **Homeowners' Association.** A homeowners association shall be established if the common open space is proposed to be owned by a homeowners association. Membership in the association is mandatory for all purchasers of homes in the development and their successors.

A typical ownership option is a homeowners association. This method gives the residents the greatest degree of control over the use and management of common open space.

The homeowners' association bylaws, guaranteeing continuing maintenance of the open space and other common facilities, and the declaration of covenants, conditions and restrictions of the homeowners association shall be submitted for approval to the [name of city, village, town or county] as part of the information required for the preliminary plat. The homeowners' association bylaws or the declaration of covenants, conditions and restrictions of the homeowners association shall contain the following information:

A homeowners' association is a formally constituted non-profit corporation made up of the property owners and/or residents of the development for the purpose of owning and maintaining the common open space and facilities. This section of the ordinance describes provisions required to be included in the homeowners' association documents which must be submitted to the local government for review and approval.

1. The legal description of the common land;
2. A description of common facilities;
3. The restrictions placed upon the use and enjoyment of the lands or facilities;
4. Persons or entities entitled to enforce the restrictions;
5. A mechanism to assess and enforce the common expenses for the land or facilities including upkeep and maintenance expenses, real estate taxes and insurance premiums;

6. A mechanism for resolving disputes among the owners or association members;
7. The conditions and timing of the transfer of ownership and control of land facilities to the association;
8. Any other matter the developer deems appropriate.

5.3 Condominium Associations. If the common open space and facilities is to be held under the Condominium Ownership Act, Chapter 703 of the Wisconsin Statutes, the condominium instruments shall identify the restrictions placed upon the use and enjoyment of the common open space. All common open space shall be held as a "common element" as defined in section 703.0 1(2) of the Wisconsin Statutes.

The State Historical Society of Wisconsin can accept a historic preservation easement on properties listed or determined eligible for the state and national registers of historic p/aces.

5.4 A Nonprofit Conservation Organization. If the common open space is to be held by a nonprofit conservation organization, the organization must be acceptable to the [city, village, town, county]. The conveyance to the nonprofit conservation organization must contain appropriate provisions for reversion in the event that the organization becomes unwilling or unable to uphold the terms of the conveyance.

5.5 Public Dedication of Open Space and Streets.

1. The [city, village, town, county] may accept the dedication of fee title or dedication of a conservation easement to the common open space. The [city, village, town, county] may accept the common open space provided:
   a. The common open space is accessible to the residents of the [city, village, town, county];
   b. The [city, village, town, county] agrees to and has access to maintain the common open space.
3. Streets or other public ways which have been designated on a duly adopted official map or element of the [city, village, town, county] comprehensive plan shall be dedicated or reserved by the subdivider to the [city, village, town, county]. The street or public way shall be made a part of the plat in the locations and dimensions indicated in the comprehensive plan and as set forth in this ordinance.

This pro vision, for example, would allow a farmer to continue farming a parcel of land which the use of that parcel for other purposes is limited by the conservation easement.

5.6.1 Individual Ownership. An individual may hold fee title to the land while a nonprofit or other qualified organization holds a conservation easement uses for the common open space.

5.7 Maintenance Plan. Every conservation subdivision must include a plan that provides evidence of a means to properly manage the common open space in perpetuity and evidence of the long-term means to properly manage and maintain all common facilities, including any storm water facilities. The plan shall be approved by, the [governing body, plan commission] prior to final plat approval.

1. The plan shall do the following:
   a. Designate the ownership of the open space and common facilities in accordance with section *5.1.*
   b. Establish necessary regular and periodic operation and maintenance responsibilities.
   c. Estimate staffing needs, insurance requirements, and other associated costs and define the means for funding the same on an on-going basis.
   d. Include a land stewardship plan specifically focusing on the long-term management of common open space lands. The land stewardship plan shall include a narrative, based on the site analysis required in section 3.2, describing:

i. Existing conditions including all natural, cultural, historic, and scenic elements in the landscape.

ii. The proposed end state for each common open space area; and the measures proposed for achieving the end state.

iii. Proposed restoration measures, including: Measures for correcting increasingly destructive conditions, such as erosion; and measures for restoring historic features and habitats or ecosystems.

iv. The operations needed for maintaining the stability of the resources, including: mowing schedules; weed control; planting schedules; clearing and cleanup; at the [city, village, town county]'s discretion, the applicant may be required to place in escrow sufficient funds for the maintenance and operation

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costs of common facilities for a maximum of one year. 2. In the event that the organization established to own and maintain the open space and common facilities, or any successor organization, fails to maintain all or any portion of upon the residents and owners of the open space and common facilities, setting forth the manner in which the organization has failed to maintain the common facilities in reasonable condition. Such notice shall set forth the nature of corrections required and the time within which the corrections shall be made. Upon failure to comply within the time specified, the organization, or any successor organization, shall be considered in violation this Ordinance, in which case the bond, if any, may be forfeited, and any permits may be revoked or suspended. The [city, village, town, county] may enter the premises and take corrective action. a. The costs of corrective action by the [city, village, town, county] shall be assessed ratably, in accordance with tax assessments, against the properties that have the right of enjoyment of the common facilities and shall become a lien on said properties. The [city, village, town, county], at the time of entering upon such common facilities for the purpose of maintenance, shall file a notice of such lien in the office of the County Register of Deeds upon the properties affected by such lien. 3. Management plans can be amended by the owner identified under section *5.1* with the approval of the [plan commission, governing body].	the common facilities in reasonable order and conditio

Appendix D

Town of Franklin, Massachusetts
Best Management Practices Manual

Town of

Franklin

Best Development Practices

Guidebook

Version 1, November 2001

Table of Contents

Introduction

The Franklin Best Development Practices Guidebook (BDP Guidebook) is a set of guidelines for developers, designers and project reviewers intended to improve the quality of development in Franklin. The Guidebook describes the required and preferred design and construction practices in Franklin related to stormwater management, erosion and sedimentation control, landscape design, and site planning. **Any project proposed in Franklin that requires Planning Board or Zoning Board of Appeals (ZBA) approval shall comply with the requirements of this Guidebook.**

None of the practices in the Guidebook are new, and many have already been used extensively in Massachusetts. The Guidebook codifies these practices as official Town policy, thus taking some of the "guesswork" out of project design and review. The Guidebook also provides a single-source reference book for designers and reviewers working in Franklin. Recognizing that many best development practices are site-dependent, the Guidebook identifies a range of practices that are relevant to development and redevelopment projects on a variety of sites.

The Guidebook is divided into five sections. Section I is a **checklist for designers** to help them determine which best development practices are likely to be applicable to their project. Project reviewers will also use this checklist to assess the project's compliance with the requirements of the BDP Guidebook. Sections II through V discuss best development practices related to **stormwater management**, **erosion and sedimentation control**, **landscape design**, and **site planning**. These four sections describe the best development practices that are applicable in different situations and some technical details of the practices. References are provided for those who seek more information and design specifications for the various practices.

Thank you for taking the time to read this Guidebook. With your participation, the Town of Franklin will become a model for attractive and environmentally responsible community development.

I. Checklist for Designers

The Checklist for Designers is a summary of the best development practices that this Guidebook requires or recommends, and when they should be used. Prior to submitting an application for review, the applicant shall fill out this checklist to verify that he or she has complied with Franklin's policies and planned the development or redevelopment site in a way that furthers the goals discussed below. The checklist shall then be submitted with the application. The Planning Board and/or ZBA and their technical consultants will use the checklist to evaluate whether the application complies with this Guidebook.

Stormwater Management

GOALS and NEEDS addressed:

1. Protect local and regional wetlands and water bodies
2. Maximize groundwater recharge to retain a viable local groundwater supply
3. Ensure that Franklin complies with the EPA Stormwater Phase II Requirements

FRANKLIN POLICIES:

(A) All new development projects in Franklin shall meet the following three stormwater management performance standards. All redevelopment projects shall meet the standards to the maximum feasible extent, and, if they fail to meet the standards, shall retrofit or expand existing stormwater management systems to improve existing conditions.

1. Post-development peak discharge rates from the site shall not exceed pre-development peak discharge rates from the site.
2. Annual groundwater recharge from the post-development site shall approximate annual recharge from the pre-development site.
3. The stormwater management system shall remove at least 80% of the average annual load of total suspended solids (TSS) from the post-development stormwater created on developed site.

(B) Non-structural stormwater management systems should be used wherever site conditions allow, as outlined in the Guidebook. Drain pipe/catch basin systems may be used, in part or in whole, only if the applicant can demonstrate that other systems are not feasible due to site conditions.

BEST DEVELOPMENT PRACTICES One or more of the following must be used to meet the above policies.	Incorporated into Project?
Vegetated swales *(recommended to collect runoff from roadways & parking lots)*	❑
Vegetated filter strips *(recommended to filter and infiltrate runoff from roadways, parking lots, and driveways; use with (a) along roadsides and parking lots)*	❑
Constructed wetlands *(preferred method for stormwater retention & pollutant removal)*	❑
Bioretention cells *(recommended on residential lots and parking lot islands)*	❑
Pervious paving surfaces *(recommended in overflow parking and low-traffic areas)*	❑
Roof gardens *(encouraged on flat commercial and industrial rooftops)*	❑
Retention basins *(less preferred method for stormwater retention & pollutant removal)*	❑
Detention basins *(may be used in series with other practices, such as constructed wetlands, to provide pre-treatment)*	❑
Drain pipe/catch basin systems *(discouraged, unless other stormwater collection and conveyance systems have been demonstrated not to be feasible due to site conditions)*	❑
Have you documented that other systems are infeasible?	❑

Erosion and Sedimentation Control

GOALS and NEEDS addressed:

1. Minimize erosion
2. Prevent sedimentation of water bodies and its attendant environmental impacts

FRANKLIN POLICIES:

(A) Any proposed project on a previously undeveloped site shall accommodate the development program in a way that minimizes clearing and regrading, especially in areas of steep slopes, erosion-prone soils, or sensitive vegetation. For redevelopment projects, the site plan shall concentrate development in previously-disturbed areas to the extent possible.

(B) As a condition of approval, every proposed project shall submit and adhere to a construction management plan that addresses soil stabilization, sediment retention, perimeter protection, construction scheduling, traffic area stabilization and dust control.

BEST DEVELOPMENT PRACTICES The applicant must comply with all of the following requirements.	Incorporated into Project?
Clearing and regrading have been minimized	❑
Development is focused in previously disturbed areas *(for redevelopment projects)*	❑
A construction management plan has been prepared	❑
The construction management plan addresses:	
Soil stabilization *(cover or stabilize erodible surfaces not in immediate use)*	❑
Sediment retention *(runoff interceptors and sediment traps/ponds)*	❑
Perimeter protection *(vegetated buffers or silt fences at the limit of work)*	❑
Construction scheduling *(minimize disturbed area at any given time)*	❑
Traffic area stabilization *(crushed rock or similar at construction vehicle entrance and parking areas)*	❑
Dust control *(plan for stabilizing dusty surfaces when necessary)*	

Landscape Design

GOALS and NEEDS addressed:

1. Minimize demand for irrigation water
2. Maximize groundwater recharge from landscaped areas
3. Preserve native biodiversity by retaining habitat and defending against invasive species
4. Maximize the value to wildlife of human-managed landscapes

FRANKLIN POLICIES:

(A) Site plans and landscape plans for all proposed projects shall take appropriate steps, as outlined in the Guidebook, to minimize water use for irrigation and to allow for natural recharge of groundwater.

(B) Landscape plans shall follow the guidelines in the Guidebook for selecting species that are most appropriate to the site conditions. Native species and habitat-creating species shall be used in all landscape plans to the maximum extent possible while still meeting the site's landscaping needs. Invasive species identified in this Guidebook may not be planted in Franklin under any condition.

BEST DEVELOPMENT PRACTICES The applicant must comply with all of the following requirements.	Incorporated into Project?
Clearing and regrading have been minimized *(natural vegetation must be retained to the maximum extent possible, given the development program)*	❑
Irrigation, if present, is water efficient *(if an in-ground irrigation systems is proposed, it is a water efficient system with automatic sensors to prevent overwatering)*	❑
Landscaped areas retain water *(gardens are mulched and designed for water infiltration)*	❑
No invasive species are used *(species from the invasive species list may not be used)*	❑
Native and habitat-creating species are used *(species from these lists have been incorporated into the landscape design whenever possible)*	❑
Species are appropriate to the soil, site, and microclimate conditions *(select appropriate species from the lists of salt-tolerant, urban-tolerant, wetland, moist-tolerant and drought-tolerant species)*	❑

Site Planning

GOALS and NEEDS addressed:

1. Protect Franklin's natural environment, including habitat, water resources, and ecosystem services
2. Create a visually appealing community
3. Preserve the Town's historic and cultural heritage
4. Stabilize and increase property values
5. Encourage sustainable development

FRANKLIN POLICY:
Subdivision plans and site plans for all forms of development shall adhere to the principles of *environmental compatibility*, *aesthetic compatibility*, and *energy-efficient design*.

BEST DEVELOPMENT PRACTICES The site plan must address all of the following principles.	Incorporated into Project?
Unique natural features have been preserved *(the development program should avoid or else showcase significant natural features)*	❑
Historic and cultural resources have been preserved *(the development program should avoid or else showcase significant historic and cultural features)*	❑
Clearing, grading, and building placement consider viewsheds	❑
Cut and fill have been minimized	❑
Buildings blend into the natural topography	❑
Buildings are oriented to the sun and wind for maximum energy efficiency	
Vegetated protection from northwest (winter) winds is provided	❑
Deciduous species planted or retained close to the E, S and W building edges	❑

II. Stormwater Management

a. Overview and Policies

The need for a strong and innovative stormwater management policy is based on Franklin's attempt to address several challenges:

- Franklin has numerous wetlands and water bodies, and is at the headwaters of the Charles River, all of which are affected by polluted runoff.
- The Town relies on local groundwater aquifers for its public water supply; with Franklin facing seasonal water shortages, groundwater recharge is an essential function.
- The U.S. Environmental Protection Agency (EPA) has recently promulgated the so-called "Stormwater Phase II Requirements," which require communities like Franklin to manage polluted runoff effectively.[1] (Notes and references are provided in the endnotes.)

In order to ensure a minimum level of stormwater management for development and redevelopment projects, Franklin has adopted the following stormwater management performance standards.[2] The adoption of performance standards allows the design engineer to select one or more stormwater management systems that are most appropriate and cost-effective for the particular site.

FRANKLIN POLICY: All new development projects in Franklin must meet the following three stormwater management performance standards. All redevelopment projects shall meet the standards and if they fail to meet the standards, shall retrofit or expand existing stormwater management systems to improve existing conditions.

1. Post-development peak discharge rates from the site shall not exceed pre-development peak discharge rates from the site.
2. Annual groundwater recharge from the post-development site shall approximate annual recharge from the pre-development site.
3. The stormwater management system shall remove at least 80% of the average annual load of total suspended solids (TSS) from the post-development stormwater created on developed site.

There is a growing realization among water resource professionals that conventional systems of stormwater collection, conveyance, and end-of-the-pipe dry-basin detention are no longer sufficient to improve the water quality of surface water bodies. Therefore, the Town's general preference is that stormwater be conveyed and treated in natural and vegetated systems such as vegetated swales, filter strips, constructed wetlands, and bioretention cells. While some of these practices may be new to the Town of Franklin, they have been used successfully in other towns and states and have gained support from the EPA because of their generally superior performance

FRANKLIN POLICY: Non-structural stormwater management systems should be used wherever site conditions allow, as outlined in the Guidebook. Drain pipe/catch basin systems may be used, in part or in whole, only if the applicant can demonstrate that other systems are not feasible due to site conditions.

in attenuating peak runoff rates, filtering pollutants, recharging groundwater, and allowing retention of the natural landscape. Recognizing that non-structural systems are not appropriate in all situations, the Guidebook also discusses other practices that will be permissible in certain situations.

This section of the Guidebook discusses nine stormwater management practices that can be used, alone or in combination, to meet the performance standards. Other systems not discussed in this guidebook may also be acceptable if the applicant can demonstrate their fulfillment of the above standards. Table 2-1 provides a summary of the practices discussed in this chapter and when each practice is encouraged or allowed.

Table 2-1: Use of Stormwater Management Practices in Franklin

Practice	Franklin's Policy	Appropriate Uses
Vegetated Swales	Strongly encouraged	Roadsides, parking lots
Vegetated Filter Strips	Strongly encouraged	Roadsides, residential frontage areas, parking lots, perimeter protection
Constructed Wetlands	Strongly encouraged	Commercial and industrial sites, office campuses, subdivisions
Bioretention Cells (Rain Gardens)	Strongly encouraged	Residential lots, parking lot islands
Pervious Paving Surfaces	Encouraged	Parking overflow areas
Roof Gardens	Encouraged	Office/industrial buildings
Retention Basins	Neutral	Subdivisions, office developments
Detention Basins	Allowed in combination with other practices	All areas of development, if necessary
Drain Pipe/Catch Basin System	Allowed when other systems are not practical due to site constraints	All areas of development, if necessary

There are several factors to consider when deciding on which practice(s) to implement in any given project. Among these factors are the space required, soils and slopes on site, depth to the water table, maintenance requirements, pollutant removal efficiencies, cost, and ability to meet Franklin's stormwater performance standards.

b. Summary of Practices

Table 2-2 provides a summary of design and site considerations for the various stormwater management systems.

Table 2-2: Design and Site Considerations for Stormwater Practices[3]

	Vegetated Swales	Vegetated Filter Strips	Constructed Wetlands	Bioretention Cells	Pervious Paving	Retention Basins	Detention Basins	Catch Basins
Space Required	Bottom width: 2 ft. min. 6 ft. max.	Recommended minimum width: 10-20 ft.	5% of drainage area	Min width: 5-10 ft Min length: 10-20 ft Min. depth: 2-4 ft	Not a factor	Min. pool surface: 0.25 acres recom'd	1 acre foot per 4 acres drainage area	Not a factor
Soils	Permeable soils perform better, but wet swales can be used in less permeable soils	Permeable soils perform better, but soils are not a limitation	Soils are not a limitation	Permeable soils recom'd (infilt. rates >0.27 in/hr). Underdrains allow for less permeable soils.	Permeable soils perform better	Not a factor	Not a factor	Not a factor
Slope of Catchment Area	A design consideration, but usually not a limitation	A design consideration, but usually not a limitation	Max. 15% for forested; 5% for shrubs/ herbs	A design consideration, but usually not a limitation	Usually not a limitation	Maximum 15%	Maximum 15%	Not a factor
Water Table and Bedrock	Generally not a constraint	Generally not a constraint	Water table should be at or near soil surface, or else a liner can be used	2-4 ft above water table/bedrock recommended	2-5 ft above water table/ bedrock recom'd	Not a factor	Generally not a constraint	Not a factor
Proximity to Building Foundations	Min. 10 ft. down-gradient from buildings & foundations recom'd	Min. 10 ft. downgradient from buildings & foundations recom'd	Min. distance 10 ft.	Min. 10 ft. downgradient from buildings & foundations recom'd	Not a factor	Min. distance of 10 ft	Min. distance of 10 ft.	Not a factor
Max. Depth	N/A	N/A	4-6 ft.	2-4 ft., depending on soil type	N/A	3-6 ft.	3-12 ft.	N/A
Maintenance Requirement	Low: routine landscape maint.	Low: routine landscape maint.	Moderate; depends on sediment'n rate	Low: property owner can include in normal site landscape maint.	Low: routine landscape maint.	Moderate; depends on sediment'n rate	Moderate: routine sediment removal	Moderate: routine sediment removal

Table 2-3 should be used in determining compliance with Franklin's 80% TSS removal standard. TSS removal efficiency for each of the various stormwater management systems shall be presumed to be the value shown in Table 2-3 unless the applicant can provide additional satisfactory information or documentation that the system has a greater TSS removal efficiency. Other systems not discussed in this Guidebook may also be acceptable if the applicant can demonstrate their fulfillment of the Franklin stormwater management performance standards.

If more than one practice is used to achieve the required 80% TSS removal, the removal efficiency rates must be multiplied together, not added. For example, if the first practice has a 60% TSS removal rate and the second practice has a 20% removal rate, a total of only 68% of TSS would be removed. (60% of the total, plus 20% of the remaining 40% of TSS.)

Table 2-3: TSS Removal Rates for Stormwater Management Practices[4]

Practice	**Design Rate for TSS Removal** (use this number to calculate compliance with the 80% TSS removal requirement)	**Range of Average TSS Removal Rates**
Vegetated swale	70%	60-80%
Vegetated filter strip	30% per 10' of width[a]	30-65%, depending on width
Constructed wetland[b]	80%	65-80%
Bioretention cell	80%[c]	65-80%
Retention basin[b]	70%	60-80%
Detention basin[d]	60%	60-80%
Deep sump and hooded catch basin	25%	25% w/cleanout

[a] For widths greater than 10', TSS removal is determined multiplicatively. For example, for a 30' wide strip, the TSS removal rate would be (1- (0.7*0.7*0.7)) = 66%.

[b] Must have sediment a forebay or pre-treatment.

[c] If an underdrain is used, the water must be conveyed to a secondary treatment device such as a constructed wetland or a retention basin.

[d] Post-treatment is required (e.g., by a constructed wetland or retention basin).

c. Discussion of Practices

Each of the nine stormwater management practices is discussed in more detail below. References in the endnotes provide additional information on the use, design, and construction of these practices.

1. Vegetated Swales

Swales are earthen channels most commonly covered with a dense growth of grass or other vegetation, and are designed primarily to control water quantity and quality.[5] The design of vegetated swales has improved over the years, enabling engineers and hydrologists to implement them for a variety of different purposes. Depending on hydrological conditions and design, swales can be dry, wet, or grassed:

- **Dry swales** are channels filled with approximately 30 inches of soil (50% sand and 50% loam) that allows full infiltration of the stormwater.
- **Wet swales** are generally used when the water table is at or near the soil surface or when soils are poorly drained. Theses swales have a ponding area that should be planted with moist-tolerant species to enhance nutrient uptake and sediment retention.
- **Grassed swales** are planted with grass species that provide a dense cover and serve to provide sediment retention, nutrient uptake and filtration. They are suitable for sandy loam soils. Pollutants are removed from stormwater by the filtering action of the grass, sediment deposition, and/or infiltration into the soil. Grass swales are designed to remain dry most of the time and are specifically planted with species to enhance nutrient uptake and filtration.

Figure 2-1: A grass swale surrounding a parking lot

Design Considerations

Swales are easily implemented on large lot residential sites (½ to 1 acre or larger), office and industrial campuses, roadways where right-of-way widths are adequate, and parking lot medians and edges (see photo at left). Ideally, stormwater should flow from the impervious surface through a vegetated filter strip before entering the swales (see Figure 2-2). Typically, dry and grass swales are used for low density residential projects or very small impervious areas and require soils that have infiltration rates of 0.27-0.50 inches per hour. Wet swales, on the other hand, are convenient for treating highway runoff in low lying or flat terrain areas and need to be planted with water tolerant vegetation.

Swales should be built at a gentle slope so that water flows at a relatively low velocity. The minimum allowable slope is ½%, while the maximum slope is based on velocity. Water velocity in the swale should generally not exceed 3 feet per second, which typically corresponds to a

maximum slope of about 5%. If necessary, the swale may be steeper in places, provided that riprap or other stabilization is used to prevent scouring and erosion within the swale. The side slopes should be at a maximum of 3:1, and the length of the swale should be calculated to accommodate the entire calculated runoff volume from a 10-year storm. Regular maintenance such as mowing, sodding, and repair of eroded areas is necessary for swales. In addition, the accumulated sediment may need to be periodically removed, particularly during the construction and early site stabilization periods.

2. Vegetated Filter Strips

Filter strips are typically bands of close-growing vegetation, placed between pollutant source areas and the receiving water body (either a natural water body or a constructed swale). To protect natural water bodies (e.g., streams or wetlands), filter strips should consist of natural buffer strips already existing on the site. Not only do filter strips protect sensitive areas such as wetlands, woodlands and erodible soils; they also reduce runoff impacts by trapping sediment and sediment-bound pollutants, provide some infiltration, and slow and disperse stormwater flow over a wide area.[6] Figure 2-2 illustrates some of the biochemical processes by which filter strips remove pollutants.[7]

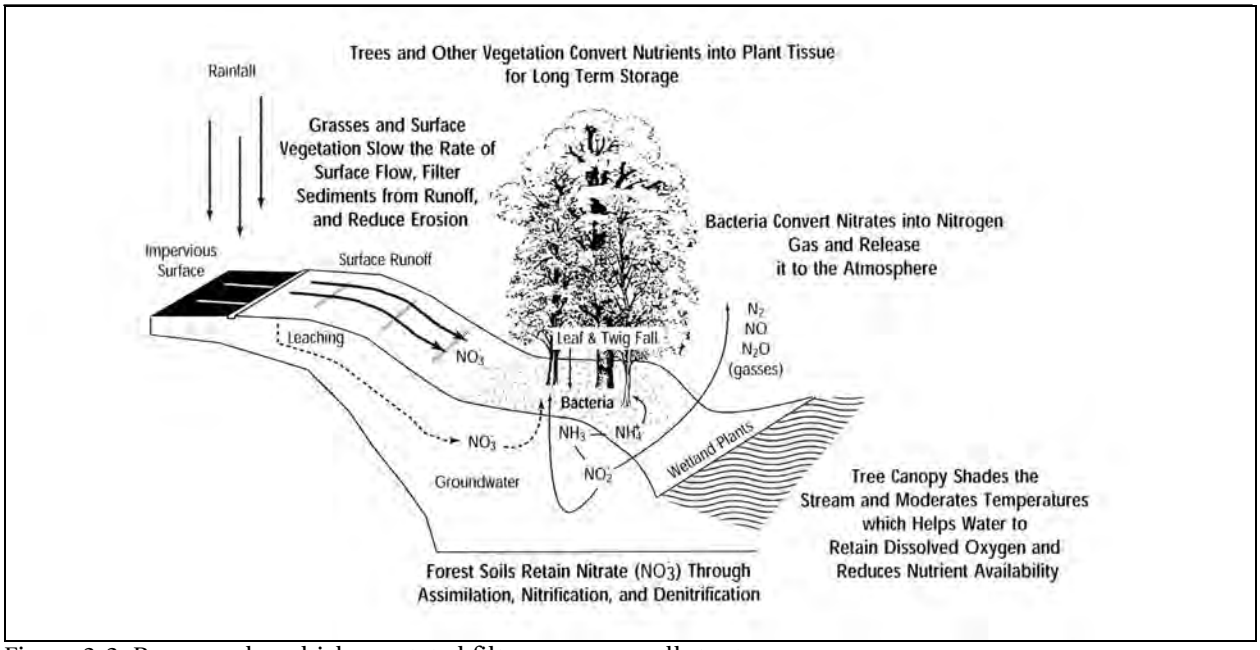


Figure 2-2: Processes by which vegetated filters remove pollutants

Design Considerations

Treatment of stormwater in filter strips is accomplished physically by a combination of filtration through the standing vegetation and infiltration into the underlying soils. In order to treat stormwater effectively, filter strips must be designed to function as overland flow systems where stormwater is evenly distributed. Because there is a high potential for short-circuiting of the filter strips and reduced pollutant removal, grading must be designed carefully to provide uniform flow into the filter strips.

If filter strips are wide enough and planted with appropriate plant species, they will provide wildlife habitat as well as visual amenities in the landscape. It is important to note that filter strips are usually implemented in combination with other stormwater management facilities that specifically control stormwater volume. Finally, for a filter strip to be efficient, a minimum width of 10-20 feet is recommended. Upkeep of filter strips should be incorporated into routine landscape maintenance, which would include raking the filter strip, removing large trash or debris that has accumulated, and regularly cleaning up sediment.

3. Constructed Wetlands

Constructed wetlands (or stormwater wetlands) are shallow pools that create growing conditions suitable for marsh plants. These systems are designed to maximize pollutant removal through retention, settling, and uptake by wetland plants.[8] Stormwater wetlands serve several benefits simultaneously. The primary purpose of constructed wetlands is to improve water quality by removing sediment and pollutants. However, these wetlands can also provide excellent habitat for wildlife and waterfowl. In general, a constructed wetland would be a suitable stormwater management practice for residential subdivisions and commercial developments.

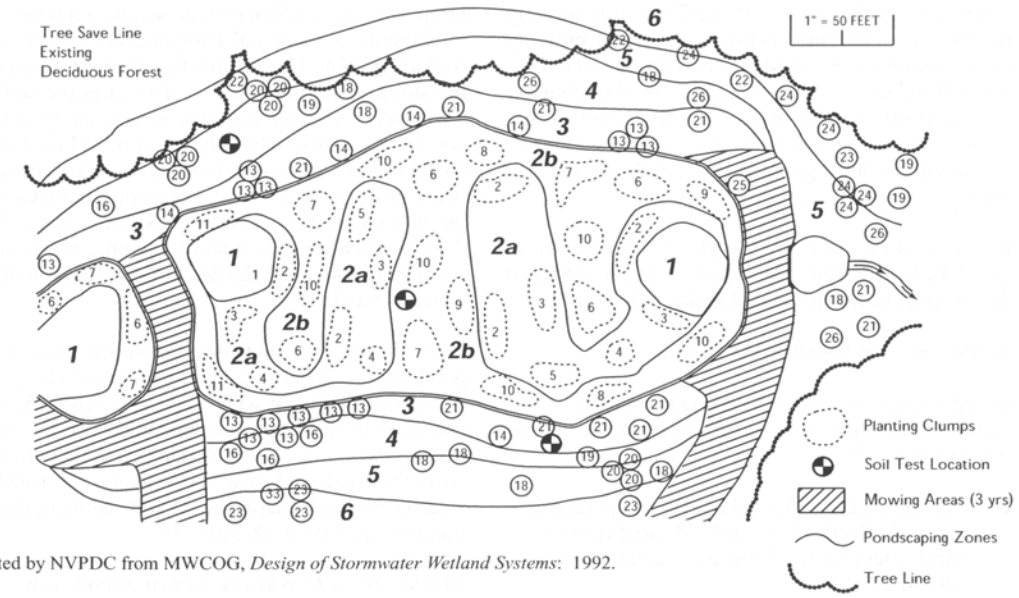
Figure 2-3: A constructed wetland

Design Considerations

Constructed wetlands must be designed with consideration to the size of the contributing watershed area, amount of baseflow, soil type, and available space. The contributing watershed may be as small as 5 acres; however, the smaller the watershed area, the more difficult it is to create sufficient drainage and runoff to keep the wetland perpetually wet. Since wetlands need to maintain soil moisture throughout the year, it is important to have a dry-weather baseflow or a groundwater supply. The preferred soil types for constructed wetlands are less-permeable soils that have relatively small pores and are less prone to evaporation.

The surface area of constructed wetlands should be at least 1% of the contributing drainage area, and the wetlands should have a length to width ratio of at least 1.5:1.[9] In order to increase the efficiency of the retention pond, a sediment forebay must be incorporated as a pretreatment device.

As with all other stormwater management practices, stormwater wetlands also require ongoing maintenance to retain their maximum effectiveness. However, several design features can decrease the amount of maintenance that a wetland needs. For example, a reverse-slope pipe or a weir outlet with a trash rack should be used to prevent clogging of the outlet; orifices should have diameters no less than 3″; and direct maintenance access should be provided to the forebay to allow for sediment removal. Selection of plant species is one of the most important parts of creating a stormwater wetland, as the plants are largely responsible for the pollutant and sediment retention and uptake. Please refer to Figure 2-4[10] for a sample wetland vegetation layout and **Section III** for a list of plant species suitable for planting in constructed wetlands.



Adapted by NVPDC from MWCOG, *Design of Stormwater Wetland Systems*: 1992.

PLANT MATERIALS (By Pondscaping Zone)

KEY SPECIES		QTY	SIZE
Zone 1: Deep Pool			
1	Wild Celery	25	Tubers, cheesecloth sinkers
Zone 2a: Low Marsh			
2	Duck Potato	375	(All) Containers
3	Pickerelweed	300	or peat pot 18" o.c.
4	Arrow Arum	275	
5	Wild Rice	150	
Zone 2b: High Marsh			
6	Common 3-Square	500	(All) Containers
7	Softstem Bulrush	500	or peatpot 18" o.c.
8	Lizards Tail	150	
9	Sweet Flag	150	
10	Rice Cutgrass	150	
11	Sedge spp.	150	
Zone 3: Shoreline			
12	Switchgrass over Red Fescue		
13	Button Bush	8	Container
14	River Birch	6	Container
21	Black Willow	12	1" caliper container
Zone 4: Riparian			
15	Tall Fescue, wildlife mix	100	lbs/ac Hydroseed
13	Button Bush	4	Container
16	Green Ash	4	2" B&B
17	Arrowood Viburnum	24	Container on embankments
18	Silky Dogwood	4	2" B&B
19	Sycamore	4	2" B&B

KEY SPECIES		QTY	SIZE
Zone 5: Floodplain			
15	Tall Fescue	100	lbs/ac Hydroseed
18	Silky Dogwood	4	2" B&B
26	Tulip Poplar	4	2" B&B
20	Elder Berry	9	Container
21	Black Willow	12	1" B&B
22	Shad Bush	4	1" B&B
Zone 6: Upland			
23	Willow Oak	6	2" B&B
24	Spice Bush	3	Container
19	Tulip Poplar	4	2" B&B
18	Silky Dogwood	2	2" B&B
Embankment			
23	Periwinkle	48	Container

PONDSCAPING NOTES

1. No trees in embankment or along mowed maintenance access area.
2. Tree-save line denotes limit of disturbance during wetland excavation.
3. Pondscaping zones and marsh planting zones to be confined in field after excavation.
4. Existing topsoil to be stockpiled and used to dress pondscaping zones 4,5, and 6.
5. Reinforcement planting after first growing season based on field inspection of marsh plan survival/colonization rates.
6. Three soil pit tests taken to confirm general soil properties.
7. Switchgrass overseeded on Red Fescue in Pondscaping Zone 3, Tall Fescue and Wildlife grass mix used in Zones 4,5, and 6 within three days of final grading for erosion control.
8. Six inches of wood mulch around all trees and shrubs (excluding trunk line), planting holes to be three times rootball diameter.

Figure 2-4: Sample wetland vegetation layout

4. Bioretention Cells (Rain Gardens)

Bioretention cells (otherwise known as rain gardens) are landscaped areas that mimic upland vegetation systems. These systems are designed to trap stormwater, infiltrate it, and treat it by means of vegetational uptake (uptake of certain minerals and nutrients by vegetation), biological degradation (microbial/bacterial metabolic activities), and/or gravitational sediment removal.

Runoff is conveyed as sheet flow to the treatment area, which consists of a grass buffer strip, sand bed, ponding area, organic layer or mulch layer, planting soil, and plants (see Figure 2-7[11]). Runoff passes first over or through a sand bed, which slows the runoff and distributes it evenly along the ponding area. The ponding area is made up of a surface organic layer, ground cover and the underlying planting soil. The ponding area is graded such that there is a depression in the middle where water remains until it infiltrates or evaporates. The depression should be designed to hold up to 6 inches of water.[12] An overflow structure should be provided for situations where the ponding area is not sufficient. As shown in Figure 2-7, the infiltrated water may also be collected through an underdrain and outlet, which would drain water to a constructed wetland or retention pond for further treatment.

Figure 2-5: A bioretention cell on a residential lot

Bioretention cells can be used in both residential and commercial projects. In residential subdivisions, bioretention cells are used to retain and infiltrate stormwater locally so that it does not need to be conveyed and treated by means of a more extensive stormwater management system. Each residential lot would typically have one or more bioretention cells (which are essentially landscaped gardens) that receive stormwater from the roof and driveway and infiltrate it to the ground. Each homeowner is responsible for maintaining the bioretention cell(s) on their property, just as they would maintain their garden.

In commercial projects, bioretention cells are installed as depressed islands in the parking lot. Stormwater is directed to these islands, where it is treated and infiltrates into the ground.

Figure 2-6: Bioretention cell in a parking lot

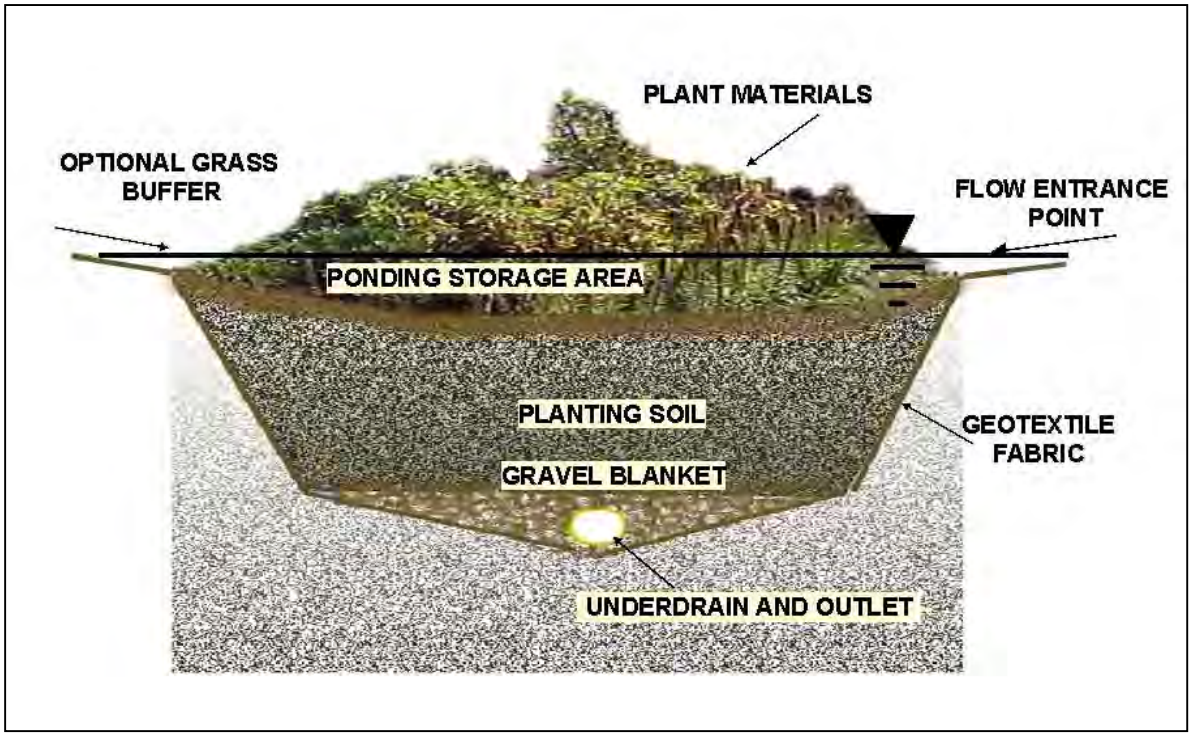


Figure 2-7: Bioretention cell

Design Considerations

The design of bioretention cells must consider the site area, slope, soils, groundwater, and maintenance needs. Figure 2-8[13] illustrates a typical bioretention cell installation. Bioretention cells should be designed to occupy 5 to 7 percent of the drainage area multiplied by the rational method runoff coefficient ("c") determined for the site.[14] Recommended minimum dimensions are 15 feet by 40 feet for bioretention cells receiving parking lot runoff. Bioretention cells on individual house lots can be much smaller.

The site should have shallow slopes (approximately 5% or less) so that water flow is guaranteed but velocity is not too high. An underdrain should be used in situations where soils are tight and there is a concern about the cell backing up or flooding. (In areas of less pervious soils, bioretention cells may be constructed by importing more permeable soils for the cell itself, in combination with an underdrain which prevents water from ponding above a less permeable natural soil layer.) An underdrain should also be used where the water table is close to the surface and there is a concern about groundwater pollution. In other situations, an underdrain generally is not needed.

Bioretention cells need to be maintained regularly to ensure the presence of mulch and good soil, attend to any diseased or dead plants, and remove collected sediment, litter and debris.

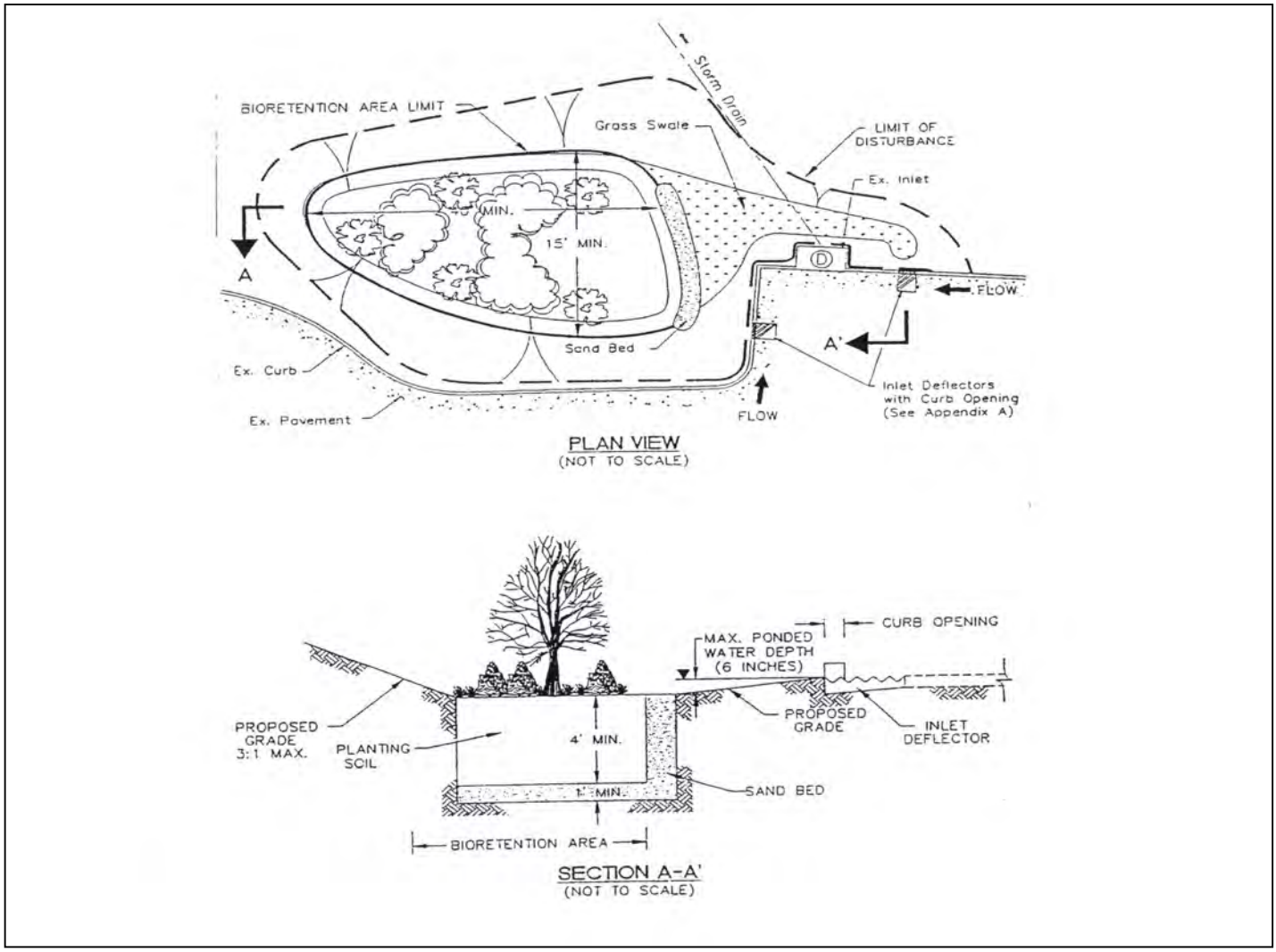


Figure 2-8: Typical design layout of a bioretention cell.

5. Pervious Paving Surfaces

Pervious paving surfaces typically consist of a permeable surface with an underlying crushed/broken stone reservoir to temporarily store runoff before it infiltrates into the ground. The main purposes of this application are to reduce the amount of stormwater runoff from paved areas and to infiltrate stormwater into the underlying soils. By reducing the amount of stormwater runoff, pervious paving surfaces reduce the cost of stormwater management.

Pervious paving surfaces that are now available include porous asphalt, pervious concrete and grass pavers. Porous asphalt and pervious concrete appear to be the same as traditional pavement from the surface, but incorporate void spaces to allow infiltration. These systems have been applied successfully in a few locations in New England where soils consist of particularly well-drained sands and gravels that allow the pores to drain rapidly. However, in areas of tighter soils, porous asphalt and pervious concrete are generally not recommended in this region because water remaining in the void areas is subject to the freeze-thaw cycle which stresses and weakens the pavement.

Figure 2-9: Grass pavers

Grass pavers, shown in Figure 2-9, are a viable option in New England's climate.[15] Grass pavers consist of concrete interlocking blocks or a synthetic fibrous gridded system with open areas designed to allow grass to grow. The design should allow for infiltration into the underlying soils so that stormwater does not pond near the surface.

Design Considerations

Grass pavers are most suitable for low-traffic areas such as the overflow areas of commercial or office parking lots, residential driveways, and service areas that will be subject to light traffic. Franklin recommends their use in these situations. If these systems are used, stormwater calculations should account for the reduced amount of runoff generated by areas with grass pavers. In general, grass paver systems should not be salted in the winter because this will threaten the viability of the plants. However, salting will not typically be required in the low-traffic areas where grass pavers are recommended.

6. Roof Gardens

Roof gardens are precultivated vegetation mats placed on several layers including a fertilizer layer, a substrate mat, a protective fleece and an impervious membrane. Roof gardens provide several functional benefits such as reducing stormwater runoff volume and pollutant load, increasing the energy efficiency of buildings, improving air quality by removing particles in the air and by photosynthesis, and increasing the aesthetic value of the area. Roof gardens can be built on almost any rooftop, from a residential building to a commercial or industrial building. Figure 2-10 shows a typical application.[16] The Town of Franklin recommends that roof gardens be used in large commercial, office, and institutional buildings that have flat roofs.

Figure 2-10: A roof garden in Stuttgart, Germany

Once established, roof gardens do not need extensive maintenance other than occasional fertilization and weeding. During the initial stage some watering might be required; however, usually within six months the plants are able to sustain themselves.

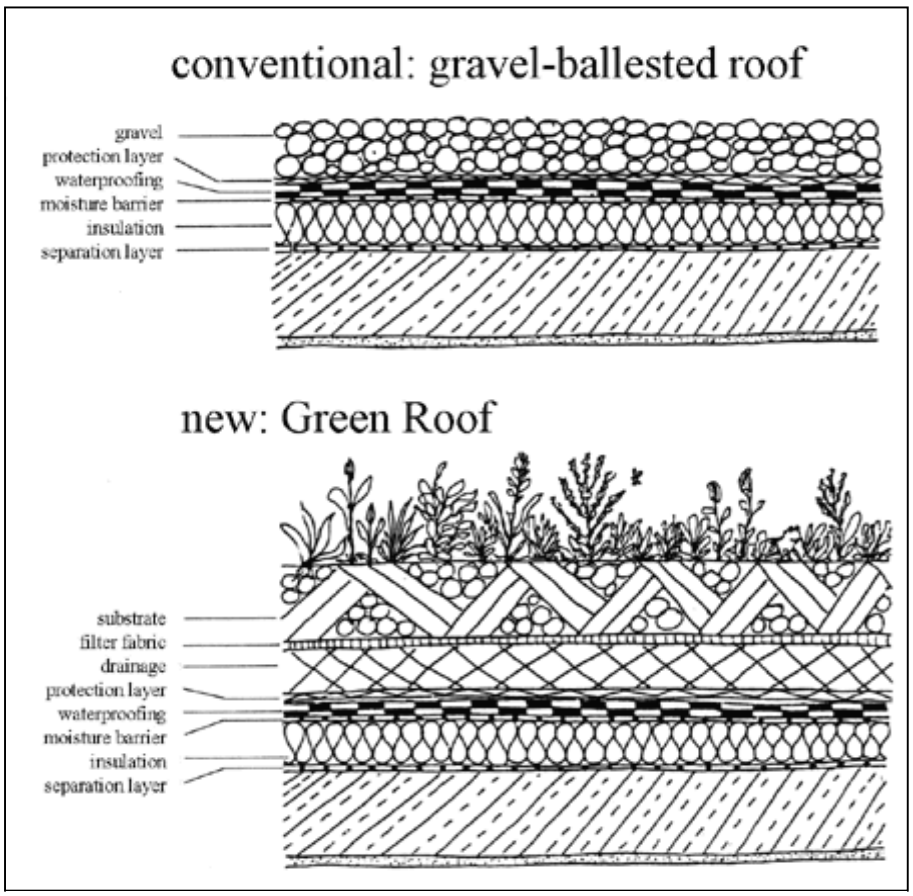


Figure 2-11: Typical roof garden design

Since the soil layer is not deep, it will not support tall vertical growth or large plants; therefore, cutting or mowing is not required. Load reserves of at least 15 pounds per square feet beyond snow load requirements are needed to install a roof garden.[17] If properly built over a suitable roofing membrane, roof gardens do not present a leaking problem.

7. Retention Basins

Retention basins are constructed to have a permanent pool of water to treat stormwater. The pool allows settling of sediments, removal of soluble pollutants by algal uptake, and some groundwater recharge as shown in Figure 2-12[18]. The basins are designed to include additional storage capacity to control peak discharge rates. The primary component of a retention basin is a deep, permanent pool, but the basin may also include a shallow marsh or a sediment forebay to increase sediment and nutrient removal.[19] In general, the Town of Franklin does not recommend that retention basins be used as the primary means of attenuating peak runoff rates or removing pollutants. Constructed wetlands are generally a preferred system since they have greater pollutant uptake functions. However, retention basins may be used in subdivisions as well as commercial and industrial areas when other stormwater management systems are not feasible or sufficient because of site conditions or the nature of the development program. Retention basins may also be used in series with constructed wetlands as a sediment trap, particularly during construction.

Figure 2-12: Retention basin

Design Considerations

Retention basins must drain a sufficiently large area to maintain a permanent pool of water. The minimum recommended area is typically around 10 acres, assuming impervious surface percentages typical of suburban developments.[20] Within the watershed area that drains to the retention basin, the slopes and the stormwater conveyance system must result in a metered flow of stormwater that does not flood the basin all at once. The use of filter strips and swales can help slow and infiltrate water on its way to the basin.

Retention basins can be constructed in a wide range of soil types. However, when native soils have a rapid percolation rate, soils should be compacted or supplemented sufficiently so that the pond does not dry up during the dry season. The soils should retain sufficient infiltration potential so that the pond also continues to play a role in groundwater recharge. In order to increase the efficiency of the retention basin, a sediment forebay must be incorporated as a pretreatment device. As with constructed wetlands, retention basins should use non-clogging outlets and large orifices (not less than 3 inches in diameter), and should provide easy dredging access to reduce long-term maintenance requirements and difficulties.

8. Detention Basins

Detention basins are depressed areas whose outlets have been designed to detain stormwater runoff for some minimum time to allow particles and associated pollutants to settle. Since the aim of detention basins is mainly to control flooding and remove sediments, they do need not to have a permanent pool and therefore can be dry during non-flood conditions. Typically, they are used in conjunction with other stormwater management systems such as retention basins or constructed wetlands as a primary treatment.

The Town of Franklin discourages the use of detention basins as the primary means of flood control. Instead, vegetated swales and filter strips should be used whenever possible to attenuate peak runoff rates. When site characteristics do not allow use of such practices, however, detention basins may be considered as part of the stormwater management system. In addition, detention basins may be used as a pre-treatment device to settle out particulates prior to discharge to a constructed wetland or retention basin, where additional treatment and infiltration will occur.

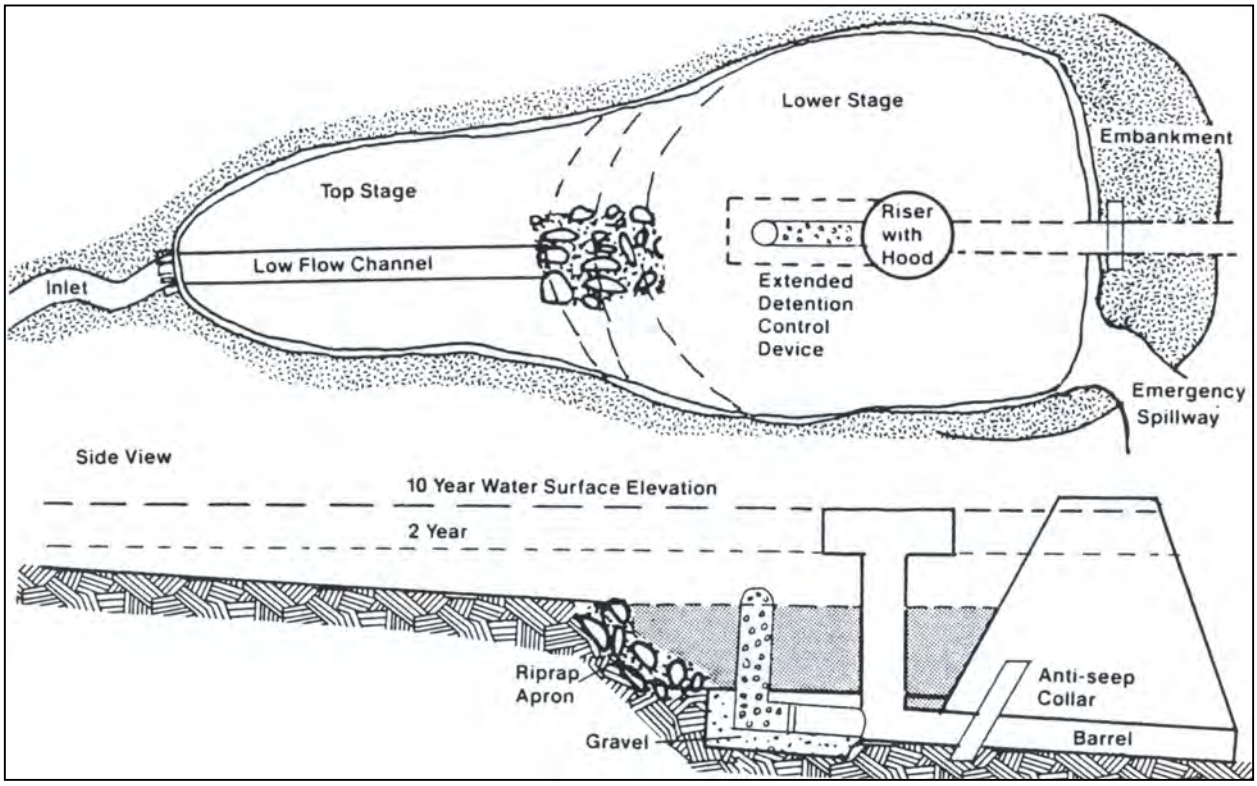


Figure 2-13: Schematic design of a dry extended detention pond

Design Considerations

Detention basins are most practical for use on sites that are at least 10 acres, which allows for the use of larger outlet orifices that are less likely to clog. Detention basins can be used on sites with a slope of up to about 15 percent. There is no minimum slope requirement, provided that there is enough change in elevation to ensure flow. Soil type is not a factor except in areas with rapidly percolating soils such as sand. In these areas, an impermeable liner should be used to prevent groundwater contamination from untreated runoff. Detention basins should be designed with sediment forebays, which allows sediment to be trapped prior to entering the detention basin. This feature also reduces maintenance requirements for the detention basin. As with constructed

wetlands, detention basins should use non-clogging outlets and large orifices (not less than 3 inches in diameter), and should provide easy dredging access to reduce long-term maintenance requirements and difficulties.

Any detention basin in the Town of Franklin must provide landscaping and planting to minimize its visual impacts. The plants selected for the ponding area should be able to withstand both wet and dry periods. Along the perimeter of the basin, however, the plants should be adapted to dry conditions and should create a visual vegetated buffer.

9. Catch Basins and Drain Pipes

Catch basins are storm drains that capture and roughly filter stormwater through a grate or curb inlet and capture sediment, debris and associated pollutants in a deep sump (Figure 2-14[21]). In most cases a hood is also included to separate oil and grease from the stormwater. The essential function of a catch basin is to act as a pretreatment device for other structures incorporated into a storm sewer system. The performance of a catch basin in removing sediment and pollutants will depend greatly on the size of the drainage area, the size of the sump, and the amount of maintenance it receives. Although catch basins are currently used in virtually all circumstances, they typically cannot remove pollutants as well as most of the other practices mentioned in this section and require frequent maintenance. Catch basins should only be used when the other practices mentioned in this section prove unfeasible. The designer must document the reason(s) why the other practices are not feasible before the use of catch basins may be approved.

Figure 2-14: A catch basin inlet

When catch basins are used, the Town will consider it preferable if they discharge individually or in pairs to nearby swales, constructed wetlands, or bioretention cells, rather than carrying runoff further to a larger retention/infiltration system. Lengthy catch basin-piped drain-manhole networks are discouraged. In general, the goal is to use vegetated, low-velocity channels to hold and infiltrate stormwater locally, not to efficiently capture and deliver stormwater to watercourses.

Design Considerations

Catch basins should be designed to hold a combined volume of at least 400 cubic feet per acre of contributing impervious area and have sumps that are at least four feet deep. The grates and inlets should be sized and constructed to pass the 10-year storm volume into the deep sump. Flow from the catch basin/drain pipe system should be directed to another stormwater management device, such as a constructed wetland, for further treatment. Catch basin inlets should be cleaned regularly (at least twice a year) and after large storms. Removed sediment should be disposed of in accordance with applicable local, state and federal guidelines and regulations.

III. Erosion and Sedimentation Control

Erosion and sedimentation control practices should be incorporated into the planning, construction, and operation of any project in Franklin. Specific measures must be presented for review prior to construction.

a. Site Planning

The most important erosion control practice is to minimize clearing and regrading, as discussed in **Section V**, Site Planning.

FRANKLIN POLICY: Any proposed project on a previously undeveloped site must accommodate the development program in a way that minimizes clearing and regrading, especially in areas of steep slopes, erosion-prone soils, or sensitive vegetation. For redevelopment projects, the site plan should concentrate development in previously-disturbed areas to the extent possible.

The initial step to control erosion and sedimentation lies in developing a plan that is appropriate to the site features including topography, soils, drainage ways, and natural vegetation. The site planning process should begin with a thorough evaluation of sensitive areas requiring protection as well as less sensitive areas suitable for development. The site plan should delineate a limit of work that limits clearing and regrading and protects the most sensitive areas, based on the criteria in Table 3-1. For example, in residential subdivisions, native vegetation should be retained on individual houselots to the extent possible, rather than creating larger lawns.

Table 3-1: Guidelines for identifying sensitive site features[22]

Topography	Drainage	Soils	Natural vegetation
Slopes that are steeper and/or longer typically create more erosion. Slopes that exceed the following thresholds are likely to be sensitive and erosion-prone: • Slopes of 5-7% longer than 300 feet • Slopes of 7-15% longer than 150 feet • Slopes of more than 15% longer than 75 feet	Where possible, retain natural drainage ways and depressions and utilize for stormwater conveyance	Consider factors such as erodibility, permeability, depth to water table and bedrock, and soils with shrink/swell potential or slippage tendencies. The most erodible soils contain high proportions of silt and very fine sand. The presence of clay or organic matter tends to decrease erodibility.	This is the most important factor in preventing erosion. Vegetated buffers filter runoff, decreasing runoff velocity, and increase infiltration capacity.

b. Construction Period Impacts

Prior to the commencement of construction, the limit of clearing and limit of work identified on the site plan and approved by the Town must be suitably marked. Acceptable markers include survey tape or plastic fences. These markers are in addition to any fences that the Conservation Commission may require for sensitive areas such as wetlands, streams and their buffers. Construction activities and construction traffic must be limited to the area identified on the site plan, and no stockpiling of materials, soils, or debris or other activity may occur outside of the limit of work.

FRANKLIN POLICY: As a condition of approval, every proposed project must submit and adhere to a construction management plan that addresses soil stabilization, sediment retention, perimeter protection, construction scheduling, traffic area stabilization and dust control.

1. Soil Stabilization

The construction management plan should outline a plan for cover and/or stabilization of erodible surfaces that are not the immediate focus of construction activity. The Town requires covering and stabilization as a way of minimizing soil erosion as well as sedimentation in the Town's water bodies and storm sewer system. Cover measures must be implemented on areas that have already been disturbed but will not be worked on during the next 7 days during dry conditions or next 2 days during wet conditions. Acceptable cover methods include, but are not limited to, the use of mulch, erosion control nets and blankets, plastic covering, seeding and sodding. These are described in the following paragraphs.

Mulching is generally considered to be a suitable short-term protective measure. The main purpose of mulching is to protect the site from erosion by stabilizing soils and reducing stormwater runoff velocity. Mulch can also enhance plant establishment by conserving moisture, holding fertilizer, seed and topsoil in place, and moderating soil temperature. The most commonly used mulches include straw, wood fiber or cellulose, compost and wood chips. The effectiveness of mulching depends on site characteristics and maintenance: if the site is prone to high winds or has steep slopes, additional steps should be taken to anchor the mulch, such as planting vegetation or providing netting or blanketing. The thickness of the cover should be maintained at all times and any area that has eroded should be remulched and anchored until it has been stabilized.

Figure 3-1: Geotextiles used for stabilizing a hillside

Similar to mulching, plastic covering is also acceptable as a short-term protective measure. This technique simply involves covering the area of concern with a plastic sheet and using tires or sandbags to weight the plastic down. Plastic covering is generally used on cut and fill slopes and stockpiles. Plastic covering should not be used if there is a sensitive area located downslope, because of the rapid runoff created by the plastic covering. Although this is a fairly easy technique to apply, it requires careful maintenance. The plastic cover can easily be torn or damaged by the sun and can clog drainage systems if not removed properly. Therefore, regular maintenance should be provided to ensure that the plastic is undamaged at all times and fully removed after it is no longer needed.

Seeding, sodding and erosion nets and blankets are usually more appropriate as long-term solutions for areas that will remain unworked for months. **Section IV** lists recommended species to plant for erosion control purposes. A well-designed landscaping plan can easily incorporate areas of planting for permanent erosion control. If the area must be stabilized immediately, then the use of sodding is more appropriate since it can provide immediate erosion protection. Sodding is appropriate for use on residential or commercial lawns, steeply-sloped areas, waterways and channels carrying intermittent flow, and areas around drop inlets that require stabilization.[23] Sod maintenance is essential during the establishment period. Sod should be

provided with adequate moisture and fertilizer. If the sod does not root and stay healthy, it should be replaced by new sodding or a different technique.

Erosion control nets or blankets, also referred to as geotextiles, are another suitable long-term stabilization technique (see Figure 3-1[24]). Geotextiles are used for preventing erosion and holding seed and mulch in place on steep slopes, as well as in channels to aid vegetation establishment. Geotextiles can be made of synthetic materials such as polypropylene, polyester, polyethylene, nylon, and polyvinyl chloride as well as biodegradable materials such as mulch matting, jute, coconut fiber and other wood fibers. For effective stabilization, good contact with the ground must be maintained and no erosion should occur beneath the net or blanket. Synthetic geotextiles can be sensitive to light and wind; therefore, they should be inspected regularly and any problematic areas should be repaired immediately.

2. Sediment Retention

Sediment retention from construction sites is a three-step process. First, all surface runoff from disturbed areas must be intercepted since this runoff contains high sediment loads. Second, the runoff must be conveyed to a sediment trap or pond where sediment removal will occur. Finally, the cleaned runoff must be discharged downslope of any disturbed areas. Typically, interceptor dikes and swales are used to intercept runoff; check dams are used to reduce flow velocity and remove sediment; ditches and pipes are used to convey the runoff; and riprap or level spreaders are used to dissipate runoff velocity in a non-erosive manner. As shown in Figure 3-2[25], interceptor dikes can collect the runoff and direct it to pipes and/or ditches which can convey the runoff to a sediment pond. The outflow from the pond can be connected to a stream (as shown in this case) or to a vegetated area. Riprap may be used to stabilize outlets. Check dams can be incorporated into the design to reduce the velocity of the runoff. Typically, check dams are installed in swales or ditches and consist of small gravel, rock, sandbag, log or straw dams.

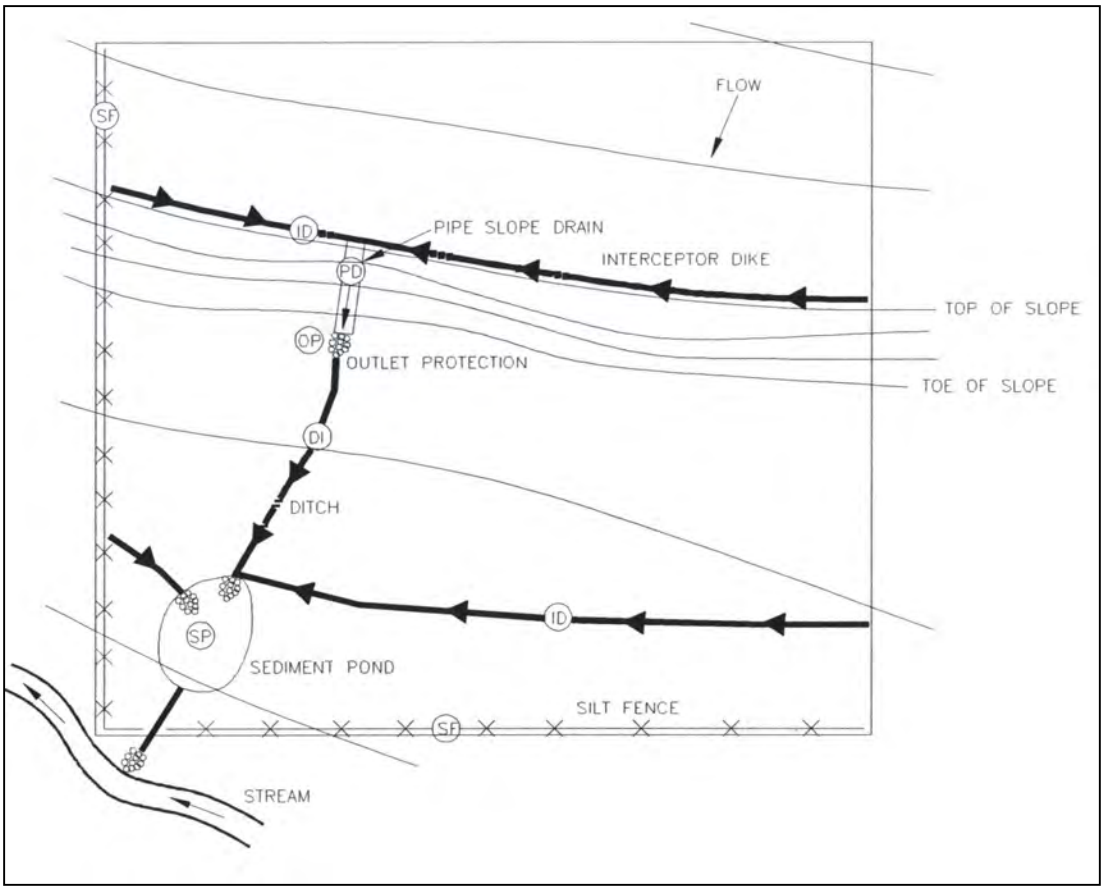


Figure 3-2: Sample sediment retention plan

As mentioned above, sediment must be conveyed to sediment traps or ponds prior to being discharged. Sediment traps should be used for areas less than about three acres, and sediment ponds should be used for larger areas. Stormwater runoff is conveyed through these structures, where sediment is settled (mostly small particles of 0.02 mm or so) and turbidity is slightly reduced.[26] When sediment reaches one foot in depth, the trap or the pond should be cleaned. Any embankments or slopes should also be routinely checked and any damage properly repaired. The construction management plan must state how surface runoff will be intercepted and settled before it is released into the ground or off-site.

3. Perimeter Protection

While interceptors and sediment traps/ponds discussed above will provide the primary sediment retention on construction sites, perimeter protection is also required to prevent residual sedimentation of adjacent lands and waters. The construction management plan should identify measures to prevent sediment from being transported off of the site. Again, the purpose of this requirement is to minimize sedimentation in the Town's water bodies, storm sewer system, and adjacent properties. Measures such as vegetated filter strips, silt fences, or brush barriers should be provided at the limit of work to filter runoff and capture sediment. In places where the limit of work is not near the edge of the site, a natural vegetation buffer of 40 feet is generally considered to be an acceptable retention system, except where the natural vegetation is a wetland, a wetland buffer or otherwise sensitive landscape feature, in which case a silt fence or similar device should generally be used. Figure 3-3[27] illustrates proper installation of hay bales for sediment retention purposes.

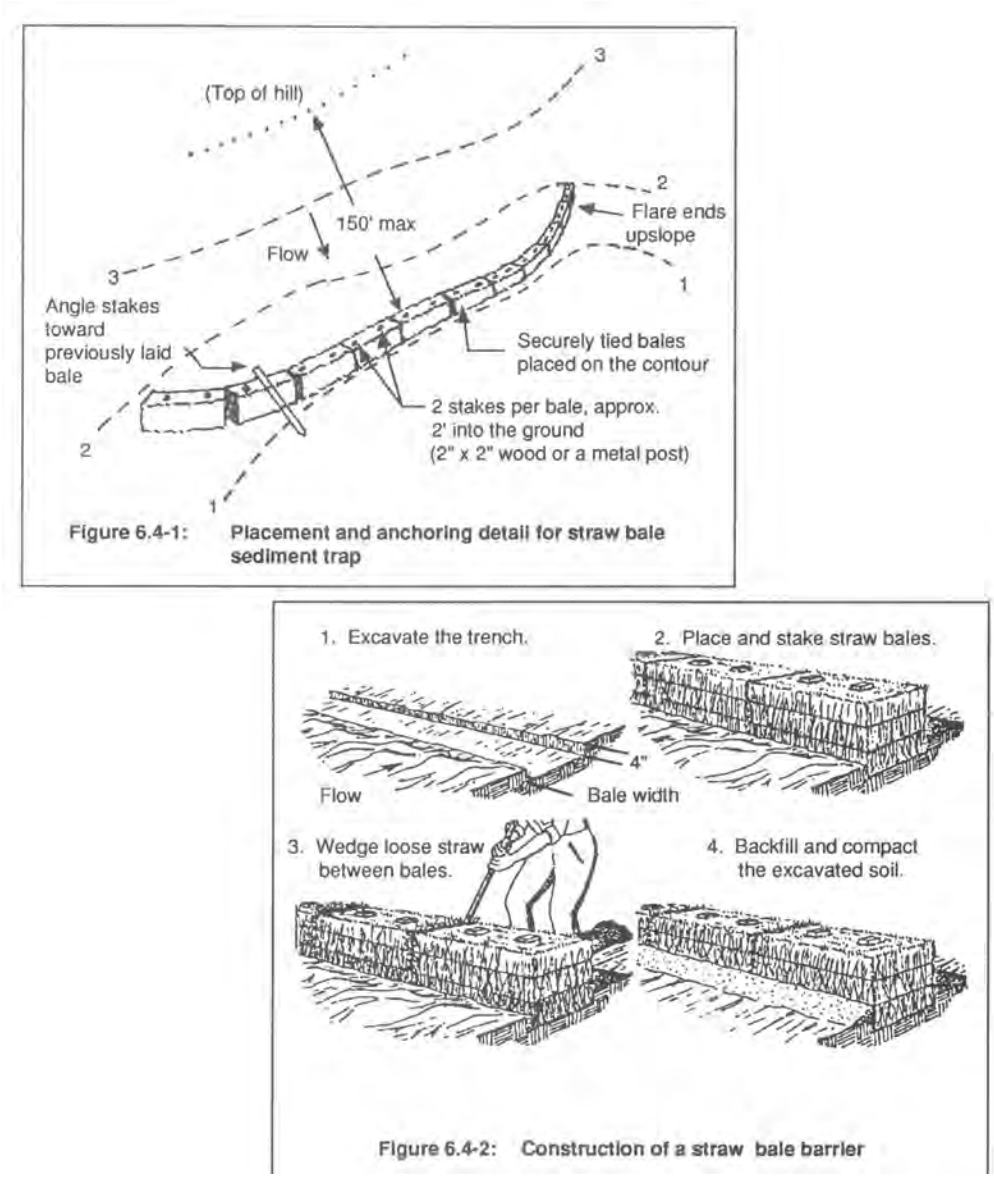


Figure 3-3: Installation of hay bales for sediment retention purposes

4. Other Practices

Scheduling of Operations

The construction management plan should state when clearing, grubbing, grading, construction, and replanting will occur on each section of the site. If construction phasing has not been determined at the time of the initial permitting, this section of the construction management plan may be submitted later, but must be submitted at least 60 days prior to the desired commencement of construction. Construction must be phased by area so that the smallest practical area of land is exposed for the shortest possible time.

Traffic Area Stabilization

To reduce the amount of sediment transported off site by construction vehicles and to reduce the erosion of areas disturbed by vehicle traffic, roads and parking areas should be stabilized immediately after initial grading. Not only will this stabilization reduce amount of sediment transported out of the site; it will also reduce the amount of easily erodible mud that forms on site. Stabilization can be achieved by use of a 6 inch deep layer of crushed rock, gravel base, or crushed surfacing base on the area of construction entrances or roads and parking areas. For any area that will be subject to long-term or high-volume construction vehicle traffic, a truck wash should be implemented, with dirty water channeled through sediment traps or ponds prior to discharge.

Dust Control

The construction management plan should commit to minimizing wind transport of dust from exposed soil surfaces onto roadways, drainage ways, and surfaces waters by spraying exposed soils with water until they are sufficiently damp so as to not produce dust, but not so wet as to produce runoff, whenever weather conditions are dry and windy.

IV. Landscape Design

This section of the Guidebook addresses three critical goals for the Town: stabilizing water use at a sustainable level; creating landscapes that minimize natural habitat destruction and maximize habitat value; and encouraging the development of landscapes that provide environmental quality and visual relief.

a. Water-Sensitive Landscaping

Franklin currently suffers from a seasonal water supply shortage due in large part to lawn and garden watering. At the same time, development and the attendant rise in impervious surfaces is altering the natural hydrological cycle and reducing recharge to the aquifers. Without careful attention to water use and hydrologic systems, Franklin could face continued water shortages as well as large future expenditures related to public water supply.

FRANKLIN POLICY: Site plans and landscape plans for all proposed projects must take appropriate steps, as outlined in this section, to minimize water use for irrigation and to allow for natural recharge of groundwater.

On previously undeveloped ("greenfield") sites, the most important water-sensitive practice is to minimize the disturbance and clearing of natural vegetation. Guidelines to meet this objective are provided in **Section III** and **Section V** of this Guidebook. Typically, this will mean preserving some portion of the site as open space, plus reducing the area of lawn and garden in favor of native vegetation in both residential and commercial/industrial projects. In places where native vegetation is cleared, at least some of the area should function as a groundwater recharge system. For example, a landscaped garden could function as a bioretention cell through appropriate subsurface design and selection of species, or portions of a lawn could serve as a vegetated filter strips for driveway runoff if properly graded. In general, the landscape design should aim to:

- Retain and recharge water onsite;
- Preserve existing vegetation to the maximum extent possible;
- Preserve soil permeability during development; and
- Minimize the use of turf grass in landscaping, opting instead for a variety of native species.

To keep the water onsite, impervious areas need to be reduced to the maximum extent practical. Planting beds should be designed to conserve the water they receive. This can be achieved by grading the beds so that slope is gradual and stormwater runoff will have more time to percolate into the soil, and by using plant species that do not require large amounts of water.

To meet its water conservation objectives, Franklin discourages in-ground irrigation systems. However, if irrigation systems are proposed, they shall be water-efficient drip systems or soil soakers equipped with automatic sensors that prevent watering when soils are already wet, or when it is raining. Drip irrigation is defined as the frequent slow application of water to a very small area in the root zone of the plant. Water slowly drips through either porous plastic pipes or emitters located below the soil surface. Drip systems have been found to reduce water use by 20-50%.[28] Soil soakers consist of long plastic or canvas tubes perforated with tiny holes through which the water seeps as a fine mist. Soil soakers are connected to a garden hose and can be left in place on the surface of the planting bed or buried under the mulch.

For garden areas, landscape plans should specify the use of a suitable mulch. Use of mulch is beneficial for several reasons. Mulch layers:

- Help capture moisture for vegetation that would normally be lost through evaporation;
- Prevent erosion by protecting the soil surface from raindrop impacts and by reducing the velocity of overland flow;
- Help prevent crusting, sealing and compaction of the surface, thereby preserving the infiltration rate;
- Protect seeds by forming an insulating layer against extreme heat and cold and by creating a suitable microclimate for seed germination; and
- Reduce weed growth and the need for herbicide application.[29]

Good mulching materials include compost, pine bark, pine straw (pine needle bales), leaf mold, rotted manure, lawn clippings, aged and shredded hardwood bark, aged wood chips, and straw or chopped hay.

b. Plant Species

In the interest of striking an appropriate balance between community development and conservation, the Town of Franklin is committed to retaining natural habitats and habitat functions on developed sites to the maximum extent possible. In addition, to further the Town's water conservation goals, drought-tolerant species should be used in appropriate situations.

FRANKLIN POLICY: Landscape plans shall follow the guidelines in this section for selecting species that are most appropriate to the site conditions. Native species and habitat-creating species shall be used in all landscape plans to the maximum extent possible. Invasive species identified in this section shall not be planted in Franklin under any condition.

Landscape designers working on Franklin projects should use the following lists to select the most appropriate species for each portion of their site. Recognizing that many species are well-suited to several circumstances, there is much overlap among the nine lists of species provided below. Each list is also divided into different forms of plants, such as shade trees, ornamental trees, evergreen trees, deciduous shrubs, groundcovers, and flowers. The lists are not all-inclusive, and landscape designers may propose the use of other species not included here, provided they are not invasive species. However, these lists are intended to provide a sufficiently wide range of species that the Town considers generally acceptable under different circumstances. Information in this list is based on several sources including 974 CMR 3.05,[30] a wetlands creation manual,[31] landscaping catalogs,[32,33]and professional landscape architects and biologists.

1. Native Species

The following species are native to Franklin and well-adapted to the area's climate. Many of the species also provide good wildlife habitat value.

Shade Trees

Botanical Name	*Common Name*
Acer rubrum	Red Maple
Acer saccharum	Sugar Maple
Betula lenta[F]	Sweet Birch[F]
Betula alleghaniensis[F]	Yellow Birch[F]
Betula papyrifera	Paper Birch
Carya ovata[+]	Shagbark Hickory[+]
Castanea dentate	American Chestnut
Fagus grandifolia	American Beech
Fraxinus americana	White Ash
Fraxinus pennsylvanica	Green Ash
Juglans cinerea[+]	Butternut[+]
Liquidambar styraciflua[F]	Sweetgum[F]
Liriodendron tulipifera[F]	Tulip Tree[F]
Nyssa sylvatica	Black Tupelo
Platanus occidentalis	American Sycamore
Quercus alba[+F]	White Oak[+F]
Quercus bicolor[+F]	Swamp White Oak[+F]
Quercus coccinea[+F]	Scarlet Oak[+F]
Quercus palustris[+F]	Pin Oak[+F]
Quercus rubra	Northern Red Oak
Salix nigra	Black Willow
Sassafras albidum	Common Sassafras
Tilia americana 'Redmond'	Redmond Linden
Ulmus americana, disease-resist. var.	American Elm

Notes:
[+] Recommended for planting on the portions of the site away from walks or roads.
[F] These trees need extra care if they are planted during the fall season.
^ Canadian Hemlock is currently under attack by an insect that has no predator.

Evergreen Trees

Botanical Name	*Common Name*
Ilex opaca	American Holly
Juniperus virginiana	Eastern Red Cedar
Pinus rigida	Pitch Pine
Pinus strobus	Eastern White Pine
Thuja occidentalis	American Arborvitae
Tsuga canadensis	Canadian Hemlock^

Ornamental Trees

Botanical Name	*Common Name*
Alnus rugosa	Speckled Alder
Amelanchier canadensis	Shadblow Serviceberry
Amelanchier laevis	Allegany Serviceberry
Betula nigra[F]	River Birch[F]
Betula papyrifera[F]	Paper Birch[F]
Carpinus caroliniana[F]	American Hornbeam [F]
Cercis canadensis	Eastern Redbud
Cornus alternifolia[F]	Pagoda Dogwood[F]
Cornus florida ^[F]	Flowering Dogwood ^ [F]
Crataegus punctata	Dotted Hawthorn
Hamamelis virginiana	Common Witchhazel
Larix laracina	American Larch
Larix decidua	European Larch
Ostrya virginiana	Hop Hornbeam
Prunus pennsylvanica[F]	Pin Cherry[F]
Prunus virginiana[F]	Common Chokecherry[F]
Salix discolor	Pussy Willow
Viburnum lentago	Nannyberry Viburnum

Notes:
^ Cornus florida has been adversely affected by an anthracnose epidemic in the Northeast U.S. in the past two decades. Anthracnose spreads rapidly to other flowering dogwoods. Before using this species, check with local agricultural extensions for the status of anthracnose.
[F]These trees need extra care if they are planted during the fall season.

Deciduous Shrubs

Botanical Name	*Common Name*
Arctostaphylos uva-ursi	Bearberry
Aronia melanocarpa	Black Chokeberry
Clethra alnifolia	Summersweet Clethra
Comptonia peregrina	Sweetfern
Cornus alterniflora	Pagoda Dogwood
Cornus amomum	Silky Dogwood
Cornus racemosa	Gray Dogwood
Cornus rugosa	Redleaf Dogwood
Ilex verticillata	Common Winterberry
Lindera benzoin	Common Spicebush
Myrica pennsylvanica	Northern Bayberry
Azalea nudiflorum	Early Deciduous Pink Azalea
Rhododendron roseum	Roseshell Azalea
Rhododendron viscosum	Swamp Azalea
Rhus glabra	Smooth Sumac
Rhus typhina	Staghorn Sumac
Rosa carolina	Carolina Rose
Rubus odoratus	Flowering Raspberry
Sambucus canadensis	American Elder
Vaccinium corymbosum	Highbush Blueberry
Viburnum acerifolium	Mapleleaf Viburnum
Viburnum cassinoides	Witherod Viburnum
Viburnum dentatum	Arrowwood Viburnum
Viburnum trilobum	American Cranberrybush Viburnum

Evergreen Shrubs

Botanical Name	*Common Name*
Juniperus communis 'Compressa'	Common Juniper
Kalmia angustifolia	Sheeplaurel
Kalmia latifolia	Mountainlaurel
Taxus canadensis	Canadian Yew

Groundcovers

Botanical Name	*Common Name*
Cornus canadensis	Bunchberry Dogwood
Gaultheria procumbens	Checkerberry Wintergreen
Mitchella repens	Partridgeberry
Vaccinium angustifolium	Lowbush Blueberry
Vaccinium macrocarpum	Cranberry

Meadow Grasses/Wildflowers

Botanical Name	*Common Name*
Festuca elatior	Tall Fescue
Lolium perenne	Palmer II Perr. Ryegrass
Sorghastrum nutans	Indian Grass
Panicum	Blackwell Switchgrass
Andropogon gerardii Vitman	Big Bluestem
Schizachyrium scoparium	Little Bluestem
Calamagrostis canadensis	Blue Joint Reedgrass
Antennaria alpina	Alpine Pussy-Toes
Aristida dichotoma	Poverty Grass
Aster linariifolius	Bristly Aster
Eragrostis spectabilis	Purple Lovegrass
Houstonia caerulea	Bluets
Juncus bufonius	Toad Rush
Senecio aureus	Golden Ragwort

2. Salt Tolerant Species

These species are well-suited to roadsides and other locations that are likely to collect salty winter runoff.

Shade Trees

Botanical Name	*Common Name*
Acer campestre	Hedge Maple
Aesculus hippocastanum	Horse-chestnut
Betula lenta *[F]	Sweet Birch*[F]
Betula alleghaniensis *[F]	Yellow Birch*[F]
Fraxinus americana *	White Ash*
Gleditsia triacanthos inermis	Thornless Honeylocust
Nyssa sylvatica *	Black Tupelo*
Quercus alba *+	White Oak*+
Quercus macrocarpa+	Bur Oak+
Quercus robur+	English Oak+
Quercus rubra	Red Oak
Ulmus glabra	Scotch Elm
Ulmus pumila	Siberian Elm

Notes:
* Native Plants
+ Recommended for planting on portions of the site away from walks or roads.
[F] These trees need extra care if they are planted during the fall season.

Ornamental Trees

Botanical Name	*Common Name*
Amelanchier canadensis *	Shadblow Serviceberry*
Betula papyrifera *[F]	Paper Birch*[F]
Betula populifolia *[F]	Gray Birch*[F]
Prunus pennsylvanica *[F]	Pin Cherry*[F]
Prunus virginiana *[F]	Common Chokecherry*[F]
Pyrus calleryana[F]	Callery Pear[F]
Pyrus calleryana 'Bradford'	Bradford Pear
Salix discolor *	Pussy Willow*

Evergreen Trees

Botanical Name	*Common Name*
Juniperus virginiana *	Eastern Red Cedar*
Picea pungens 'glauca'	Blue Colorado Spruce
Pinus nigra	Austrian Pine
Pinus ponderosa	Ponderosa Pine
Pinus rigida *	Pitch pine*

Deciduous Shrubs

Botanical Name	*Common Name*
Arctostaphylos uva-ursi *	Bearberry*
Aronia melanocarpa *	Black Chokeberry*
Aronia prunifolia *	Purplefruit Chokeberry*
Hippophae rhamnoides	Common Seabuckthorn
Lindera benzoin *	Common Spicebush*
Myrica pennsylvanica *	Northern Bayberry*
Rhus glabra *	Smooth Sumac*
Rhus typhina *	Staghorn Sumac*
Salix humilis *	Prairie Willow*
Salix lucida *	Shining Willow*
Shepherdia argentea	Buffaloberry
Tamarix ramosissima	Five Stamen Tamarisk

Vaccinium corymbosum *	Highbush Blueberry*
Viburnum cassinoides *	Witherod Viburnum*
Viburnum dentatum *	Arrowwood Viburnum*

Notes:
* Native Plants
+ Recommended for planting on portions of the site away from walks or roads.
[F]These trees need extra care if they are planted during the fall season.

Evergreen Shrubs

Botanical Name	*Common Name*
Pinus mugo	Mugo Pine
Taxus canadensis *	Canadian Yew*

Groundcovers

Botanical Name	*Common Name*
Vaccinium angustifolium *	Late Lowbush Blueberry*
Vaccnium palladum	Early Lowbush Blueberry

3. Urban Tolerant Species

These species are suitable for planting in "high-stress" environments where there will be pavement within the tree's drip line, high levels of pedestrian or vehicular traffic, vehicle exhaust and air pollution, or other urban stressors. For example, most of these species are generally well-suited to being planted in parking lot islands or other narrow landscaped areas.

Shade Trees

Botanical Name	*Common Name*
Acer campestre	Hedge Maple
Acer rubrum *	Red Maple*
Acer saccharum *	Sugar Maple*
Carpinus betulus fastigiata[F]	Pyramidal European Hornbeam[F]
Celtis occidentalis	Hackberry
Cladastris lutea	Yellowwood
Corylus colurna	Turkish Hazelnut
Eucommia ulmoides	Hardy Rubber Tree
Fraxinus pennsylvanica *	Green Ash*
Gingko biloba	Maidenhair Tree (female +)
Gleditsia triacanthos inermis	Thornless Honeylocust
Liquidambar styraciflua *[F]	Sweet Gum*[F]
Maclura pomifera inermis 'Park'	Park Osage Orange
Nyssa sylvatica *	Black Tupelo*
Platanus acerifolia[F]	London Plane Tree[F]
Sophora japonica	Scholartree
Tilia cordata	Littleleaf Linden
Zelkova serrata[F]	Japanese Zelkova[F]

Notes:
* Native Plants
+ Recommended for planting on portions of the site away from walks or roads.
[F]These trees need extra care if they are planted during the fall season.

Ornamental Trees

Botanical Name	*Common Name*
Betula nigra *[F]	River Birch*[F]
Cercidiphyllum japonicum	Katsuratree
Chionanthus virginicus	White Fringetree
Cornus kousa[F]	Kousa Dogwood[F]
Crataegus phaenopyrum	Washington Hawthorn
Magnolia stellata[F]	Star Magnolia[F]
Ostrya virginiana *	American Hophornbeam*
Oxydendron arboreum[F]	Sourwood[F]

Prunus sargentii[F]	Sargent Cherry[F]
Pyrus calleryana[F]	Callery Pear[F]
Syringa reticulata	Japanese Tree Lilac

Deciduous Shrubs

Botanical Name	*Common Name*
Cornus sericea	Red Osier Dogwood
*Ilex verticillata**	Common Winterberry*
*Ilex verticillata 'Nana'**	Dwarf Winterberry*
Rhus aromatica 'Gro-low'	Dwarf Fragrant Sumac
Spiraea bumalda varieties	Spirea
*Vaccinium angustifolium**	Lowbush Blueberry*

Groundcovers

Botanical Name	*Common Name*
Cotoneaster horizontalis	Rockspray Cotoneaster
Hedera helix	English Ivy
Juniperus chinensis sargentii	Sargent Juniper
Juniperus horizontalis varieties	Creeping Juniper
Vinca minor	Periwinkle
Pachysandra terminalis	Japanese Pachysandra

4. Species for Erosion Control

These species can be used for stabilizing the ground and preventing erosion, and should be considered for planting in areas with steep slopes or unstable, erodible soils.

Botanical Name	*Common Name*
Aegopodioum podagraria 'Variegatum'	Variegated Snow-on-the-Mountain
Celastrus scandens	American Bittersweet
Clematis paniculata	Clematis
Cornus, shrubby types	Dogwood (Silky, Gray-stemmed, Gray, Redleaf)
Cotoneaster, low types	Cotoneaster
Cytisus spp.	Scotch Broom
Erica spp.	Heath
Euonymus fortunei 'Colorata' and cvs.	Wintercreeper
Forsythia suspensa and cvs.	Weeping Forsythia
Genista x 'Lydia'	Genista lydia
Hedera helix and cvs.	English Ivy
Hemerocallis, all	Daylilly
Houtuynia cordata 'Chameleon'	Chaeleon Houtuynia
Itea spp.	Sweetspire
Juniperus, low types	Juniper
Ligustrum, all	Privet
Myrica pennsylvanica	Northern Bayberry
Parthenocissus spp.	Ivy
Polygonum aubertii	Silver-vine Fleeceflower
Rhus aromatica and cvs.	Fragrant Sumac
Rosa, most	Most roses
Salix purpurea	Purpleosier Willow
Stephanandra incisa	Cutleaf Stephanandra
Symphoricarpos x chenaultii 'Hancock'	Chenault Coralberry
Vinca minor and cvs.	Periwinkle
Yucca filamentosa	Yucca

5. Wetland Species

This list of species is generally well-suited for planting in constructed wetlands, wet swales, and other stormwater management areas that will typically be wet. Plantings in each section of the wet area must be selected according to the hydrological conditions in that area. See Figure 2-4 for a sample wetland planting layout.

Herbaceous Plants

Botanical Name	*Common Name*	*Water Depth (see below)*
Osmunda cinnamomea	Cinnamon fern	Transitional
Osmunda regalis	Royal fern	Transitional
Symplocarpus foetidus	Skunk cabbage	Transitional
Scirpus cyperinus	Woolgrass	Shallow
Thelypteris palustri	Marsh fern	Shallow
Caltha leptosepala	Marsh Marigold	Shallow
Polygonum coccineum	Pennsylvania smartweed	Shallow
Lobelia cardinalis	Cardinal Flower	Shallow
Lobelia siphilitica	Great Lobelia	Shallow
Iris versicolor	Blue Flag Iris	Medium
Acorus calamus	Sweet flag	Medium
Calla palustris	Water arum	Medium
Sparganium eurycarpum	Burreed	Medium
Scirpus americanus	Three-square	Medium
Scirpus fluviatilis	River bulrush	Medium
Sagittaria latifolia	Arrowhead	Medium
Ponetederia cordata	Pickerelweed	Medium
Peltandra cordata	Arrow arum	Medium
Potamogeton pectinatus	Sago pondweed	Deep
Vallisneria americana	Tapegrass	Deep
Ranunculus flabellaris	Yellow water buttercup	Deep
Ranunculus aquatilis	White water buttercup	Deep
Scirpus validus	Bulrush	Deep
Nymphea odorata	Fragrant white lily	Deep
Nuphar luteum	Spatterdock	Deep
Brasenia schrebrri	Watershield	Deep

Transitional: seasonally flooded; Shallow: seasonally flooded to permanently flooded to 15 cm; Medium: 15 to 50-cm water depths; Deep: 50 to 200-cm water depths.

Shrubs

Botanical Name	*Common Name*
Clethra alnifolia	Summersweet Clethra
Cornus amomum	Silky Dogwood
Ilex verticillata	Winterberry
Kalmia angustifolia	Sheep Laurel
Lindera benzoin	Spicebush
Rhodendron viscosum	Swamp Azalea
Viburnum recognitum	Northern Arrowwood
Vaccinium corymbosum	Highbush Blueberry

Trees

Botanical Name	*Common Name*
Nyssa sylvatica	Black gum
Quercus bicolor	Swamp oak
Fraxinus americana[+]	White ash[+]
Fraxinus pennsylvanica *	Green Ash*
Acer rubrum[+]	Red Maple[+]
Quercus bicolor^	Swamp oak^
Betula nigra^	River birch^

Notes:
*Species that will tolerate flooding for more than 1 year
[+]Species that will tolerate flooding for one growing season
^Species that will tolerate flooding for less than 30 days during the growing season

Woody Wetland Plants

Botanical Name	*Common Name*
Salix nigra *	Black Willow*
Cephalanthus occidentalis *	Buttonbush*
Cornus stolonifera *	Red-osier Dogwood*
Sambucus canadensis[+]	Elder[+]
Vaccinium corymbosum[+]	Blueberry[+]
Chamaecyparis thyoides[+]	Atlantic white cedar[+]
Alnus rugosa[+]	Spackled Alder[+]
Nyssa sylvatica^	Black gum^
Ilex opaca^	American Holly^

6. Moist Tolerant Species

These species require significant moisture, and many are adapted to survive periods of standing water. In general, these species should only be planted where local soil and topography produce moist conditions. Landscape designers should not rely upon irrigation to sustain these species.

Woody Plants

Botanical Name	*Common Name*
Acer negundo	Box Elder
Acer rubrum	Red Maple
Alnus rugosa	Speckled Alder
Amelanchier	Serviceberry
Andromeda polifolia	Bog Rosemary
Aralia spinosa	Devil's Walkingstick
Aronia arbutifolia	Chokeberry
Azalea arborescens	Sweet Azalea
Azalea vaseyi	Pinkshell Azalea
Azalea viscosum	Swamp Azalea
Betula nigra	River Birch
Calluna vulgaris	Heather
Calycanthus floridus	Common Sweetshrub
Campsis radicans	Trumpet Creeper
Cephalanthus occidentalis	Buttonbush
Chamaecyparis thyoides	Atlantic White Cedar
Clethra acuminata	Mountain Pepperbush
Clethra alnifolia	Summersweet
Cornus spp.	Dogwood (Silky, Shrub, Gray)
Erica carnea	Heath
Gymnocladus dioicus	Kentucky Coffee Tree

Halesia diptera	Two-winged Silverbell
Hamamelis virginiana	Witchhazel
Ilex spp.	Holly
Ilex verticillata	Winterberry
Kalmia latifolia	Mountain Laurel
Larix spp.	Larch
Leucothoe fontanesiana	Drooping Leucothoe
Lindera benzoin	Spicebush
Magnolia virginiana	Sweetbay Magnolia
Malus	Crabapple
Myrica pennsylvanica	Bayberry
Nyssa sylvatica	Black Gum
Rhododendron canadense	Rhodora (for bogs only)
Rhododendron maximum	Rosebay Rhododendron
Rhus aromatica	Fragrant Sumac
Salix	Willow
Sambucus canadensis	American Elder
Sassafras albidum	Common Sassafras
Vaccinium	Blueberry, Cranberry
Zenobia pulverulenta	Dusty Zenobia

Perennials

Botanic Name	*Common Name*
Aconitum carmichaelii	Monkshood
Amsonia hubrechtii	Star Flower
Aruncus dioicus	Goatsbeard
Clatha palustris	Marsh Marigold
Chelone lyonii	Turtlehead
Cimicifuga	Snakeroot
Epimedium	Bishops' Cap
Ferns	Ferns
Filipendula ulmaria	Meadowsweet
Gillenia trifoliate	Bowman's Root
Helleborus niger	Christmas Rose
Hemerocallis	Daylilly
Hibiscus moscheutos	Rosemallow
Iberis sempervirens	Candy Tuft
Iris ensata	Japanese Iris
Iris siberica	Siberian Iris
Kirengeshoma palmate	Yellow Waxbells
Liatris spicata	Gayfeather
Limonium latifolium	Sea Lavender (for salt marsh only)
Lobelia cardinalis	Cardinal Flower
Lobelia siphilitica	Big Blue Lobelia
Monarda didyma	Beebalm
Petasites	Butterbur
Phlox divaricata	Woodland Phlox
Platycodonj grandiflorus	Balloon flower
Polygonatum	Solomon's Seal
Tradescantia x andersonianan	Spiderwort
Trillium	Wakerobin
Trollius	Globeflower

Grasses

Botanical Name	*Common Name*
Carex muskingumensis	Palm Sedge
Miscanthus sacchariflorus Giganteus	Giant Silver Banner Grass
Pennisetum alopecuroides	Fountain Grass
Sisyrinchium	Blue-eyed Grass
Typha angustifolia	Cattail

7. Drought Tolerant Species

These species require relatively little water, can survive longer periods without water, and/or are adapted to grow in well-drained soils. In the interest of minimizing the demand for irrigation water, these species should be considered in sunny areas with well-drained soil that are likely to experience dry conditions.

Woody Plants

Botanical Name	*Common Name*
Abies concolor	White Fir
Acer truncatum	Shantung Maple
Aesculus x carnea	Ruby Horsechestnut
Aesculus pavia	Red Buckeye
Aralia spinosa	Devil's Walkingstick
Arctostaphylos uva-ursi	Bearberry
Buddleia alternifolia	Fountain buddleia
Calluna vulgaris	Heather
Campsis radicans	Trumpet Creeper
Caragana microphylla	Littleleaf Caragana
Carpinus betulus	European Hornbeam
Carpinus caroliniana	American Hornbeam
Chaenomeles speciosa	Flowering Quince
Chamaecyparis thyoides	Atlantic White Cedar
Comptonia peregrina	Sweet Fern
Cornus racemosa	Gray Dogwood
Corylus colurna	Turkish Filbert
Cotinus coggygria	Smoke Tree
Crataegus crusgalli	Cockspur Hawthorn
Fraxinus pennsylvanica	Green Ash
Gleditsia tricanthos inermis	Honeylocust
Gymnocladus dioicus	Kentucky Coffee tree
Hamamelis	Witchhazel
Hybiscus syriacus	Rose-of-Sharon
Hydrangea	Hydrangea
Indigofera gerardiana	Himalayan Indigo
Jasminum nudiflorum	Winter Jasmine
Juniperus	Juniper
Kerria japonica	Japanese Kerria
Koelreuteria paniculata	Golden Rain Tree
Kolkwitzia amabilis	Beautybush
Microbiata decussata	Siberian Carpet Cypress
Myrica pensylvanica	Northern Barberry
Pinus banksiana	Jack Pine
Pinus mugo	Mugo Pine
Pinus nigra austriaca	Austrian Pine
Pinus strobus	Eastern White Pine

Platanus x acerfolia	London Planetree
Potentilla fruticosa	Potentilla
Prunus maritima	Beach plum (especially back and scarlet)
Quercus	Oak
Rhus	Sumac
Rosa rugosa	Rugosa Rose
Salix	Willow
Sambucus canadensis	American Elder
Sassafras albidum	Common Sassafras
Shepherdia argentea	Buffalo Berry
Sophora japonica	Scholartree
Stephanandra incisa	Cutleaf Stephanandra
Vitex agnus-castus	Chastetree

Perennials

Botanical Name	*Common Name*
Anthemis tinctoria	Golden Marguerite
Artemisia	Wormwood
Armeria maritime	Thrift
Asclepias tuberosa	Butterfly Milkweed
Aubrieta deltoidea	False Rock Cress
Aurinia saxatilis	Basket-of-Gold
Callirhoe involucrata	Poppy Mallow
Campanula carpatica	Carpathian Bellflower
Centaurea Montana	Mountain Bluet
Cerastium tomentosum	Snow-in-Summer
Echinacea purpurea	Coneflower
Echinops ritro	Globe Thistle
Eryngium planum	Sea Holly
Eupatorium	Hardy Ageratum
Gaillardia x grandiflora	Blanket Flower
Geranium dalmaticum	Cranesbill
Geranium macrorhizum	Bigroot
Gypsophila	Baby's Breath
Helianthus grosse-serratus	Sawtooth Sunflower
Hemerocallis fulva	Daylilly
Lamium maculatum	Spotted Dead Nettle
Lewisia cotyledon	Bitter Root
Nepera x faassenii	Persian Catmint
Oenothera	Evening Primrose
Opuntia humifusa	Prickly Pear
Papaver orientale	Poppy
Perovskia atriplicifolia	Russian Sage
Phlox subulata	Moss Pink
Polemonium caereum	Jacob's Ladder
Rudbeckia	Coneflower
Salvia verticillata	Purple Rain
Santolina chamaecyparissus	Lavender Cotton
Sedum	Stonecrop
Sempervivum	Houseleek
Stachys byzantina	Lamb's Ears
Stokesia laevis	Stoke's Aster
Thymus serpyllum	Mother-of-Thyme
Yucca	Desert Candle

Grasses

Botanical Name	*Common Name*
Bouteloua gracilis	Blue Gramma
Elymus arenarius	Blue Lyme Grass
Festuca cinerea	Blue Fescue
Schizachyrium scoparium	Little Bluestem

8. Habitat Creating Species

Habitat creating species provide food or home sites for birds and other animals.

The following plants provide good habitat value for birds and animals.

Trees

Botanical Name	*Common Name*
Acer rubrum	Red Maple
Acer saccharinum	Sugar Maple
Amelanchier canadensis	Serviceberry
Betula nigra	River Birch
Betula papyrifera	White Birch
Celtic occidentalis	Hackberry
Cornus, most	Dogwoods
Crataegus, most	Hawthorn
Malus, most	Crabapple
Nyssa sylvatica	Black gum
Picea glauca	White spruce
Picea pungens	Blue Spruce
Pinus strobus	White Pine
Populus, most	Poplars
Quercus alba	White Oak
Quercus palustris	Pin Oak
Quercus rubra	Red Oak
Sorbus aucuparia	Mountain Ash
Tsuga canadensis and cvs.	Eastern Hemlock

Shrubs

Botanical Name	*Common Name*
Amelanchier canadensis and cvs.	Serviceberry
Aralia spinosa	Devil's Walking Stick
Aronia spp. And cvs.	Chokeberry
Cornus, most	Dogwoods
Cotoneaster spp. and cvs.	Cotoneaster
Ilex glabra	Inkberry
Juniperus virginiana and cvs.	Eastern Red Cedar
Myrica pensylvanica	Bayberrry
Rosa rugosa	Rugosa Rose
Salix discolor	Pussy Willow
Viburnum dentatum	Arrowwood

The following plant species provide persistent fruit that lasts into the late fall and winter, thus providing food for wildlife during the critical months when food is most difficult to find.

Trees

Botanical Name	*Common Name*
Cornus mas	Cornelian Cherry Dogwood (Golden Glory)
Crataegus phaenopyrum	Washington Hawthorn
Malus spp., most	Crabapple

Shrubs

Botanical Name	*Common Name*
Aronia arbutifolia	Red Chokeberry
Ilex glabra	Inkberry
Juniperus spp. and cvs.	Juniper
Myrica pennsylvanica	Bayberry
Pyracantha coccinea and cvs.	Firethorn
Rhodotypos scandens	Black Jetbead
Rhus spp.	Sumac
Rosa rugosa and cvs.	Rugosa Rose
Rosa wichuriana and cvs.	Memorial Rose
Viburnum dilatatum	Linden Viburnum
Viburnum setigerum	Tea Viburnum

9. Invasive Species

Invasive plants are introduced species that tend to spread into natural habitats and outcompete native species because of their superior reproductive ability, aggressive growth pattern, or (most commonly) lack of native competitors, herbivores, parasites, or diseases. In terms of maintaining native biodiversity, invasive species are a serious threat because they compete with native species for limited land, water and sunlight. Franklin's policy prohibits the planting of invasive species that appear in the following list.

Shade Trees

Botanical Name	*Common Name*
Acer ginnala	Amur Maple
Acer platanoides	Norway Maple
Acer pseudoplatanus	Sycamore Maple
Populus alba	White Cottonwood
Robinia pseudoacacia	Black Locust

Deciduous Shrubs/Vines

Botanical Name	*Common Name*
Ampelopsis brevipedunculata	Porcelain Berry
Berberis thunbergii	Japanese Barberry
Berberis vulgaris	Common Barberry
Celastrus orbiculata	Oriental Bittersweet
Cynanchum louiseae	Black Swallow-wort
Elaeagnus umbellata	Autumn Olive
Elaeagnus angustifolia	Russian Olive
Euonymus alatus	Winged Euonymus
Euphorbia cyparissias	Cypress Spurge
Hesperis natonalis	Dame's Rocket

Ligustrum obtusifolium	Blunt-leaver Privet
Ligustrum vulgare	Privet
Lonicera japonica	Japanese Honeysuckle
Lonicera maackii	Amur Honeysuckle
Lonicera morrowii	Morrow's Honeysuckle
Lonicera tatarica	Tatarian Honeysuckle
Lonicera xbella	Morrow's x Tatarian Honeysuckle
Polygonum cuspidatum	Japanese Knotweed
Pueraria lobata	Kudzu
Rhamnus cathartica	Common Buckthorn
Rhamnus frangula	Shining Buckthorn
Rosa multiflora	Multiflora Rose

Meadow Grasses/Wildflowers

Botanical Name	*Common Name*
Achillea millefolium var. millefolium	Common Yarrow
Aegopodium podagraria	Goutweed
Alliaria petiolata	Garlic Mustard
Cabomba caroliniana	Fanwort
Centaurea maculosa	Spotted Knapweed
Cirsium canadense	Field or Canada Thistle
Coreopsis lanceolata	Lance-leaved Coreopsis (Tickseed)
Cytisus scoparius	Scotch Broom
Daucus carota	Queen Anne's Lace
Egeria densa	Giant Waterweek
Epilobium hirsutum	Hairy Willow-herb
Euphorbia cyparissias	Cypress Spurge
Galium mollugo	Field Madder
Glaucium flavum	Sea Poppy
Glechoma hederacea	Gill-over-the-ground (Ground Ivy)
Holcus lanatus	Velvet Grass
Hypericum perforatum	Common St. John's Wort
Iris pseudacorus	Yellow Iris
Linaria vulgaris	Butter and Eggs
Lysimachia nummularia	Moneywort
Lythrum salicaria	Purple Loosestrife
Myosotis scorpioides	True Forget-me-not
Myriophyllum heterophyllum	Variable Water-milfoil
Myriophyllum spicatum	Spiked Water-milfoil
Najas minor	Lesser Naiad
Nasturtium officinale	Watercress
Phalaris arundinace	Reed Canary Grass
Phragmites australis	Phragmites
Plantago lanceolata	Ribgrass (Lance-leaved Plantain)
Poa compressa	Canada Bluegrass
Potamogeton crispus	Curly or Crisped Pondweed
Ranunculus acris	Tall Buttercup
Ranunculus bulbosus	Bulbous Buttercup
Ranunculus repens	Creeping Buttercup
Ribes rubrum	Garden Red Currant
Rumex acetosella	Sheep Sorrel
Rumex crispus	Curled Dock
Rumex obtusifolius	Bitter or Broad-leaved Dock
Solanum dulcamara	Bittersweet Nightshade
Trapa natans	Water Chestnut

Tussilago farfara	Coltsfoot
Verbascum thapsus	Flannel-leaved Mullein

Lawn Grasses

Botanical Name	*Common Name*
Agrostis gigantea	Redtop, Upland Bentgrass
Festuca longifolia	Hard Fescue
Festuca ovina	Sheep Fescue

V. Site Planning

Franklin's site planning policy is intended to further the Town's goals of:

- **Protecting the environment**, including wildlife habitat, water resources, and "ecosystem services" such as groundwater recharge, flood attenuation and pollutant removal;
- **Creating a visually appealing community**;
- **Preserving the Town's cultural heritage**, including historic sites, view corridors, trees and other noteworthy features;
- **Stabilizing and increasing property values**; and
- **Encouraging sustainable development** that minimizes energy use and pollution.

FRANKLIN POLICY: Subdivision plans and site plans for all forms of development shall adhere to the principles of *environmental compatibility*, *aesthetic compatibility*, and *energy-efficient design*.

In order to minimize costs related to design and engineering (as well as construction), it is recommended that applicants follow the **four-step planning process** described in Appendix A. Creative designers will usually be able to find many cost savings in Franklin's site planning guidelines related to a reduction in clearing, cut and fill, replanting, and stormwater management needs.

Guidelines and criteria for site planning include the following:

- **Refrain from disturbing unique natural features of the site to the maximum extent possible.** Depending on the site, such features could include wooded areas, specimen trees (e.g. larger than 10" diameter at breast height), knolls, and rock outcroppings as well as the more typically conserved streams, wetlands and ponds. These features should be identified early in the site planning process (for example, in the survey or an early site visit) and incorporated into the site plan either as "focal points" for the development or as protected areas, whichever is more appropriate. In general, clearing of vegetation and alteration of topography shall be limited to the maximum percent lot coverage stated in the zoning bylaw (structures plus paving) plus 10% (e.g., 35% in the RR-I district and 70% in the C-II district). Native vegetation shall be planted in disturbed areas as needed to enhance or restore wildlife habitat. Disturbance shall be limited to construction areas only. Preservation of groups of trees (e.g., beech, oak, hickory, etc.) is encouraged.
- **Refrain from disturbing sites of historic and/or cultural significance.** Significant sites could include old buildings, cellar holes or graveyards, as well as historic trees that have a diameter at breast height of 20" or greater.
- **Preserve views and vistas both into and out of the site.** A visual analysis should be conducted to identify any scenic "windows" into the site and preserve the aesthetic value of these views whenever possible.
- **Minimize cut and fill.** Roads should follow the natural contours whenever possible, taking a steeper path only if necessary. Steep areas on individual house lots should generally be left as natural vegetation, not regraded to allow for a sloping lawn. This approach can reduce grading costs and stormwater control costs because it often results in

less land being disturbed, thereby creating fewer erosion or runoff problems. In addition, future homeowners will have fewer expenses and hassles related to maintaining steep lawns and landscaped areas, which are often costly to maintain and have low utility as yards.

- **Locate houses and buildings in a way that blends into the natural topography.** Buildings should not be set high up on a hill where they will be an eyesore or a focus of attention. Generally buildings should be situated near the grade of the road, unless this would require extensive regrading, in which case they may be higher or lower. For buildings located much above the road, an extra effort should be made to recess these buildings into the treeline to reduce their visual impact.

- **Conserve energy by orienting buildings to the sun and wind for maximum efficiency.** Buildings should be aligned to be protected from cold winter winds, shaded from summer sun, and open to winter sun. Protection from cold winter winds can be achieved by retaining natural vegetation at a building's northwest edge or by planting evergreen species such as white pine (*Pinus strobus*) in this location. For summer shading and winter heating, deciduous species can be planted close to the building, along the east, south and west exposures. Winter sunlight will penetrate the empty branches and provide heat. Home interiors should be laid out with time-of-day occupancy in mind.[34] Living and high-activity rooms should be placed on the south side where they are heated by the low winter sun and shaded from the high summer sun. Garages, utility rooms and closets can be positioned to provide insulating barriers on the northeast and northwest sides.

Appendix A

This Guidebook requires site plans and subdivision applications to consider the presence of natural, cultural, and aesthetic features on any proposed development or redevelopment site. To meet this requirement, the Town recommends that designers utilize a four-step planning process to identify and plan for these site features.[35] The Town also recommends this process as a way of expediting the project review and approval process and minimizing the need for re-designs.

Under the four-step process, the applicant first prepares an "environmental constraints and opportunities plan" for an initial Planning Board meeting. At this meeting, the applicant and the Planning Board identify those portions of the site that should be conserved (e.g., wetlands, viewsheds, specimen trees, historic sites), and those that are most suitable for development. This analysis should consider natural and visual features, as well as the site's orientation with respect to the sun and wind. With this input, the designer then identifies building sites and lays out the internal circulation network in a way that minimizes clearing, vegetation disturbance and regrading, and situates the buildings within the natural topography. The last step is to draw in the lot lines, if applicable. The goal of this process is not to reduce the overall development program, but rather to lay it out in a less expensive and more environmentally and aesthetically compatible fashion.

The four site planning steps are described below.

1. Constraints and Opportunities Plan

Site planning should begin with the preparation of a **constraints and opportunities plan** to understand the site's features and its context. The plan should identify water resources (wetlands, streams, ponds, vernal pools, floodplains, and springs or seeps), site conditions (steep slopes, significant rock outcroppings, landforms such as knolls and hollows, hydric soils, and prime aquifer recharge areas), ecological features (woodlands, wildlife habitat, and rare species), scenic/visual features (specimen trees, farmland and meadows, and views both into and out from the site), and historic and archaeological resources. The constraints and opportunities plan may be prepared in conjunction with the site survey, but will require more investigation and analysis than a survey usually provides. Ideally a multidisciplinary team with an engineer, scientist, and landscape architect will visit

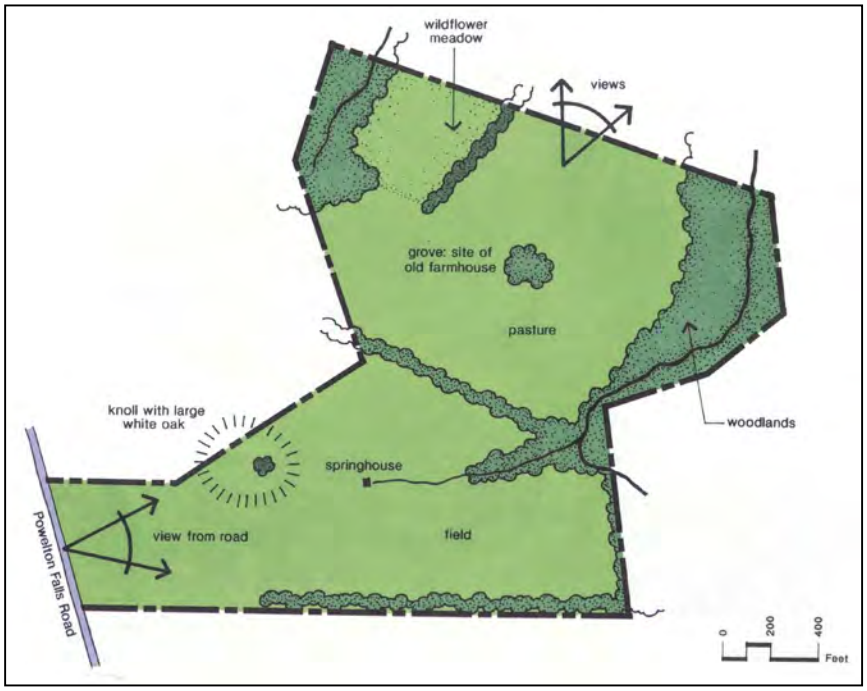


Figure A-1: Sample constraints and opportunities plan showing significant natural and cultural features as well as viewsheds.

the site and prepare the constraints and opportunities plan. During this step, the designer should also consider the locational context, including surrounding land uses, water resources, historic sites, and other features. The constraints and opportunities plan can either be a single plan or a series of layers of clear plastic or tracing paper, each representing one set of site features.

2. Identify the Conservation and Development Areas

Once all of the existing conditions information has been combined on the constraints and opportunities plan, the most suitable areas for development and conservation will become apparent. Conserved lands should include *primary conservation areas* (areas such as wetlands, floodplains, and steep slopes that are generally unbuildable due to environmental regulations or site conditions) as well as *secondary conservation areas* (unique or attractive site features, or areas that are important for environmental protection but not otherwise regulated). Working within the zoning guidelines, the designer should identify areas that will be conserved and areas that will be developed. The designer should be creative in trying to site the desired development program outside of the identified conservation areas, using Franklin's flexible development options if appropriate.

3. Locate the Building Sites and Lay Out the Roads and Trails

Building sites should be sited within the identified development areas to the maximum extent possible. Again, use of Franklin's various flexible development options may be necessary to meet this goal. In addition, the site will need to be designed carefully, with the site's constraints and opportunities in mind. Sensitive features in the conservation areas (e.g., vernal pools) should be buffered from the development areas, while scenic or historic features (e.g., knolls, meadows, or rock outcroppings) could be "showcased" by providing an open view to toward them. In residential projects, natural vegetation will often need to be retained on individual house lots so that the total development program can fit into a development area that is only a fraction of the site's total land area. Finally, buildings should be sited with consideration to the view from the

Figure A-2: Sample plan identifying conservation and development areas. Note that the conservation areas include both regulated areas (wetlands and streams) as well as significant site features identified in the constraints and opportunities plan (viewshed from the road, scenic knoll, and wildflower meadow).

public way as well as the view out from the buildings. In suburban and rural sections of the Town, developments should generally be as naturally camouflaged as possible.

As discussed in **Section V**, buildings should also be oriented to the sun and wind for maximum efficiency. Protection from cold winter winds can be achieved by retaining natural vegetation along a building's northwest edge or by planting evergreen species such as white pine (*Pinus strobus*) in this location. For summer shading and winter heating, deciduous species can be planted close to the building, along the east, south and west exposures. Winter sunlight will penetrate the empty branches and provide heat. Home interiors should be laid out with time-of-day occupancy in mind. Living and high-activity rooms should be placed on the south side where they are heated by the low winter sun and shaded from the high summer sun. Garages, utility rooms and closets can be positioned to provide insulating barriers on the east and west sides.

Figure A-3: Buildings and roads are sited within the development envelopes identified in Step 2.

During this step, the system of roads and pedestrian network (if any) should be laid out based on the most efficient way to access the building sites with a minimum of environmental and aesthetic impacts. From an engineering standpoint, it is important to consider the topography; from an environmental approach, to consider mature tree stands, wildlife habitat areas, wetlands, etc.; and from an aesthetic and speed control perspective to build "slow" roads. "Slow" roads are naturally curving, or have short straight segments connected with relatively tight bends that force drivers to go slowly. As with the siting of buildings, preserving vistas should be a prime consideration.

4. Draw in the Lot Lines

Once steps 1 through 3 have been completed, the lot lines (if any) can be drawn in based on the building locations. The location of the buildings may necessitate a subdivision plan that takes advantage of Franklin's flexible development options.

Figure A-4: Sample of a residential subdivision plan produced under the four-step planning process. Note that developed areas avoid, but are suituated to take advantage of, sensitive and scenic site features.

Figure A-5: Sample of a more conventional residential subdivision. Note that the developed areas destroy or obscure many of the site's natural and scenic features. **This type of site planning should be avoided in Franklin.**

Endnotes

[1] Overall, these practices will aid Franklin in meeting the EPA Stormwater Phase II requirements. The EPA's goals are to minimize polluted stormwater entering rivers and streams by reducing the discharge of pollutants to the maximum extent practicable; to protect water quality; and to satisfy the appropriate water quality requirements of the Clean Water Act. Phase I of EPA's plans was initiated in 1990 and regulated municipal separate storm sewer systems (MS4s) that were defined as "large" and "medium." Phase II, which was recently finalized, focuses on "small" MS4s. Franklin operates a small MS4 and is therefore subject to the Phase II requirements. To comply with the Phase II requirements, the EPA requires that towns set in place regulations and programs that include public education and outreach, public involvement, illicit discharge detection and elimination, construction site runoff control, post-construction runoff control and pollution prevention/good housekeeping.

[2] These stormwater management standards are adopted from the Massachusetts Department of Environmental Protection (DEP) Stormwater Policy Handbook. The DEP standards already apply to any project that falls under the jurisdiction of the Wetlands Protection Act. Franklin has adopted three of the nine DEP standards, and has incorporated by reference the relevant portions for the DEP's Stormwater Policy Handbook that relate to the implementation of these standards. For Franklin standard #2 (DEP standard #3), engineers should consult the DEP Handbook to determine the requirement for on-site recharge and how to demonstrate compliance with this requirement. For Franklin standard #3 (DEP standard #4), engineers should also consult the DEP Handbook for additional information. The Stormwater Policy Handbook and an accompanying Stormwater Technical Handbook may be downloaded from the DEP's website at www.state.ma.us/dep or purchased at the state bookstore.

[3] Adapted from the *Low Impact Development (LID) Design Strategies: An Integrated Design Approach*, Department of Environmental Resources, Prince George's County, Maryland, June 1999, www.co.pg.md.us/Government/DER/PPD/pgcounty/pdf/LID/LiDNatl.pdf. Additional information from the *DEP Stormwater Policy Handbook* and *EPA Stormwater Phase II Best Management Practices Factsheets*, www.epa.gov/npdes/menuofbmps/menu.htm.

[4] Based on the table in the *DEP Stormwater Policy Handbook*, with additional information on other systems added from *Prince George's County LID Design Strategies*.

[5] *Prince George's County LID Design Strategies.*

[6] *Prince George's County LID Design Strategies.*

[7] *Northern Virginia Planning District Commission (NVPDC) Nonstructural Urban BMP Handbook*, Department of Conservation and Recreation/Division of Soil and Water Conservation, December 1996, www.novaregion.org.

[8] *NVPDC Nonstructural Urban BMP Guidebook.*

[9] *Stormwater Management Fact Sheet: Stormwater Wetlands*, The Stormwater Center, www.stormwatercenter.net.

[10] *NVDPC Nonstructural Urban BMP Handbook.*

[11] *Bioretention: A Low Impact Stormwater Best Management Practice*, University of Maryland, www.ence.umd.edu/~apdavis/Bioret.htm.

[12] *EPA Stormwater Technology Fact Sheet – Bioretention*, EPA 832–F-99–012.

[13] *Maryland Stormwater Design Manual.*

[14] EPA Stormwater Technology Fact Sheet.

[15] EPA Stormwater Phase II Best Management Practices Factsheets, www.epa.gov/npdes/menuofbmps/menu.htm.

[16] www.uncommonplants.com

[17] *Green Roofs: Stormwater Management From the Top Down*, Katrin Scholz-Brath, www.edcmag.com, January/February 2001.

[18] The University of Florida Natural Area Teaching Lab has been working on retention basin designs as part of their Stormwater Ecological Enhancement Project. See natl.ifas.ufl.edu.

[19] *DEP Stormwater Manual*.

[20] *DEP Stormwater Manual*.

[21] *EPA Stormwater Phase II Best Management Practices Factsheets*.

[22] *Prince George's County LID Design Strategies*.

[23] *EPA Stormwater Phase II Best Management Practices Factsheets*.

[24] Geotextiles and other erosion control and stormwater management products may be purchased from numerous commercial vendors. Vendors include Synthetic Industries, www.fixsoil.com; Pinelands Nursery, www.pinelandsnursery.com; North American Green, www.nagreen.com; and the American Excelsior Company, www.amerexcel.com/erosionindex.htm.

[25] *Surface Water Design Manual*, King County, Washington, Department of Natural Resources, September 1998.

[26] King County, WA, *Surface Water Design Manual*.

[27] *Best Management Practices for Minnesota: Protecting Water Quality in Urban Areas*, Minnesota Pollution Control Agency, 1991.

[28] *NVPDC Nonstructural Urban BMP Handbook*.

[29] *NVPDC Nonstructural Urban BMP Handbook*.

[30] Devens Enterprise Commission list of native species, invasive species, and other species for use in project landscaping. See www.devensec.com.

[31] *Creating Freshwater Wetlands*, Donald A. Hamoner, Lewis Publishers, Michigan, 1992.

[32] Lake County Nursery, Inc. Catalog, Perry, OH, 1995

[33] Weston Nurseries Catalog, Hopkinton, MA, 1999, www.westonnurseries.com.

[34] *Best Development* Practices, Reid H. Ewing *et al.*, Planners Press, 1996.

[35] This process is the essentially the same as the planning process required for projects proposed under Franklin's Senior Village Overlay District. This process is based on the work of Randall Arendt as presented in his book *Conservation Subdivision Design*, 1996. The images used in this section of the Handbook are taken from Arendt's book.

Appendix B

PSC Annual Reports on Water Conservation Programs

Public Service Commission of Wisconsin
Report on Water Conservation Programs

Utility Name:	Waukesha Water Utility
Report Date:	Report Due Date – 03/01/2010
Report Period:	01/01/2009– 12/31/2009
Report Frequency:	Annual
Billing Frequency:	Quarterly
Person Submitting Report:	Nancy Quirk, P.E.

Background

The Public Service Commission ordered the Waukesha Water Utility to report to the Commission by March 1, 2010 on its water conservation programs in docket 6240-WR-106.

The order reads to provide the following information:

a. setting forth monthly [quarterly usage will be provided as Waukesha Water Utility does not bill monthly at this time] water usage for each customer class;
b. the measures taken to educate residential customers about the conservation rate structure and its intended purpose;
c. the number of single family and multi-family residential customers affected by the conservation rates;
d. the breakdown of residential usage for single family, duplex, and triplex customers per block per quarter;
e. an analysis of the effects of the overall water conservation program on customer behavior and water usage trends;
f. the total number of customers receiving a toilet rebate by customer class and any other information the utility can supply that will explain what programs are producing results and what programs , though well meaning, may be having little or no effect.

PART I – WATER CONSERVATION RATES

It is premature to predict the actual affects of the new rates that were implemented in June of 2009 due to the timing of the rate case. Once implemented, the first group of customers impacted by the new rates did not get a bill that recognized the full impact of the rates for 3 months. We will have a more accurate reflection of the impact once we have the data for the 2010 summer season.

Residential Rates

RESIDENTIAL RATES PER THOUSAND GALLONS (EFFECTIVE 6/5/09)				
		One Family	Duplex	Triplex
	Amount	Gallons	Gallons	Gallons
Block 1	$ 2.05	0 - 10,000	0 - 20,000	0 - 20,000
Block 2	$ 2.65	10,001- 30,000	20,001 - 35,000	20,001 - 60,000
Block 3	$ 3.40	Over 30,000	Over 35,000	Over 60,000

RESIDENTIAL RATES PER THOUSAND GALLONS (EFFECTIVE 6/1/07)				
		One Family	Duplex*	Triplex*
	Amount	Gallons	Gallons	Gallons
Block 1	$ 1.95	0 - 30,000	0 - 30,000	0 - 30,000
Block 2	$ 2.20	30,001- 40,000	30,001- 40,000	30,001- 40,000
Block 3	$ 2.70	Over 40,000	Over 40,000	Over 40,000

* The customer billing system did not have the duplex and triplex separated from single family until later in 2007.

Data for the water usage in our residential class of customers over 2008 and 2009 follows:

SINGLE FAMILY RESIDENTIAL

Billing Period 1 - [01/01/2008 - 03/31/2008], [01/01/2009 - 03/31/2009] **SINGLE FAMILY RESIDENTIAL**

Volume Block (Gallons)	Year	Number of Customers with Bills Ending in Block	Percentage of Customers with Bills Ending in Block	Total Volume Billed in Block in Period	Percentage of Volume Billed in Block in Period
Block 1 (0-10,000)	2009	5,316	34.6%	33,421,400	16.0%
	2008	5,088	33.3%	31,566,200	14.9%
Block 2 (10,001-30,000)	2009	9,592	62.4%	156,263,300	74.9%
	2008	9,707	63.5%	160,089,900	75.6%

Block 3 (30,000+)	2009	468	3.0%	18,961,600	9.1%
	2008	486	3.2%	19,983,300	9.4%
Total	2009	15,376	100.0%	208,646,300	100.0%
	2008	15,281	100.0%	211,639,400	100.0%

Billing Period 2 - [04/01/2008 - 06/30/2008], [04/01/2009 - 06/30/2009] **SINGLE FAMILY RESIDENTIAL**

Volume Block (Gallons)	Year	Number of Customers with Bills Ending in Block	Percentage of Customers with Bills Ending in Block	Total Volume Billed in Block in Period	Percentage of Volume Billed in Block in Period
Block 1 (0-10,000)	2009	5,455	35.4%	34,553,500	16.6%
	2008	5,193	34.0%	32,928,300	15.6%
Block 2 (10,001-30,000)	2009	9,495	61.6%	154,892,300	74.6%
	2008	9,607	62.9%	158,400,600	75.1%
Block 3 (30,000+)	2009	456	3.0%	18,223,500	8.8%
	2008	482	3.2%	19,465,900	9.2%
Total	2009	15,406	100.0%	207,669,300	100.0%
	2008	15,282	100.0%	210,794,800	100.0%

Billing Period 3 - [07/01/2008 - 09/30/2008], [07/01/2009 - 09/30/2009] **SINGLE FAMILY RESIDENTIAL**

Volume Block (Gallons)	Year	Number of Customers with Bills Ending in Block	Percentage of Customers with Bills Ending in Block	Total Volume Billed in Block in Period	Percentage of Volume Billed in Block in Period
Block 1 (0-10,000)	2009	4,175	27.1%	26,545,900	10.3%
	2008	4,204	27.5%	26,717,700	10.6%
Block 2 (10,001-30,000)	2009	9,892	64.2%	173,091,000	67.0%
	2008	9,785	63.9%	170,038,600	67.3%
Block 3 (30,000+)	2009	1,351	8.8%	58,730,600	22.7%
	2008	1,314	8.6%	56,004,900	22.2%
Total	2009	15,418	100.0%	258,367,500	100.0%
	2008	15,303	100.0%	252,761,200	100.0%

Billing Period 4 - [10/01/2008 - 12/31/2008], [10/01/2009 - 12/31/2009] **SINGLE FAMILY RESIDENTIAL**

Volume Block (Gallons)	Year	Number of Customers with Bills Ending in Block	Percentage of Customers with Bills Ending in Block	Total Volume Billed in Block in Period	Percentage of Volume Billed in Block in Period
Block 1 (0-10,000)	2009	5,090	32.9%	32,578,500	14.8%
	2008	4,868	31.7%	30,847,100	13.8%
Block 2 (10,001-30,000)	2009	9,739	63.0%	161,520,500	73.3%
	2008	9,713	63.3%	162,127,100	72.3%
Block 3 (30,000+)	2009	630	4.1%	26,356,300	12.0%
	2008	762	5.0%	31,161,000	13.9%
Total	2009	15,459	100.0%	220,455,300	100.0%
	2008	15,343	100.0%	224,135,200	100.0%

Total for Reporting Period [01/01/2008 - 12/31/2008], [01/01/2009 - 12/31/2009] **SINGLE FAMILY RESIDENTIAL**

Volume Block (Gallons)	Year	Number of Customers with Bills Ending in Block	Percentage of Customers with Bills Ending in Block	Total Volume Billed in Block in Period	Percentage of Volume Billed in Block in Period
Block 1 (0-10,000)	2009	20,036	32.5%	127,099,300	14.2%
	2008	19,353	31.6%	122,059,300	13.6%
Block 2 (10,001-30,000)	2009	38,718	62.8%	645,767,100	72.1%
	2008	38,812	63.4%	650,656,200	72.3%
Block 3 (30,000+)	2009	2,905	4.7%	122,272,000	13.7%
	2008	3,044	5.0%	126,615,100	14.1%
Total	2009	61,659	100.0%	895,138,400	100.0%
	2008	61,209	100.0%	899,330,600	100.0%

TWO-FAMILY RESIDENTIAL (DUPLEX)

Billing Period 1 - [01/01/2008 - 03/31/2008], [01/01/2009 - 03/31/2009] **TWO-FAMILY RESIDENTIAL**

Volume Block (Gallons)	Year	Number of Customers with Bills Ending in Block	Percentage of Customers with Bills Ending in Block	Total Volume Billed in Block in Period	Percentage of Volume Billed in Block in Period
Block 1 (0-20,000)	2009	613	42.2%	8,135,200	21.5%
	2008	591	41.4%	7,868,800	21.6%
Block 2 (20,001-35,000)	2009	548	37.8%	14,558,500	38.4%
	2008	567	39.8%	15,124,000	41.4%
Block 3 (35,000+)	2009	290	20.0%	15,180,200	40.1%
	2008	268	18.8%	13,497,500	37.0%
Total	2009	1,451	100.0%	37,873,900	100.0%
	2008	1,426	100.0%	36,490,300	100.0%

Billing Period 2 - [04/01/2008 - 06/30/2008], [04/01/2009 - 06/30/2009] **TWO-FAMILY RESIDENTIAL**

Volume Block (Gallons)	Year	Number of Customers with Bills Ending in Block	Percentage of Customers with Bills Ending in Block	Total Volume Billed in Block in Period	Percentage of Volume Billed in Block in Period
Block 1 (0-20,000)	2009	609	42.0%	7,988,700	22.6%
	2008	629	43.3%	8,345,800	23.4%
Block 2 (20,001-35,000)	2009	578	39.9%	15,206,300	42.9%
	2008	570	39.3%	15,261,300	42.8%
Block 3 (35,000+)	2009	263	18.1%	12,218,300	34.5%
	2008	253	17.4%	12,028,700	33.8%
Total	2009	1,450	100.0%	35,413,300	100.0%
	2008	1,452	100.0%	35,635,800	100.0%

Billing Period 3 - [07/01/2008 - 09/30/2008], [07/01/2009 - 09/30/2009] **TWO-FAMILY RESIDENTIAL**

Volume Block (Gallons)	Year	Number of Customers with Bills Ending in Block	Percentage of Customers with Bills Ending in Block	Total Volume Billed in Block in Period	Percentage of Volume Billed in Block in Period
Block 1 (0-20,000)	2009	508	35.0%	6,746,800	16.9%
	2008	540	37.0%	7,121,800	18.2%
Block 2 (20,001-35,000)	2009	593	40.9%	15,879,900	39.8%
	2008	580	39.8%	15,430,200	39.4%
Block 3 (35,000+)	2009	350	24.1%	17,283,700	43.3%
	2008	338	23.2%	16,642,500	42.5%
Total	2009	1,451	100.0%	39,910,400	100.0%
	2008	1,458	100.0%	39,194,500	100.0%

Billing Period 4 - [10/01/2008 - 12/31/2008], [10/01/2009 - 12/31/2009] **TWO-FAMILY RESIDENTIAL**

Volume Block (Gallons)	Year	Number of Customers with Bills Ending in Block	Percentage of Customers with Bills Ending in Block	Total Volume Billed in Block in Period	Percentage of Volume Billed in Block in Period
Block 1 (0-20,000)	2009	564	38.9%	7,539,500	20.1%
	2008	573	39.3%	7,503,100	19.9%
Block 2 (20,001-35,000)	2009	596	41.1%	15,945,000	42.4%
	2008	587	40.3%	15,619,300	41.4%
Block 3 (35,000+)	2009	289	19.9%	14,098,000	37.5%
	2008	298	20.4%	14,581,800	38.7%
Total	2009	1,449	100.0%	37,582,500	100.0%
	2008	1,458	100.0%	37,704,200	100.0%

Total for Reporting Period [01/01/2008 - 12/31/2008], [01/01/2009 - 12/31/2009] **TWO-FAMILY RESIDENTIAL**

Volume Block (Gallons)	Year	Number of Customers with Bills Ending in Block	Percentage of Customers with Bills Ending in Block	Total Volume Billed in Block in Period	Percentage of Volume Billed in Block in Period
Block 1 (0-20,000)	2009	2,294	39.5%	30,410,200	20.2%
	2008	2,333	40.3%	30,839,500	20.7%
Block 2 (20,001-35,000)	2009	2,315	39.9%	61,589,700	40.8%
	2008	2,304	39.8%	61,434,800	41.2%
Block 3 (35,000+)	2009	1,192	20.5%	58,780,200	39.0%
	2008	1,157	20.0%	56,750,500	38.1%
Total	2009	5,801	100.0%	150,780,100	100.0%
	2008	5,794	100.0%	149,024,800	100.0%

THREE-FAMILY RESIDENTIAL (TRIPLEX)

Billing Period 1 - [01/01/2008 - 03/31/2008], [01/01/2009 - 03/31/2009] **THREE-FAMILY RESIDENTIAL**

Volume Block (Gallons)	Year	Number of Customers with Bills Ending in Block	Percentage of Customers with Bills Ending in Block	Total Volume Billed in Block in Period	Percentage of Volume Billed in Block in Period
Block 1 (0-20,000)	2009	27	33.3%	320,300	14.7%
	2008	31	38.8%	392,600	17.6%
Block 2 (20,001-60,000)	2009	53	65.4%	1,796,700	82.2%
	2008	46	57.5%	1,559,800	69.9%
Block 3 (60,000+)	2009	1	1.2%	69,100	3.2%
	2008	3	3.8%	279,600	12.5%
Total	2009	81	100.0%	2,186,100	100.0%
	2008	80	100.0%	2,232,000	100.0%

Billing Period 2 - [04/01/2008 - 06/30/2008], [04/01/2009 - 06/30/2009] **THREE-FAMILY RESIDENTIAL**

Volume Block (Gallons)	Year	Number of Customers with Bills Ending in Block	Percentage of Customers with Bills Ending in Block	Total Volume Billed in Block in Period	Percentage of Volume Billed in Block in Period
Block 1 (0-20,000)	2009	26	32.1%	322,200	14.0%
	2008	28	35.0%	358,100	15.7%
Block 2 (20,001-60,000)	2009	51	63.0%	1,692,400	73.6%
	2008	48	60.0%	1,627,600	71.4%
Block 3 (60,000+)	2009	4	4.9%	283,500	12.3%
	2008	4	5.0%	293,000	12.9%
Total	2009	81	100.0%	2,298,100	100.0%
	2008	80	100.0%	2,278,700	100.0%

Billing Period 3 - [07/01/2008 - 09/30/2008], [07/01/2009 - 09/30/2009] **THREE-FAMILY RESIDENTIAL**

Volume Block (Gallons)	Year	Number of Customers with Bills Ending in Block	Percentage of Customers with Bills Ending in Block	Total Volume Billed in Block in Period	Percentage of Volume Billed in Block in Period
Block 1 (0-20,000)	2009	22	27.2%	286,300	11.4%
	2008	21	25.9%	256,600	11.0%
Block 2 (20,001-60,000)	2009	54	66.7%	1,857,200	74.2%
	2008	58	71.6%	1,904,900	82.0%
Block 3 (60,000+)	2009	5	6.2%	359,900	14.4%
	2008	2	2.5%	162,100	7.0%
Total	2009	81	100.0%	2,503,400	100.0%
	2008	81	100.0%	2,323,600	100.0%

Billing Period 4 - [10/01/2008 - 12/31/2008], [10/01/2009 - 12/31/2009] **THREE-FAMILY RESIDENTIAL**

Volume Block (Gallons)	Year	Number of Customers with Bills Ending in Block	Percentage of Customers with Bills Ending in Block	Total Volume Billed in Block in Period	Percentage of Volume Billed in Block in Period
Block 1 (0-20,000)	2009	21	25.9%	268,900	11.5%
	2008	28	34.6%	351,200	15.9%
Block 2 (20,001-60,000)	2009	57	70.4%	1,858,600	79.8%
	2008	52	64.2%	1,779,100	80.5%
Block 3 (60,000+)	2009	3	3.7%	201,600	8.7%
	2008	1	1.2%	79,400	3.6%
Total	2009	81	100.0%	2,329,100	100.0%
	2008	81	100.0%	2,209,700	100.0%

Total for Reporting Period [01/01/2008 - 12/31/2008], [01/01/2009 - 12/31/2009] **THREE-FAMILY RESIDENTIAL**

Volume Block (Gallons)	Year	Number of Customers with Bills Ending in Block	Percentage of Customers with Bills Ending in Block	Total Volume Billed in Block in Period	Percentage of Volume Billed in Block in Period
Block 1 (0-20,000)	2009	96	29.6%	1,197,700	12.9%
	2008	108	33.5%	1,358,500	15.0%
Block 2 (20,001-60,000)	2009	215	66.4%	7,204,900	77.3%
	2008	204	63.4%	6,871,400	76.0%
Block 3 (60,000+)	2009	13	4.0%	914,100	9.8%
	2008	10	3.1%	814,100	9.0%
Total	2009	324	100.0%	9,316,700	100.0%
	2008	322	100.0%	9,044,000	100.0%

Non-Residential Rates

Non-residential customers were under the same ordinance to ban sprinkling in daytime hours. The 2009 rate case also increased the amount of the rate between rate blocks

Usage Fees per 1,000 Gallons		
Gallons	**Commercial, Industrial, Public (2007-2008 Rates)**	**Commercial, Industrial, Public (June 2009 Rates)**
0 - 75,000	$1.95	$2.33
75,001 - 1,500,000	$1.83	$2.19
Over 1,500,000	$1.61	$1.96

Metered Usage for Non-Residential in 2008 and 2009			
Billing Class	**2008 (Gallons)**	**2009 (Gallons)**	**% Change from 2009 to 2008**
Commercial	827,543,000	806,736,000	-2.47 %
Industrial	382,413,000	325,667,000	-14.84 %
Public	99,646,000	99,619,000	-0.03 %

Outdoor Water Use/Irrigation Rates

The City wide ordinance 13.11 was enacted in 2006 and applied to all homes and businesses in Waukesha and is applicable May 1 to Oct 1 each year. This ordinance bans all sprinkling during the daytime hours of 9 AM to 5:00 PM during the stated time period. Customers are allowed to irrigate two days a week according to their address. Previous studies in the United States had indicated that we could expect a 40% reduction between average day and peak day with a two a week sprinkling allowance. Fines are approved and in place for violations to this ordinance.

Year	Volume Of Water Pumped From May 1 To September 30	% Change In Volume Pumped From 2005 (Pre-Sprinkling Ordinance)	Average Day Demand In (MG*)	Peak Day Demand In (MG*)	Difference In Average Day To Peak Day (MG*)	% Reduction In Peak Day To Average Day Demand From 2005
2005	1109337000	N/A	7.78	12.87	5.09	N/A
2006	1128313000	-11.8 %	7.18	10.23	3.05	40.1%
2007	1184112000	-11.2 %	7.17	9.79	2.62	48.5%
2008	1175796000	-15.8 %	6.91	9.93	3.02	40.7%
2009	1333367000	-16.8 %	6.79	9.35	2.56	49.7%

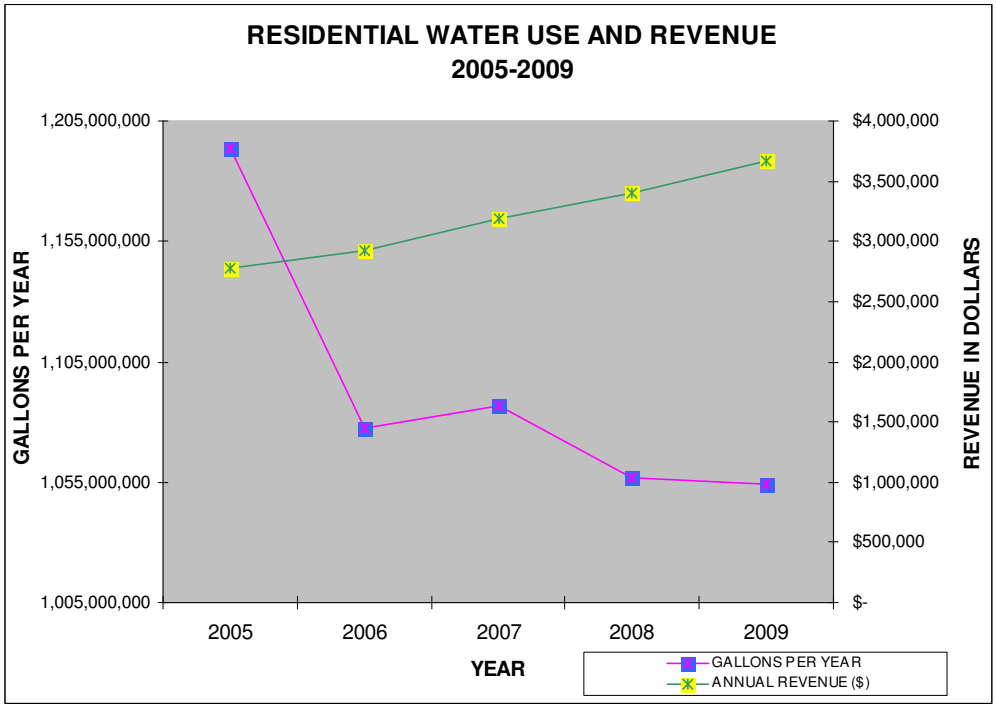
*Million Gallons

Notice to customers for Sprinkling Ordinance:

2006-Special Mailing of sprinkling brochure to each customer
2007-Bill Stuffer of sprinkling brochure to each customer
2008-Refrigerator Magnet inserted as a bill stuffer to each customer
2009-Postcard as a bill stuffer to each customer

Revenues

CHART 1: RESIDENTIAL WATER USE AND REVENUE 2005-2009



NOTE: "Residential" in the chart above includes single family, duplex and triplex customers.

Customer Education

The Waukesha Water Utility required a public hearing to be held as is customary in a utility rate case. This was advertised in the local newspapers. The Utility also had newspaper coverage of the impending rate case and a bill insert was included in the customer's bills to inform them of the change.

Which of the following measures were used to inform your customers about your utility's conservation efforts and the purpose for the conservation rate structure? [*Choose all that apply*.]

[X] Website
[X] Bill Stuffers
[X] Local Newspaper
[X] TV/Radio Advertising
[ ] Billboards
[X] Postings at Utility Offices
[X] Public Meetings
[X] School Programs
[X] Other Street Signs
[ ] None

PART II – REBATES, INCENTIVES, AND CONSERVATION EXPENSES

Conservation Program Budget and Expenses

Conservation Program Account Balance Sheet/Expenses for Period [01/01/2008- 12/31/2009]

Item	Prior Year (2008)	Current Year (2009)
Beginning Balance (Budgeted Amount)	$31,193.00	$45,061.00
Amount Escrowed (Collected)	Not required in our rate case	Not required in our rate case
Expenditures		
Toilet Rebates	$475.00	$700.00
Administrative Costs (Include salary, overhead, postage, verification, etc.)	$16,138.14	$22,651.02
Direct Advertising Costs (Include radio, television, bill stuffers, other advertising and marketing costs)	$4,572.55	$3,093.18
Other Program Costs (For example, low flow shower heads, water audits, etc.)	$200.00 (Alliance for Water Efficiency Dues)	$200.00 (Alliance for Water Efficiency Dues)
Total Expenditures	$21,385.69	$26,644.20 (*)
End of Year Balance (or Deferred Expenses)	$9,807.31	$18,416.80

(*) The 2009 Rate case was planned to be in effect in April of 2009. Due to the intervention of Clean Wisconsin in our rate case, and subsequent delay of the increased rates, expected income for the year was reduced by over $200,000. Drastic operational and capital budget cuts needed to be made to compensate for the loss of income and unexpected court costs that we incurred as a result of the intervention. These budget cuts affected our conservation program expenses.

Rebate and Incentive Programs

On October 18, 2008, Waukesha Water Utility offered a Toilet Rebate Program. The program offers a $25.00 rebate for Waukesha Water Utility customers who replaced their high-volume toilets with a High-Efficiency WaterSense 1.28 gallon per flush toilet.
Rebates are limited to one per service address.

Since October 18, 2008, Waukesha Water Utility has had 47 customers benefit from this program. These customers include 41 residential accounts, 1 commercial account, and 4 multi-family accounts.

Waukesha Water Utility's Customer Eligibility for the Rebate
Qualifications to receive a toilet rebate:

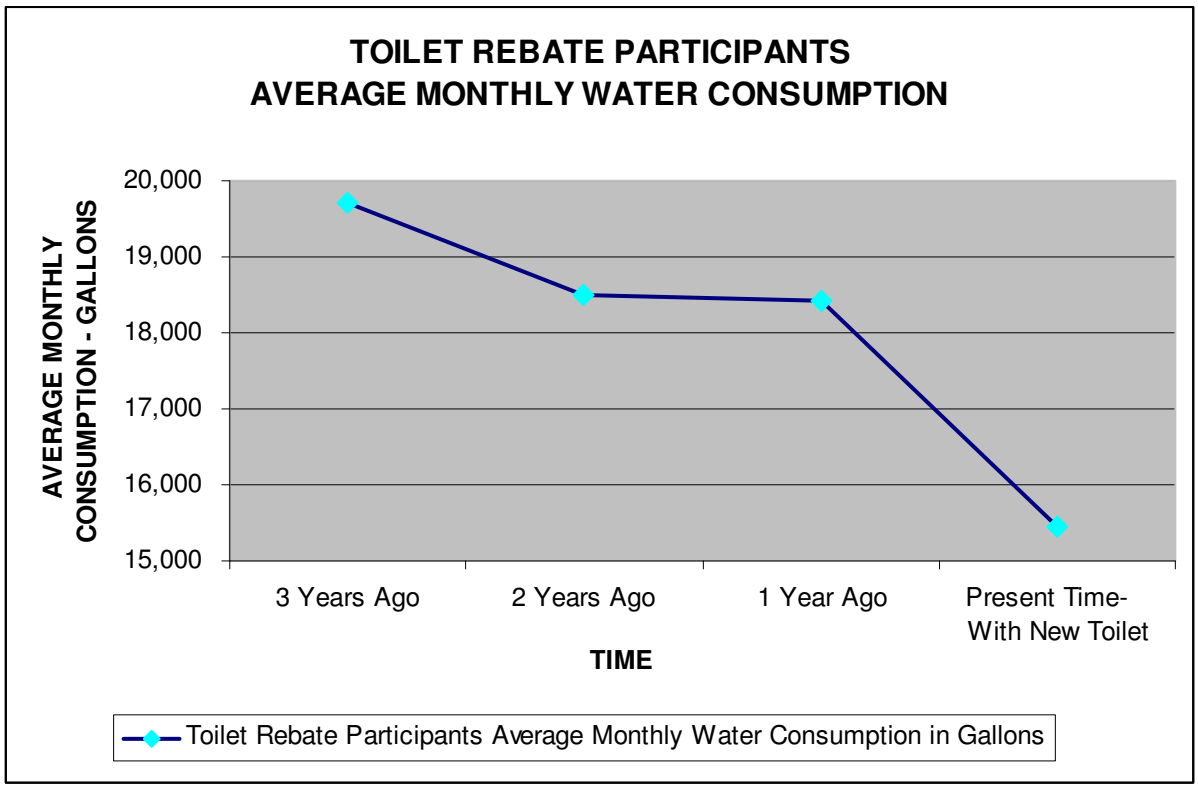
Property where toilet is installed is a customer of Waukesha Water Utility.

1. High Efficiency Toilets must replace toilets installed prior to 1994. (If you are unsure of the vintage of your toilet, you can often check the date of manufacture by looking at the underside of the tank lid. The date of the manufacture is often stamped into the porcelain. If your toilet was made after 1994, it should be an efficient model. Toilets made during the 1980s typically were designed to use 3.5 gallons per flush. Older toilets often use much more water.)
2. New toilet must be listed on EPA's WaterSense Toilet model list.
3. Applicant must be the owner of the property listed on the rebate application.
4. An original, unaltered, dated sales receipt (dated on or after Oct. 18) listing the make and model numbers, MUST accompany the rebate application.
5. Old toilets cannot be reused.
6. A picture showing proof of installation is required to be attached to the application in order to receive the rebate.
7. Applicant agrees and understands that Waukesha Water Utility or its representatives reserve the right to inspect the installation of the fixture before or after the rebate credit is mailed out to the applicant.
8. Applicant understands that Waukesha Water Utility may withhold rebate until any or all of the above listed conditions are met.

This program has been very effective. As a group, the customers have saved 631,772 gallons of water over the past year. Following is a summary showing this program's effectiveness:

TOILET REBATE TABLES AND CHARTS

Toilet Rebate Participants Average Monthly Water Consumption in Gallons				
3 Years Ago	2 Years Ago	1 Year Ago	With New Toilet	Percent Decrease
19,700	18,489	18,429	15,441	21.6%



NUMBER OF TOILET REBATES BY MONTH	
MONTH	NUMBER OF TOILET REBATES
October 2008	10
November 2008	9
January 2009	2
February 2009	2
March 2009	3
April 2009	1
May 2009	3
June 2009	5
July 2009	5
September 2009	4
October 2009	2
November 2009	1

Toilet Rebate Customer Usage Analysis Prepared 2/26/10								
	Acct. Number	High Efficiency Toilet Install Date	Total No. of Quarters with the High Efficiency Toilet	Current Avg. Consumption Per Quarter With New Toilet	Avg. Consumption Per Month 1 Year Ago Before New Toilet Installed	Avg. Consumption Per Month 2 Years Ago Before New Toilet Installed	% Change from 1 year ago Avg to Current Avg.	Calculated Water savings from 1 year ago (Gallons)
1	2-6-148.000	10/12/2008	4	14550	10775	11025	35.03%	-15100
2	1-14-683.000	10/15/2008	5	9120	13400	13300	-31.94%	17120
3	3-18-188.000	10/18/2008	4	5825	6550	9050	-11.07%	2900
4	1-3-256.000	10/18/2008	4	14450	16450	17950	-12.16%	8000
5	1-3-256.000	10/18/2008	4	14450	16450	17950	-12.16%	8000
6	1-18-428.000	10/19/2008	4	15825	17100	17100	-7.46%	5100
7	3-19-638.000	10/19/2008	4	21850	25675	30900	-14.90%	15300
8	1-30-184.00	10/20/2008	4	7375	7600	7925	-2.96%	900
9	1-21-908.000	10/23/2008	4	11525	11925	12025	-3.35%	1600
10	2-17-245.000	10/24/2008	6	7283	10700	8850	-31.93%	13668
11	3-21-800.000	11/1/2008	4	14475	17625	18400	-17.87%	12600
12	1-17-046.000	11/2/2008	4	6825	30225	30875	-77.42%	93600
13	2-18-904.000	11/8/2008	5	13080	12925	16275	1.20%	-620
14	1-1-170.000	11/10/2008	5	3600	0	0		
15	1-24-381.000	11/14/2008	4	14750	16850	16925	-12.46%	8400
16	3-6-059.000	11/20/2008	4	10550	14200	12700	-25.70%	14600
17	1-22-893.000	11/22/2008	4	21000	20875	23650	0.60%	-500
18	3-19-613.000	11/23/2008	4	28200	28550	27950	-1.23%	1400
19	3-19-642.000	11/24/2008	4	33725	39525	41175	-14.67%	23200
20	1-11-163.000	1/20/2009	3	3725	6175	5525	-39.68%	9800
21	1-15-115.000	1/30/2009	3	15633	17675	20550	-11.55%	8168
22	3-9-059.000	2/16/2009	3	10833	14700	15275	-26.31%	15468
23	2-7-109.000	2/21/2009	4	15475	20025	23175	-22.72%	18200
24	3-21-751.000	3/18/2009	3	6300	10025	9275	-37.16%	14900
25	1-8-52.000	3/27/2009	3	19433	21950	19875	-11.47%	10068
26	1-23-918.000	3/28/2009	3	24267	22875	24350	6.09%	-5568
27	2-25-025.000	4/17/2009	3	14600	18700	21475	-21.93%	16400
28	2-1-228.000	5/14/2009	2	8100	18100	17250	-55.25%	40000
29	3-21-197.000	5/15/2009	2	47750	49525	55050	-3.58%	7100
30	3-11-042.000	5/29/2009	2	18150	23500	20875	-22.77%	21400
31	3-11-042.000	6/4/2009	2	20350	23600	21400	-13.77%	13000
32	1-1-257.000	6/8/2009	2	5550	5725	4550	-3.06%	700
33	3-22-186.000	6/19/2009	3	15233	17750	18725	-14.18%	10068
34	3-24-177.000	6/22/2009	2	9500	11675	11725	-18.63%	8700
35	3-7-31.000	6/25/2009	2	56800	79600	0	-28.64%	91200

36	1-15-510.000	7/3/2009	1	10000	11925	12725	-16.14%	7700
37	3-19-303.000	7/6/2009	2	33550	33775	33325	-0.67%	900
38	2-14-477.000	7/10/2009	2	10550	14950	15500	-29.43%	17600
39	1-16-605.000	7/11/2009	1	8500	16000	17725	-46.88%	30000
40	3-23-065.000	7/18/2009	2	12900	31050	15275	-58.45%	72600
41	1-12-616.000	9/6/2009	1	29200	28275	26550	3.27%	-3700
42	1-15-835.000	9/12/2009	1	15100	17450	14450	-13.47%	9400
43	1-13-490.000	9/18/2009	1	11600	6000	10625	93.33%	-22400
44	1-8-002.000	9/30/2009	4	39075	36450	34175	7.20%	-10500
45	1-17-200.000	10/2/2009	1	6900	18200	9350	-62.09%	45200
46	2-22-283.000	10/30/2009	1	7800	6625	7500	17.74%	-4700
47	2-24-013.000	11/13/2009	1	5000	4975	5900	0.50%	-100
							Total Gallons Saved from Toilet Rebate Group in 2009 from 1 year ago	**631,772**

Other Water Conservation Measures

We continue to utilize and implement our Water Conservation and Protection Plan that was adopted in 2006. http://www.ci.waukesha.wi.us/web/guest/waterconservationandprotectionplan

The City of Waukesha in partnership with Waukesha County created the Waukesha County Water Conservation Coalition in 2006. Past PSC reports have outlined the mission of this coalition and can also be found at our website: http://www.wisconsinwaterwise.org/

During 2008, the Waukesha County Coalition ran a residential water contest for City of Waukesha Water Utility customers. In 2009 the Utility participated in Waukesha Environmental Action League's March conference to present the prizes to the top winners of the contest. The Utility, along with one of the contest winners were interviewed on Wisconsin Public Radio on March 17, 2009. Local Milwaukee TV 6 morning program with Gus Gnorski filmed a morning event at the Water Utility on March 17. There were 3 segments where the utility highlighted components of its conservation program:

1. The Mayor affirmed the City's commitment to water conservation.
2. Kohler, inc. demonstrated low flow toilets and talk about our toilet rebate program
3. The County and City talked about the rain barrel programs they have available and our ordinance.

Throughout 2009 Waukesha Water Utility continued to participate in the coalition's committee work:

- Executive Board
- Business and Industry
- Regional Water Utility Cooperation at SEWRPC
- Residential
- Education

The Education committee has been active planning a Water and Energy Event at the Waukesha County Fairgrounds for May 7 and May 8. May 7 is planned to present Business and Utility information. May 8 is for residential water and energy conservation that will include a "kid's zone" to help inspire and educate the youth in our larger community on conservation.

The Waukesha Water Utility continues its alliance with Waukesha School District. A utility employee conducts training sessions through their environmental education department with fifth graders. We again saw close to 1000 students at one of our well houses where we show the students where our water comes from and why and how important it is to use our resource conservatively and efficiently.

PART III – OTHER INFORMATION

Water Sales Trends

Total Water Sales for Period [01/01/2006 - 12/31/2009]

Customer Class	2006	2007	2008	2009	Percentage Change from 2009 to 2006
Residential	$2,914,420	$3,261,271	$3,392,265	$3,662,592.76	+25.7 %
Commercial	$1,613,037	$1,804,015	$1,894,367	$2,017,140.85	+25.1 %
Industrial	$568,824	$653,862	$684,969	$656,030.96	+15.3 %
Public Authority	$188,058	$212,884	$215,964	$234,032.84	+24.5 %
Total Sales	$5,284,339	$5,932,032	$6,187,565	$6,569,797.41	+24.3 %

Average Number of Customers for Period [01/01/2006 - 12/31/2009]

Customer Class	2006	2007	2008	2009	Percentage Change (2009 to 2006 comparison)
Residential	16,501	16,677	16827	16955	+ 2.8 %
Commercial	2235	2264	2276	2264	+ 1.3 %
Industrial	144	141	144	147	+ 2.1 %
Public Authority	123	116	116	117	- 4.9 %
Total Customers	19,003	19,198	21,523	19,483	+ 2.5 %

Total Water Volumes Billed for Period [01/01/2006 - 12/31/2009]

Customer Class	2006	2007	2008	2009	Percentage Change (2009 to 2006 comparison)
Residential	1077127000	1086542000	1056650000	1054288000	- 2.1 %
Commercial	858062000	846566000	827543000	806736000	- 6.0 %
Industrial	424603000	404079000	382413000	325667000	- 23.3 %
Public Authority	109846000	110532000	99646000	99619000	- 9.3 %
Total Volume of Sales	2469638000	2447719000	2366252000	2286310000	- 7.4 %

Water Loss and Unaccounted For Water

Waukesha Water Utility had 34 main breaks in 2009. We had only 29 breaks in 2008. We currently have over 337 miles of water main. Our number of breaks to mile of water main ratio is very small. We did have 2 main breaks under a road project where they pulverized the existing pavement. A leak detection survey by an outside consultant was performed on this portion of main to determine if any further leaks were detected. The result of that survey indicated there were no main breaks.

Year	Total Sales (Thousands of Gallons)	Unaccounted for Water (Thousands of Gallons)	Unsold Accounted for Water (Thousands of Gallons)	Total Water Pumped (Thousands of Gallons)	% Un-accounted for water
2009	2,286,310	165,655	27,930	2,479,895	7
2008	2,366,252	126,833	37,879	2,528,933	4
2007	2,447,719	167,172	3,791	2,618,641	6
2006	2,469,638	136,136	14,676	2,622,418	5
2005	2,616,913	209,543	5,054	2,838,403	7
2004	2,528,554	164,257	6,169	2,699,006	6
2003	2,653,921	138,710	3,228	2,795,858	5
2002	2,831,912	99,764	21,540	2,953,217	3
2001	2,703,549	80,511	37,909	2,821,969	3
2000	2,685,085	131,630	19,426	2,836,141	5
1999	2,859,918	144,912	23,584	3,028,414	5

Waukesha Water Utility Conservation Report
Docket 6240-WR-106
March 1, 2010

Additional Information

There are varying factors that influence water usage in a community. It is very difficult to determine the exactness of the effectiveness of a conservation program. We keep records of rainfall, temperatures, economic conditions, and development trends as indicators of our water use patterns. We share data with neighboring utilities to negate some of the variability and unknowns as regard to weather. Below you will see the records for Waukesha Water Utility, City of Brookfield Water, City of Oconomowoc and the City of Pewaukee. We can see from this data comparison that our major difference in water usage is in summer pumping. We have effectively reduced our peak demands and thereby lowering the water use from the months of May 1 to October 1.

We can also conclude from the data below that due to our extensive public relations efforts, there are regional benefits as well.

Waukesha Pumpage		
	Total for Year	May 1 to Oct 1
2005	2838403020	1333367000
2006	2623418000	1175795000
2007	2618461000	1183827000
2008	2531108000	1128313000
2009	2479905000	1109337000
2009 to 2008	-2.02%	-1.68%
2009 to 2005	-12.63%	-16.80%

Brookfield Pumpage		
	Total for Year	May 1 to Oct 1
2005	1496931000	737230000
2006	1465878000	738889000
2007	1368726000	669849000
2008	1446256000	638479000
2009	1295283000	653848000
2009 to 2008	-10.44%	2.41%
2009 to 2005	-13.47%	-11.31%

Oconomowoc Pumpage		
	Total for Year	May 1 to Oct 1
2005	708458000	370121000
2006	673143000	337035000
2007	686683000	355702000
2008	677227000	337653000
2009	676528000	344909000
2009 to 2008	-0.10%	2.15%
2009 to 2005	-4.51%	-6.81%

Pewaukee Pumpage		
	Total for Year	May 1 to Oct 1
2005	500991000	279850000
2006	479448089	262316861
2007	445630136	232840449
2008	473648006	245615011
2009	442530424	247172062
2009 to 2008	-6.57%	0.63%
2009 to 2005	-11.67%	-11.68%

Summary/Conclusions

3/1/10

Note: Sprinkling Ordinance went into effect in 2006

Note: Inclining Rate Block Structure went into effect in June 2007

Note: 2nd Inclining Rate Block Structure went into effect in June 2009

Year	Total Pumped in Year	# Days <= 7.8 MGD	# Days > 7.8 MGD and <=8.8 MGD	# Days >8.8 MG and <=9 MG	# Days > 9 MG and <=10 MG	# Days >10 MG and <=11 MG	# Days>11 MG and <=12 MG	# Days >12 MG and <=13 MG	# Days > 13 MG	Avg. Day Pumping (gal)
2009	2479905000	330	32	2	1	0	0	0	0	6794260
2008	2528933000	328	30	6	2	0	0	0	0	6909653
*2007	2618641000	292	51	8	14	0	0	0	0	7174359
2006	2622418000	294	61	1	8	1	0	0	0	7184707
2005	2838403020	225	78	6	28	18	7	3	0	7776447
2004	2699005482	276	59	6	20	5	0	0	0	7374332
2003	2699005482	250	67	3	22	18	5	0	0	7659885
2002	2953216710	176	119	10	28	17	14	1	0	8091005
2001	2821968452	217	103	8	16	15	2	4	0	7731420
2000	2836140994	190	139	15	21	1	0	0	0	7749019
1999	3028415000	116	145	23	57	21	3	0	0	8297027
1998	3028415000	156	123	14	49	16	5	2	0	8149064

From the data above, you can see the effect of the implementation of the various programs in our conservation plan over time:

- Our total water pumped has steadily declined
- Our average day pumping has steadily declined
- The days where we needed to pump higher volumes of water have decreased.

Public Service Commission of Wisconsin
Report on Water Conservation Programs

Utility Name:	Waukesha Water Utility
Report Date:	Report Due Date – 03/01/2011
Report Period:	01/01/2010– 12/31/2010
Report Frequency:	Annual
Billing Frequency:	Quarterly
Person Submitting Report:	Nancy Quirk, P.E.

Background

The Public Service Commission ordered the Waukesha Water Utility to report to the Commission by March 1 of each year on its water conservation programs in docket 6240-WR-106.

The order reads to provide the following information:

a. setting forth monthly [quarterly usage will be provided as Waukesha Water Utility does not bill monthly at this time] water usage for each customer class;
b. the measures taken to educate residential customers about the conservation rate structure and its intended purpose;
c. the number of single family and multi-family residential customers affected by the conservation rates;
d. the breakdown of residential usage for single family, duplex, and triplex customers per block per quarter;
e. an analysis of the effects of the overall water conservation program on customer behavior and water usage trends;
f. the total number of customers receiving a toilet rebate by customer class and any other information the utility can supply that will explain what programs are producing results and what programs , though well meaning, may be having little or no effect.

PART I – WATER CONSERVATION RATES

Our first inclining rate block structure went into effect in June of 2007. The billing system at that time was not able to separate our residential class from single family to duplex or triplex. The billing system was upgraded to accommodate those rate classes at the time our second inclining rate block structure went into effect in June of 2009.

Residential Rates

RESIDENTIAL RATES PER THOUSAND GALLONS (EFFECTIVE 6/5/09)				
		One Family	Duplex	Triplex
	Amount	Gallons	Gallons	Gallons
Block 1	$ 2.05	0 - 10,000	0 - 20,000	0 - 20,000
Block 2	$ 2.65	10,001- 30,000	20,001 - 35,000	20,001 - 60,000
Block 3	$ 3.40	Over 30,000	Over 35,000	Over 60,000

RESIDENTIAL RATES PER THOUSAND GALLONS (EFFECTIVE 6/1/07)				
		One Family	Duplex*	Triplex*
	Amount	Gallons	Gallons	Gallons
Block 1	$ 1.95	0 - 30,000	0 - 30,000	0 - 30,000
Block 2	$ 2.20	30,001- 40,000	30,001- 40,000	30,001- 40,000
Block 3	$ 2.70	Over 40,000	Over 40,000	Over 40,000

* The customer billing system did not have the duplex and triplex separated from single family until later in 2007.

Data for the water usage in our residential class of customers over 2008 and 2010 follows:

SINGLE FAMILY RESIDENTIAL

Billing Period 1 - [January 1st – March 31st], [2008-2010] **SINGLE FAMILY RESIDENTIAL**

Volume Block (Gallons)	Year	Number of Customers with Bills Ending in Block	Percentage of Customers with Bills Ending in Block	Total Volume Billed in Block in Period	Percentage of Volume Billed in Block in Period
Block 1 (0-10,000)	2010	5,452	35.1%	34,459,700	16.6%
	2009	5,316	34.6%	33,421,400	16.0%
	2008	5,088	33.3%	31,566,200	14.9%
Block 2 (10,001-30,000)	2010	9,674	62.2%	156,750,700	75.4%
	2009	9,592	62.4%	156,263,300	74.9%

	2008	9,707	63.5%	160,089,900	75.6%
Block 3 (30,000+)	2010	419	2.7%	16,602,400	8.0%
	2009	468	3.0%	18,961,600	9.1%
	2008	486	3.2%	19,983,300	9.4%
Total	2010	15,545	100.0%	207,812,800	100.0%
	2009	15,376	100.0%	208,646,300	100.0%
	2008	15,281	100.0%	211,639,400	100.0%

Billing Period 2 - [April 1st – June 30th], [2008-2010] **SINGLE FAMILY RESIDENTIAL**

Volume Block (Gallons)	**Year**	**Number of Customers with Bills Ending in Block**	**Percentage of Customers with Bills Ending in Block**	**Total Volume Billed in Block in Period**	**Percentage of Volume Billed in Block in Period**
Block 1 (0-10,000)	2010	5,642	36.3%	35,987,800	17.4%
	2009	5,455	35.4%	34,553,500	16.6%
	2008	5,193	34.0%	32,928,300	15.6%
Block 2 (10,001-30,000)	2010	9,469	60.9%	153,631,700	74.4%
	2009	9,495	61.6%	154,892,300	74.6%
	2008	9,607	62.9%	158,400,600	75.1%
Block 3 (30,000+)	2010	431	2.8%	16,855,700	8.2%
	2009	456	3.0%	18,223,500	8.8%
	2008	482	3.2%	19,465,900	9.2%
Total	2010	15,542	100.0%	206,475,200	100.0%
	2009	15,406	100.0%	207,669,300	100.0%
	2008	15,282	100.0%	210,794,800	100.0%

Billing Period 3 - [July 1st – September 30th], [2008-2010] **SINGLE FAMILY RESIDENTIAL**

Volume Block (Gallons)	Year	Number of Customers with Bills Ending in Block	Percentage of Customers with Bills Ending in Block	Total Volume Billed in Block in Period	Percentage of Volume Billed in Block in Period
Block 1 (0-10,000)	2010	4,899	31.5%	31,028,900	13.4%
	2009	4,175	27.1%	26,545,900	10.3%
	2008	4,204	27.5%	26,717,700	10.6%
Block 2 (10,001-30,000)	2010	9,869	63.4%	166,975,200	71.8%
	2009	9,892	64.2%	173,091,000	67.0%
	2008	9,785	63.9%	170,038,600	67.3%
Block 3 (30,000+)	2010	808	5.2%	34,392,400	14.8%
	2009	1,351	8.8%	58,730,600	22.7%
	2008	1,314	8.6%	56,004,900	22.2%
Total	2010	15,576	100.0%	232,396,500	100.0%
	2009	15,418	100.0%	258,367,500	100.0%
	2008	15,303	100.0%	252,761,200	100.0%

Billing Period 4 - [October 1st – December 31st], [2008-2010] **SINGLE FAMILY RESIDENTIAL**

Volume Block (Gallons)	Year	Number of Customers with Bills Ending in Block	Percentage of Customers with Bills Ending in Block	Total Volume Billed in Block in Period	Percentage of Volume Billed in Block in Period
Block 1 (0-10,000)	2010	5,253	33.7%	33,394,800	15.3%
	2009	5,090	32.9%	32,578,500	14.8%
	2008	4,868	31.7%	30,847,100	13.8%
Block 2 (10,001-30,000)	2010	9,723	62.4%	160,186,400	73.3%
	2009	9,739	63.0%	161,520,500	73.3%
	2008	9,713	63.3%	162,127,100	72.3%
Block 3 (30,000+)	2010	609	3.9%	24,993,100	11.4%
	2009	630	4.1%	26,356,300	12.0%

	2008	762	5.0%	31,161,000	13.9%
Total	2010	15,585	100.0%	218,574,300	100.0%
	2009	15,459	100.0%	220,455,300	100.0%
	2008	15,343	100.0%	224,135,200	100.0%

Total for Reporting Period [January 1st – December 31st], [2008-2010] **SINGLE FAMILY RESIDENTIAL**

Volume Block (Gallons)	Year	Number of Customers with Bills Ending in Block	Percentage of Customers with Bills Ending in Block	Total Volume Billed in Block in Period	Percentage of Volume Billed in Block in Period
Block 1 (0-10,000)	2010	21,246	34.1%	134,871,200	15.6%
	2009	20,036	32.5%	127,099,300	14.2%
	2008	19,353	31.6%	122,059,300	13.6%
Block 2 (10,001-30,000)	2010	38,735	62.2%	637,544,000	73.7%
	2009	38,718	62.8%	645,767,100	72.1%
	2008	38,812	63.4%	650,656,200	72.3%
Block 3 (30,000+)	2010	2,267	3.6%	92,843,600	10.7%
	2009	2,905	4.7%	122,272,000	13.7%
	2008	3,044	5.0%	126,615,100	14.1%
Total	2010	62,248	100.0%	865,258,800	100.0%
	2009	61,659	100.0%	895,138,400	100.0%
	2008	61,209	100.0%	899,330,600	100.0%

TWO-FAMILY RESIDENTIAL (DUPLEX)

Billing Period 1 - [January 1st – March 31st], [2008-2010] **TWO-FAMILY RESIDENTIAL**

Volume Block (Gallons)	Year	Number of Customers with Bills Ending in Block	Percentage of Customers with Bills Ending in Block	Total Volume Billed in Block in Period	Percentage of Volume Billed in Block in Period
Block 1 (0-20,000)	2010	615	42.4%	8,033,100	22.1%
	2009	613	42.2%	8,135,200	21.5%

	2008	591	41.4%	7,868,800	21.6%
Block 2 (20,001-35,000)	2010	568	39.1%	14,949,000	41.1%
	2009	548	37.8%	14,558,500	38.4%
	2008	567	39.8%	15,124,000	41.4%
Block 3 (35,000+)	2010	269	18.5%	13,395,500	36.8%
	2009	290	20.0%	15,180,200	40.1%
	2008	268	18.8%	13,497,500	37.0%
Total	2010	1,452	100.0%	36,377,600	100.0%
	2009	1,451	100.0%	37,873,900	100.0%
	2008	1,426	100.0%	36,490,300	100.0%

Billing Period 2 - [April 1st – June 30th], [2008-2010] **TWO-FAMILY RESIDENTIAL**

Volume Block (Gallons)	**Year**	**Number of Customers with Bills Ending in Block**	**Percentage of Customers with Bills Ending in Block**	**Total Volume Billed in Block in Period**	**Percentage of Volume Billed in Block in Period**
Block 1 (0-20,000)	2010	635	43.7%	8,272,500	24.1%
	2009	609	42.0%	7,988,700	22.6%
	2008	629	43.3%	8,345,800	23.4%
Block 2 (20,001-35,000)	2010	594	40.9%	15,613,300	45.4%
	2009	578	39.9%	15,206,300	42.9%
	2008	570	39.3%	15,261,300	42.8%
Block 3 (35,000+)	2010	224	15.4%	10,472,800	30.5%
	2009	263	18.1%	12,218,300	34.5%
	2008	253	17.4%	12,028,700	33.8%
Total	2010	1,453	100.0%	34,358,600	100.0%
	2009	1,450	100.0%	35,413,300	100.0%
	2008	1,452	100.0%	35,635,800	100.0%

Billing Period 3 - [July 1st – September 30th], [2008-2010] **TWO-FAMILY RESIDENTIAL**

Volume Block (Gallons)	Year	Number of Customers with Bills Ending in Block	Percentage of Customers with Bills Ending in Block	Total Volume Billed in Block in Period	Percentage of Volume Billed in Block in Period
Block 1 (0-20,000)	2010	585	40.3%	7,565,900	20.5%
	2009	508	35.0%	6,746,800	16.9%
	2008	540	37.0%	7,121,800	18.2%
Block 2 (20,001-35,000)	2010	599	41.2%	15,907,500	43.1%
	2009	593	40.9%	15,879,900	39.8%
	2008	580	39.8%	15,430,200	39.4%
Block 3 (35,000+)	2010	269	18.5%	13,443,700	36.4%
	2009	350	24.1%	17,283,700	43.3%
	2008	338	23.2%	16,642,500	42.5%
Total	2010	1,453	100.0%	36,917,100	100.0%
	2009	1,451	100.0%	39,910,400	100.0%
	2008	1,458	100.0%	39,194,500	100.0%

Billing Period 4 - [October 1st – December 31st], [2008-2010] **TWO-FAMILY RESIDENTIAL**

Volume Block (Gallons)	Year	Number of Customers with Bills Ending in Block	Percentage of Customers with Bills Ending in Block	Total Volume Billed in Block in Period	Percentage of Volume Billed in Block in Period
Block 1 (0-20,000)	2010	596	41.2%	7,915,200	21.7%
	2009	564	38.9%	7,539,500	20.1%
	2008	573	39.3%	7,503,100	19.9%
Block 2 (20,001-35,000)	2010	582	40.2%	15,534,200	42.6%
	2009	596	41.1%	15,945,000	42.4%
	2008	587	40.3%	15,619,300	41.4%
Block 3	2010	269	18.6%	13,058,400	35.8%

(35,000+)	2009	289	19.9%	14,098,000	37.5%
	2008	298	20.4%	14,581,800	38.7%
Total	2010	1,447	100.0%	36,507,800	100.0%
	2009	1,449	100.0%	37,582,500	100.0%
	2008	1,458	100.0%	37,704,200	100.0%

Total for Reporting Period [January 1st – December 31st], [2008-2010] **TWO-FAMILY RESIDENTIAL**

Volume Block (Gallons)	Year	Number of Customers with Bills Ending in Block	Percentage of Customers with Bills Ending in Block	Total Volume Billed in Block in Period	Percentage of Volume Billed in Block in Period
Block 1 (0-20,000)	2010	2,431	41.9%	31,786,700	22.0%
	2009	2,294	39.5%	30,410,200	20.2%
	2008	2,333	40.3%	30,839,500	20.7%
Block 2 (20,001-35,000)	2010	2,343	40.4%	62,004,000	43.0%
	2009	2,315	39.9%	61,589,700	40.8%
	2008	2,304	39.8%	61,434,800	41.2%
Block 3 (35,000+)	2010	1,031	17.8%	50,370,400	34.9%
	2009	1,192	20.5%	58,780,200	39.0%
	2008	1,157	20.0%	56,750,500	38.1%
Total	2010	5,805	100.0%	144,161,100	100.0%
	2009	5,801	100.0%	150,780,100	100.0%
	2008	5,794	100.0%	149,024,800	100.0%

THREE-FAMILY RESIDENTIAL (TRIPLEX)

Billing Period 1 - [January 1st – March 31st], [2008-2010] **THREE-FAMILY RESIDENTIAL**

Volume Block (Gallons)	Year	Number of Customers with Bills Ending in Block	Percentage of Customers with Bills Ending in Block	Total Volume Billed in Block in Period	Percentage of Volume Billed in Block in Period
Block 1 (0-20,000)	2010	26	31.7%	313,800	13.6%
	2009	27	33.3%	320,300	14.7%
	2008	31	38.8%	392,600	17.6%

Block 2 (20,001-60,000)	2010	53	64.6%	1,762,100	76.3%
	2009	53	65.4%	1,796,700	82.2%
	2008	46	57.5%	1,559,800	69.9%
Block 3 (60,000+)	2010	3	3.7%	234,100	10.1%
	2009	1	1.2%	69,100	3.2%
	2008	3	3.8%	279,600	12.5%
Total	2010	82	100.0%	2,310,000	100.0%
	2009	81	100.0%	2,186,100	100.0%
	2008	80	100.0%	2,232,000	100.0%

Billing Period 2 - [April 1st – June 30th], [2008-2010] **THREE-FAMILY RESIDENTIAL**

Volume Block (Gallons)	**Year**	**Number of Customers with Bills Ending in Block**	**Percentage of Customers with Bills Ending in Block**	**Total Volume Billed in Block in Period**	**Percentage of Volume Billed in Block in Period**
Block 1 (0-20,000)	2010	30	37.0%	375,000	16.6%
	2009	26	32.1%	322,200	14.0%
	2008	28	35.0%	358,100	15.7%
Block 2 (20,001-60,000)	2010	46	56.8%	1,504,300	66.5%
	2009	51	63.0%	1,692,400	73.6%
	2008	48	60.0%	1,627,600	71.4%
Block 3 (60,000+)	2010	5	6.2%	384,400	17.0%
	2009	4	4.9%	283,500	12.3%
	2008	4	5.0%	293,000	12.9%
Total	2010	81	100.0%	2,263,700	100.0%
	2009	81	100.0%	2,298,100	100.0%
	2008	80	100.0%	2,278,700	100.0%

Billing Period 3 - [July 1st – September 30th], [2008-2010] **THREE-FAMILY RESIDENTIAL**

Volume Block (Gallons)	Year	Number of Customers with Bills Ending in Block	Percentage of Customers with Bills Ending in Block	Total Volume Billed in Block in Period	Percentage of Volume Billed in Block in Period
Block 1 (0-20,000)	2010	32	38.6%	351,100	15.6%
	2009	22	27.2%	286,300	11.4%
	2008	21	25.9%	256,600	11.0%
Block 2 (20,001-60,000)	2010	48	57.8%	1,689,100	74.9%
	2009	54	66.7%	1,857,200	74.2%
	2008	58	71.6%	1,904,900	82.0%
Block 3 (60,000+)	2010	3	3.6%	214,000	9.5%
	2009	5	6.2%	359,900	14.4%
	2008	2	2.5%	162,100	7.0%
Total	2010	83	100.0%	2,254,200	100.0%
	2009	81	100.0%	2,503,400	100.0%
	2008	81	100.0%	2,323,600	100.0%

Total for Reporting Period [January 1st – December 31st], [2008-2010] **THREE-FAMILY RESIDENTIAL**

Volume Block (Gallons)	Year	Number of Customers with Bills Ending in Block	Percentage of Customers with Bills Ending in Block	Total Volume Billed in Block in Period	Percentage of Volume Billed in Block in Period
Block 1 (0-20,000)	2010	28	35.0%	306,900	13.1%
	2009	21	25.9%	268,900	11.5%
	2008	28	34.6%	351,200	15.9%
Block 2 (20,001-60,000)	2010	47	58.8%	1,668,700	71.0%
	2009	57	70.4%	1,858,600	79.8%
	2008	52	64.2%	1,779,100	80.5%
Block 3 (60,000+)	2010	5	6.3%	373,300	15.9%
	2009	3	3.7%	201,600	8.7%

	2008	1	1.2%	79,400	3.6%
Total	2010	80	100.0%	2,348,900	100.0%
	2009	81	100.0%	2,329,100	100.0%
	2008	81	100.0%	2,209,700	100.0%

Total for Reporting Period [01/01/2008 - 12/31/2008], [01/01/2010 - 12/31/2010] **THREE-FAMILY RESIDENTIAL**

Volume Block (Gallons)	**Year**	**Number of Customers with Bills Ending in Block**	**Percentage of Customers with Bills Ending in Block**	**Total Volume Billed in Block in Period**	**Percentage of Volume Billed in Block in Period**
Block 1 (0-20,000)	2010	116	35.6%	1,346,800	14.7%
	2009	96	29.6%	1,197,700	12.9%
	2008	108	33.5%	1,358,500	15.0%
Block 2 (20,001-60,000)	2010	194	59.5%	6,624,200	72.2%
	2009	215	66.4%	7,204,900	77.3%
	2008	204	63.4%	6,871,400	76.0%
Block 3 (60,000+)	2010	16	4.9%	1,205,800	13.1%
	2009	13	4.0%	914,100	9.8%
	2008	10	3.1%	814,100	9.0%
Total	2010	326	100.0%	9,176,800	100.0%
	2009	324	100.0%	9,316,700	100.0%
	2008	322	100.0%	9,044,000	100.0%

Non-Residential Rates

Non-residential customers were under the same ordinance to ban sprinkling in daytime hours. The 2009 rate case also increased the amount of the rate between rate blocks

Usage Fees per 1,000 Gallons		
Gallons	**Commercial, Industrial, Public (2007-2008 Rates)**	**Commercial, Industrial, Public (June 2009 Rates)**
0 - 75,000	$1.95	$2.33
75,001 - 1,500,000	$1.83	$2.19
Over 1,500,000	$1.61	$1.96

Metered Usage for Non-Residential in 2008 and 2009					
Billing Class	**2008 (Gallons)**	**2009 (Gallons)**	**2010 (Gallons)**	**% Change from 2010 to 2009**	**% Change from 2010 to 2008**
Commercial	827,543,000	806,736,000	801,713,900	-0.62%	-3.12%
Industrial	382,413,000	325,667,000	326,289,200	+.19%	-14.68%
Public	99,646,000	99,619,000	93,491,300	-6.15%	-6.18%

Outdoor Water Use/Irrigation Rates

The City wide ordinance 13.11 was enacted in 2006 and applied to all homes and businesses in Waukesha and is applicable May 1 to Oct 1 each year. This ordinance bans all sprinkling during the daytime hours of 9 AM to 5:00 PM during the stated time period. Customers are allowed to irrigate two days a week according to their address. Previous studies in the United States had indicated that we could expect a 40% reduction between average day and peak day with a two a week sprinkling allowance. Fines are approved and in place for violations to this ordinance.

Year	Volume Of Water Pumped From May 1 To September 30	% Change In Volume Pumped From 2005 (Pre-Sprinkling Ordinance)	Average Day Demand In (MG*)	Peak Day Demand In (MG*)	Difference In Average Day To Peak Day (MG*)	% Reduction In Peak Day To Average Day Demand From 2005
2010	1074691000	-19.40	6.69	8.65	1.96	61.1%
2009	1109337000	-16.80	6.79	9.35	2.56	49.7%
2008	1128313000	-15.38	6.91	9.93	3.02	40.7%
2007	1184112000	-11.19	7.17	9.79	2.62	48.5%
2006	1175796000	-11.82	7.18	10.23	3.05	40.1%
2005	1333367000	N/A	7.78	12.87	5.09	N/A

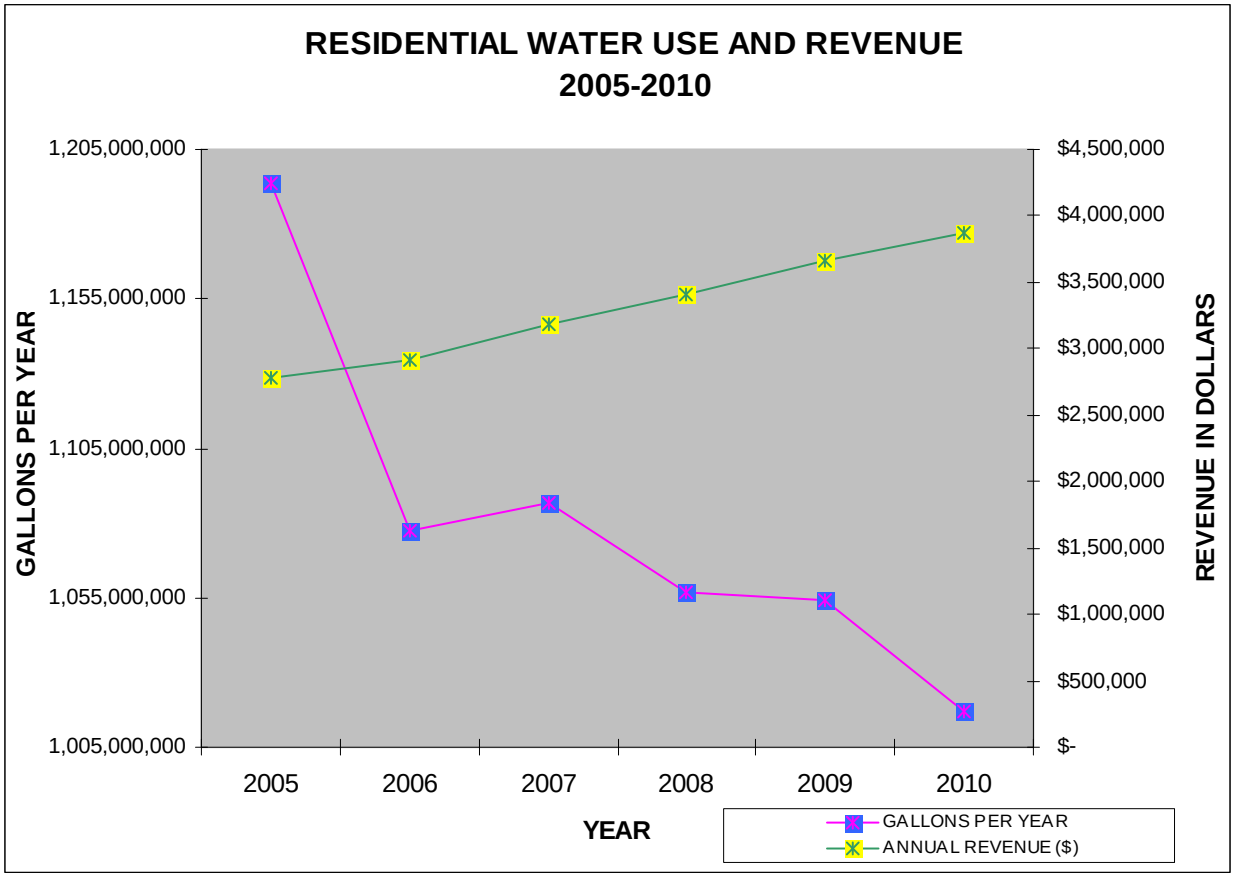
*Million Gallons

Notice to customers for Sprinkling Ordinance:
2006-Special Mailing of sprinkling brochure to each customer
2007-Bill Stuffer of sprinkling brochure to each customer
2008-Refrigerator Magnet inserted as a bill stuffer to each customer
2009-Postcard as a bill stuffer to each customer
2010-Postcard as a bill stuffer and yard signs for a "Brown Lawn" Campaign

2006-2010-Message on Water Bill under "IMPORTANT INFORMATION" from April to October reads: "The Sprinkling Ordinance is in effect May-Oct 1st. Odd number addresses water on Tuesday and Saturday; even number address on Thursdays and Sundays, before 9am and after 5pm."

Revenues

CHART 1: RESIDENTIAL WATER USE AND REVENUE 2005-2010



NOTE: "Residential" in the chart above includes single family, duplex and triplex customers.

Customer Education

Which of the following measures were used to inform your customers about your utility's conservation efforts and the purpose for the conservation rate structure? [*Choose all that apply*.]

[X] Website
[X] Bill Stuffers
[X] Local Newspaper
[X] TV/Radio Advertising
[ ] Billboards
[X] Postings at Utility Offices
[X] Public Meetings
[X] School Programs
[X] Other Street Signs
[X] Other Brown Lawn Campaign

PART II – REBATES, INCENTIVES, AND CONSERVATION EXPENSES

Conservation Program Budget and Expenses

Conservation Program Account Balance Sheet/Expenses for Period [01/01/2008- 12/31/2010]

Item	Year (2008)	Year (2009)	Current Reporting Year (2010)
Beginning Balance (Budgeted Amount)	$31,193.00	$45,061.00	$48,626.00
Amount Escrowed (Collected)	Not required in our rate case	Not required in our rate case	Not required in our rate case
Expenditures			
Toilet Rebates	$475.00	$700.00	$400.00
Administrative Costs (Include salary, overhead, postage, verification, etc.)	$16,138.14	$22,651.02	$25,407.22
Direct Advertising Costs (Include radio, television, bill stuffers, other advertising and marketing costs)	$4,572.55	$3,093.18	$2821.17
Other Program Costs (For example, low flow shower heads, water audits, etc.)	$200.00 (Alliance for Water Efficiency Dues)	$200.00 (Alliance for Water Efficiency Dues)	$474.59
Total Expenditures	$21,385.69	$26,644.20 (*)	$29,102.98
End of Year Balance (or Deferred Expenses)	$9,807.31	$18,416.80	$19,523.02

(*) The 2009 Rate case was planned to be in effect in April of 2009. Due to the intervention of Clean Wisconsin in our rate case, and subsequent delay of the increased rates, expected income for the year was reduced by over $200,000. Drastic operational and capital budget cuts needed to be made to compensate for the loss of income and unexpected court costs that we incurred as a result of the intervention. These budget cuts affected our conservation program expenses.

Rebate and Incentive Programs

On October 18, 2008, Waukesha Water Utility offered a Toilet Rebate Program. The program offers a $25.00 rebate for Waukesha Water Utility customers who replaced their high-volume toilets with a High-Efficiency WaterSense 1.28 gallon per flush toilet. Rebates are limited to one per service address.

Since October 18, 2008, Waukesha Water Utility has had 65 customers benefit from this program.

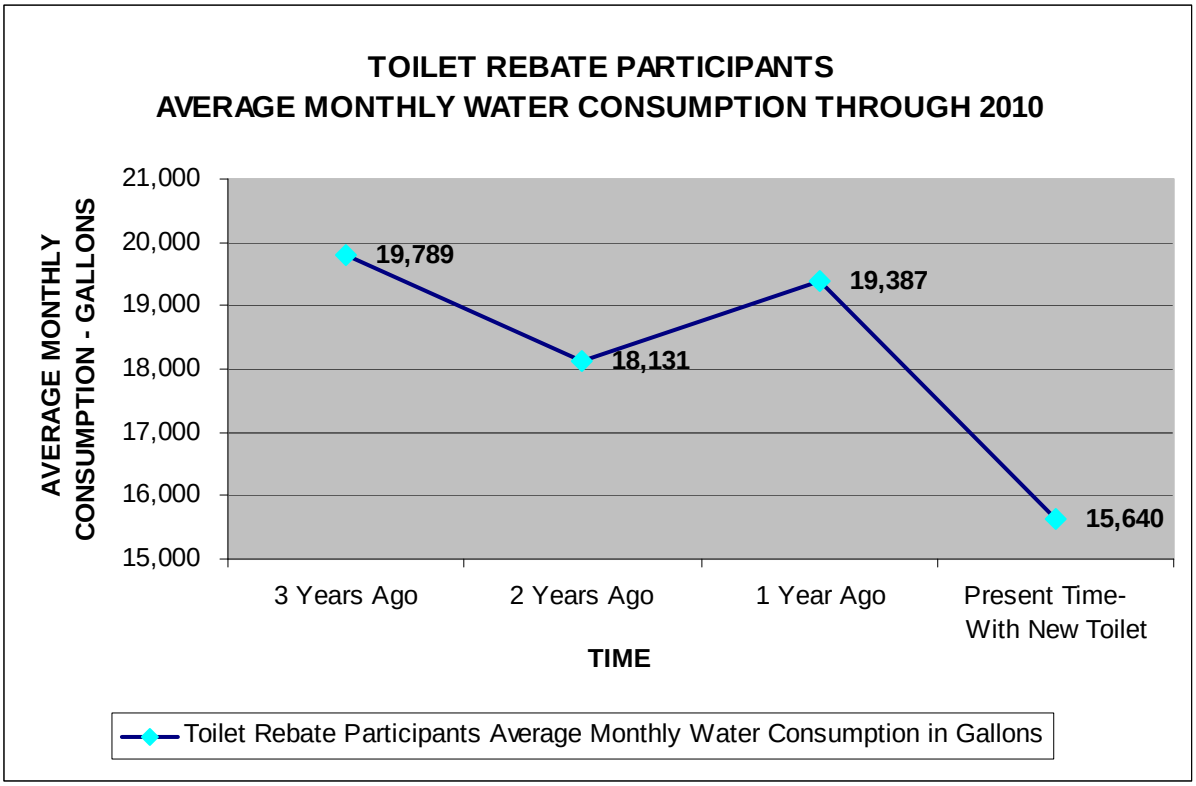
Waukesha Water Utility's Customer Eligibility for the Rebate

Qualifications to receive a toilet rebate:

1. Property where toilet is installed is a customer of Waukesha Water Utility.
2. High Efficiency Toilets must replace toilets installed prior to 1994. (If you are unsure of the vintage of your toilet, you can often check the date of manufacture by looking at the underside of the tank lid. The date of the manufacture is often stamped into the porcelain. If your toilet was made after 1994, it should be an efficient model. Toilets made during the 1980s typically were designed to use 3.5 gallons per flush. Older toilets often use much more water.)
3. New toilet must be listed on EPA's WaterSense Toilet model list.
4. Applicant must be the owner of the property listed on the rebate application.
5. An original, unaltered, dated sales receipt (dated on or after Oct. 18) listing the make and model numbers, MUST accompany the rebate application.
6. Old toilets cannot be reused.
7. A picture showing proof of installation is required to be attached to the application in order to receive the rebate.
8. Applicant agrees and understands that Waukesha Water Utility or its representatives reserve the right to inspect the installation of the fixture before or after the rebate credit is mailed out to the applicant.
9. Applicant understands that Waukesha Water Utility may withhold rebate until any or all of the above listed conditions are met.

This program has been very effective. As a group, the customers have saved 1,476,975 gallons of water. Following is a summary showing this program's effectiveness:

TOILET REBATE TABLES AND CHARTS



NUMBER OF TOILET REBATES BY MONTH	
MONTH	**NUMBER OF TOILET REBATES APPLIED FOR**
October 2008	9
November 2008	9
January 2009	2
February 2009	2
March 2009	2
April 2009	2
May 2009	1
June 2009	7
July 2009	4
August 2009	1
September 2009	5
October 2009	3
November 2009	1
January 2010	1
February 2010	3
March 2010	3
April 2010	1
May 2010	6
June 2010	2
December 2010	1
Total to Date	**65**

Toilet Rebate Customer Usage Analysis - Prepared 2/28/11								
	Account Number	High Efficiency Toilet Install Date	Total No. of Quarters with the High Efficiency Toilet	Average Consumption Per Quarter 2 Years Before New Toilet Installed	Average Consumption Per Quarter 1 Year Before New Toilet Installed	*Avg Consumption Per Quarter w/New Toilet	**Total Gallons of Water Saved With New Toilet	Avg % Per Qtr Water Savings
1	114683000	10/15/2008	8	13,300	13,400	10,988	18,900	17.70%
2	103256000	10/18/2008	9	17,950	16,450	11,589	50,500	32.62%
3	318188000	10/18/2008	9	9,050	6,550	5,600	19,800	28.21%
4	118428000	10/19/2008	8	17,100	17,100	16,513	4,700	3.44%
5	120690000	10/19/2008	9	8,625	5,400	8,511	-13,488	-21.37%
6	319638000	10/19/2008	9	30,900	25,675	21,189	63,888	25.09%
7	130184200	10/20/2008	8	7,925	7,600	7,238	4,200	6.76%
8	121908000	10/23/2008	8	12,025	11,925	11,063	7,300	7.62%
9	217245000	10/24/2008	9	9,450	10,700	9,156	8,275	9.13%
10	321800000	11/1/2008	9	18,400	17,625	14,622	30,513	18.82%
11	117046000	11/2/2008	8	30,875	30,225	6,600	191,600	78.40%
12	218904000	11/8/2008	9	16,275	12,925	11,733	25,800	19.63%
13	101170000	11/10/2008	8	0	1,600	3,138	-12,300	-96.09%
14	124381000	11/14/2008	9	16,925	16,850	14,656	20,088	13.22%
15	306059000	11/20/2008	9	12,700	14,200	10,078	30,350	25.07%
16	122893000	11/22/2008	8	28,925	28,175	22,300	50,000	21.89%
17	319613000	11/23/2008	9	27,950	28,550	26,900	12,150	4.78%
18	319642000	11/24/2008	9	41,175	39,525	40,956	-5,450	-1.50%
19	111163000	1/20/2009	7	5,525	6,175	8,714	-20,050	-48.96%
20	115115000	1/30/2009	7	20,550	17,675	15,714	23,788	17.78%
21	309059000	2/16/2009	8	15,275	14,700	11,063	31,400	26.19%
22	207109000	2/21/2009	8	23,175	20,025	16,413	41,500	24.02%
23	321751000	3/18/2009	8	9,275	10,025	8,125	12,200	15.80%
24	108052000	3/27/2009	7	19,875	23,625	19,186	17,950	11.79%
25	225025000	4/17/2009	6	19,925	19,175	15,933	21,700	18.50%
26	123918000	4/22/2009	7	24,425	22,550	19,314	29,213	17.77%
27	321197000	5/15/2009	7	55,050	49,525	38,614	95,713	26.15%
28	311042000	6/4/2009	7	21,400	23,600	18,814	25,800	16.38%
29	311042000	6/4/2009	7	21,400	23,600	18,814	25,800	16.38%
30	101257000	6/10/2009	6	4,550	5,725	4,550	3,525	11.44%
31	201228000	6/16/2009	6	17,250	18,100	8,283	56,350	53.14%
32	322186000	6/19/2009	7	18,725	17,750	14,557	25,763	20.18%
33	324177000	6/22/2009	6	11,750	11,725	9,933	10,825	15.37%
34	307031000	6/25/2009	7	0	79,600	50,971	200,400	35.97%
35	115510000	7/3/2009	6	12,725	11,925	11,500	4,950	6.69%
36	319303000	7/8/2009	6	33,325	33,775	31,050	15,000	7.45%
37	214477000	7/14/2009	5	14,375	14,675	10,380	20,725	28.54%
38	116605000	7/17/2009	5	17,725	16,000	10,720	30,713	36.43%
39	323065000	8/30/2009	6	15,275	15,525	11,617	22,700	24.57%
40	118721000	9/1/2009	5	15,400	16,000	14,660	5,200	6.62%
41	112616000	9/7/2009	5	28,275	29,200	30,980	-11,213	-7.80%
42	115835000	9/12/2009	6	19,267	17,450	15,517	17,050	15.48%

43	113490000	9/20/2009	5	10,625	12,225	9,300	10,625	18.60%
44	108002000	9/30/2009	5	36,450	39,075	27,460	51,513	27.28%
45	117200000	10/2/2009	4	8,775	9,400	5,950	12,550	34.53%
46	217250000	10/20/2009	5	16,575	16,125	14,080	11,350	13.88%
47	222283000	10/30/2009	4	7,500	9,225	6,300	8,250	24.66%
48	224013000	11/13/2009	4	5,050	5,025	3,900	4,550	22.58%
49	312002000	1/18/2010	4	12,750	16,900	13,800	4,100	6.91%
50	122092000	2/10/2010	3	23,925	20,750	16,000	19,,013	28.37%
51	121953000	2/23/2010	3	17,800	17,650	13,233	13,475	25.34%
52	102771000	2/27/2010	3	20,175	23,300	18,267	10,413	15.97%
53	116624100	3/1/2010	3	16,700	17,150	13,700	9,675	19.05%
54	123900000	3/11/2010	3	15,525	18,100	11,267	16,638	32.99%
55	114586000	3/19/2010	3	14,400	16,300	14,333	3,050	6.62%
56	205487000	4/20/2010	2	12,075	14,125	10,050	6,100	23.28%
57	320005000	5/5/2010	3	18,425	24,650	15,200	19,013	29.43%
58	120458000	5/6/2010	3	20,725	15,150	21,867	-11,788	-21.90%
59	218850000	5/10/2010	2	28,300	27,125	17,850	19,725	35.59%
60	218850000	5/10/2010	2	28,300	27,125	17,850	19,725	35.59%
61	216060000	5/14/2010	3	28,225	32,600	24,167	18,738	20.54%
62	123965000	5/20/2010	2	9,325	10,700	8,300	3,425	17.10%
63	322067000	6/21/2010	3	24,775	24,150	26,200	-5,213	-7.10%
64	321727000	6/26/2010	3	19,925	21,325	23,633	-9,025	-14.59%
65	319413000	12/10/2010	0	24825	21700	Recently Installed	NA	NA
	Sub-Totals:			1,160,392	1,240,775	1,000,956		
	Averages:			18,131	19,387	15,640		
	Total Gallons Water Saved:						**1,430,825**	
	Average Saved/Customer:						22,357	15.37%

NOTES:
***Total Consumption with New Toilet divided by number of Quarters with New Toilet**
****Gallons Saved per Quarter * Total Number of Quarters**

Other Water Conservation Measures

We continue to utilize and implement our Water Conservation and Protection Plan that was adopted in 2006. http://www.ci.waukesha.wi.us/web/guest/waterconservationandprotectionplan

The City of Waukesha in partnership with Waukesha County created the Wisconsin Water Conservation Coalition in 2006. Past PSC reports have outlined the mission of this coalition and can also be found at our website: http://www.wisconsinwaterwise.org/

During 2008, the Waukesha County Coalition ran a residential water contest for City of Waukesha Water Utility customers.

In 2009 the Utility participated in Waukesha Environmental Action League's March conference to present the prizes to the top winners of the contest. The Utility, along with one of the contest winners were interviewed on Wisconsin Public Radio on March 17, 2009. Local Milwaukee TV 6 morning program with Gus Gnorski filmed a morning event at the Water Utility on March 17. There were 3 segments where the utility highlighted components of its conservation program:

1. The Mayor affirmed the City's commitment to water conservation.
2. Kohler, inc. demonstrated low flow toilets and talk about our toilet rebate program
3. The County and City talked about the rain barrel programs they have available and our ordinance.

Throughout 2010 Waukesha Water Utility continued to participate in the coalition's committee work:

- Executive Board
- Business and Industry
- Regional Water Utility Cooperation
- Residential
- Education

In 2010, the Coalition held a Water and Energy Event at the Waukesha County Fairgrounds on May 7 and May 8. May 7 was geared for the business and utility energy and water efficiency. May 8 concentrated on residential water and energy conservation that included a "kid's zone" to help inspire and educate the youth in our larger community on conservation.

Also in 2010, the utility partnered with the coalition to begin water audits of commercial/industrial clients. We also attended the Wisconsin Restaurant Association show and exhibited for water conservation initiatives for restaurants.

The Waukesha Water Utility continues its alliance with Waukesha School District. A utility employee conducts educational sessions in collaboration with their environmental education department with fifth graders. Each year we see close to 1000 students at one of our well houses where we show the students where our water comes from and why and how important it is to use our resource conservatively and efficiently.

PART III – OTHER INFORMATION

Water Sales Trends

Total Water Sales for Period [01/01/2006 - 12/31/2010]

Customer Class	2006	2007	2008	2009	2010	Percentage Change from 2010 to 2006
Residential	$2,914,420	$3,261,271	$3,392,265	$3,662,593	$3,868,993	+32.8%
Commercial	$1,613,037	$1,804,015	$1,894,367	$2,017,141	$2,193,943	+36.0%
Industrial	$568,824	$653,862	$684,969	$656,031	$720,045	+26.6%
Public Authority	$188,058	$212,884	$215,964	$234,033	$244,700	+30.1%
Total Sales	$5,284,339	$5,932,032	$6,187,565	$6,569,797	$7,027,681	+33.0%

Average Number of Customers for Period [01/01/2006 - 12/31/2010]

Customer Class	2006	2007	2008	2009	2010	Percentage Change from 2010 to 2006
Residential	16,501	16,677	16,827	16,955	17,126	+3.79%
Commercial	2,235	2,264	2,276	2,264	2,171	-2.86%
Industrial	144	141	144	147	147	+2.08%
Public Authority	123	116	116	117	118	-4.07%
Total Customers	19,003	19,198	21,523	19,483	19,562	+2.94%

Total Water Volumes Billed for Period [01/01/2006 - 12/31/2009]

Customer Class	2006	2007	2008	2009	2010	Percentage Change 2010 to 2006
Residential	1077127000	1086542000	1056650000	1054288000	1016670300	-5.95%
Commercial	858062000	846566000	827543000	806736000	801713900	-7.03%
Industrial	424603000	404079000	382413000	325667000	326289200	-30.13%
Public Authority	109846000	110532000	99646000	99619000	93491300	-17.49%
Total Volume of Sales	2469638000	2447719000	2366252000	2286310000	2238164700	-10.34%

Water Loss and Unaccounted For Water

Waukesha Water Utility had 30 main breaks in 2010. Waukesha Water Utility had 34 main breaks in 2009. We had only 29 breaks in 2008. Please refer to **"Attachment A"** for further discussion of pressure management and water loss at Waukesha Water Utility.

Year	Total Sales (Thousands of Gallons)	Unaccounted for Water (Thousands of Gallons)	Unsold Accounted for Water (Thousands of Gallons)	Total Water Pumped (Thousands of Gallons)	% Un-accounted for water
2010	2,238,164	156,578	43,222	2,437,964	7
2009	2,286,310	165,655	27,930	2,479,895	7
2008	2,366,252	126,833	37,879	2,528,933	4
2007	2,447,719	167,172	3,791	2,618,641	6
2006	2,469,638	136,136	14,676	2,622,418	5
2005	2,616,913	209,543	5,054	2,838,403	7
2004	2,528,554	164,257	6,169	2,699,006	6
2003	2,653,921	138,710	3,228	2,795,858	5
2002	2,831,912	99,764	21,540	2,953,217	3
2001	2,703,549	80,511	37,909	2,821,969	3
2000	2,685,085	131,630	19,426	2,836,141	5
1999	2,859,918	144,912	23,584	3,028,414	5

Additional Information

There are varying factors that influence water usage in a community. It is very difficult to determine the exactness of the effectiveness of a conservation program. We keep records of rainfall, temperatures, economic conditions, and development trends as indicators of our water use patterns. We share data with neighboring utilities to negate some of the variability and unknowns as regard to weather. Below you will see the records for Waukesha Water Utility, City of Brookfield Water, City of Oconomowoc and the City of Pewaukee. We can see from this data comparison that our major difference in water usage is in summer pumping. We have effectively reduced our peak demands and thereby lowering the water use from the months of May 1 to October 1.

We can also conclude from the data below that due to our extensive public relations efforts, there are regional benefits as well.

Waukesha Pumpage		
	Total for Year	May 1 to Oct 1
2005	2838403020	1333367000
2006	2623418000	1175795000
2007	2618461000	1183827000
2008	2531108000	1128313000
2009	2479905000	1109337000
2010	2441221000	1074691000
2010 to 2009	-1.56%	-3.12%
2010 to 2005	-13.99%	-19.40%
Brookfield Pumpage		
	Total for Year	May 1 to Oct 1
2005	1496931000	737230000
2006	1465878000	738889000
2007	1368726000	669849000
2008	1446256000	638479000
2009	1295283000	653848000
2010	1272681000	607443000
2010 to 2009	-1.74%	-7.10%
2010 to 2005	-14.98%	-17.60%
Oconomowoc Pumpage		
	Total for Year	May 1 to Oct 1
2005	708458000	370121000
2006	673143000	337035000
2007	686683000	355702000
2008	677227000	337653000
2009	676528000	344909000
2010	719994000	342468000
2010 to 2009	6.42%	-0.71%
2010 to 2005	14.75%	-7.47%
Pewaukee Pumpage		
	Total for Year	May 1 to Oct 1
2005	500991000	279850000
2006	479448089	262316861
2007	445630136	232840449
2008	473648006	245615011
2009	442530424	247172062
2010	441759831	219440293
2010 to 2009	-0.17%	-11.22%
2010 to 2005	-11.82%	-21.59%

Summary/Conclusions

3/1/11

Note: Sprinkling Ordinance went into effect in 2006

Note: Inclining Rate Block Structure went into effect in June 2007

Note: 2nd Inclining Rate Block Structure went into effect in June 2009

Year	Total Pumped in Year	# Days <= 7.8 MGD	# Days > 7.8 MGD and <=8.8 MGD	# Days >8.8 MG and <=9 MG	# Days > 9 MG and <=10 MG	# Days >10 MG and <=11 MG	# Days>11 MG and <=12 MG	# Days >12 MG and <=13 MG	# Days > 13 MG	Avg. Day Pumping (gal)
2010	2441221000	342	23	0	0	0	0	0	0	6688277
2009	2479905000	330	32	2	1	0	0	0	0	6794260
2008	2528933000	328	30	6	2	0	0	0	0	6909653
*2007	2618641000	292	51	8	14	0	0	0	0	7174359
2006	2622418000	294	61	1	8	1	0	0	0	7184707
2005	2838403020	225	78	6	28	18	7	3	0	7776447
2004	2699005482	276	59	6	20	5	0	0	0	7374332
2003	2699005482	250	67	3	22	18	5	0	0	7659885
2002	2953216710	176	119	10	28	17	14	1	0	8091005
2001	2821968452	217	103	8	16	15	2	4	0	7731420
2000	2836140994	190	139	15	21	1	0	0	0	7749019
1999	3028415000	116	145	23	57	21	3	0	0	8297027
1998	3028415000	156	123	14	49	16	5	2	0	8149064

From the data above, you can see the effect of the implementation of the various programs in our conservation plan over time:

- Our total water pumped has steadily declined
- Our average day pumping has steadily declined
- The days where we needed to pump higher volumes of water have decreased.

ATTACHMENT A PAGE 1

AECOM
200 Indiana Avenue
Stevens Point, WI 54481
www.aecom.com

715 341 8110 tel
715 341 7390 fax

Final
Memorandum

To	Nancy Quirk, Waukesha Water Utility
CC	Kathy Beduhn, AECOM
Subject	Distribution Water System Pressure Waukesha Water Utility
From	Richard Hope, AECOM
Date	February 25, 2011

1.0 INTRODUCTION

The City of Waukesha has submitted an application to the Wisconsin Department of Natural Resources (DNR) for the diversion of Lake Michigan water. The DNR has requested additional information on and clarification of the application. Specifically, Wisconsin Administrative Code NR 852 (Table 2) requires the review of distribution system pressure management to determine if opportunities exist to reduce water system pressure and minimize water loss, and the DNR has requested clarification of whether Waukesha Water Utility is operating the water system within acceptable water system pressures, especially with respect to minimizing water loss. This memorandum responds to that specific request for clarification.

The Wisconsin Administrative Code NR 852 requiring the review of the distribution system pressure management is documented below.

Table 2. Required Conservation and Efficiency Measures
Wisconsin Administrative Code NR 852

CEM #	Description	Required Elements
Public Water Supply Water Use Sector (PWS)		
PWS-R1	Distribution System Pressure Management	Analyze distribution system pressure management to identify opportunities to reduce water use and minimize plumbing fixture leaks.

AECOM prepared the Water System Master Plan (August 2006) for the Waukesha Water Utility. As part of the Water System Master Plan a calibrated hydraulic model was developed and used to assist in the evaluation of system capacity and water system pressure throughout the water system. AECOM has the experience in the evaluation of water systems and specific knowledge of the Waukesha water system to provide an opinion on the whether the water system is being operated within acceptable water system pressures.

2.0 WATER SYSTEM PRESSURE

A water system needs to be designed so that adequate water system pressure is available to meet customers' needs and to provide required fire flows. In addition, regulatory requirements specify minimum pressure requirements because of health concerns that can results from the ingress of water into the water mains.

Wisconsin Administrative Code Clause 811.70 (4) discusses system pressure:

> (4) PRESSURE. All water mains, including those not designed to provide fire protection, shall be sized after a hydraulic analysis based on flow demands and pressure requirements. The minimum and maximum normal static pressure in the distribution system shall be 35 psi and 100 psi, respectively, at ground level. The system shall be designed and operated to maintain a minimum residual pressure of 20 psi at ground level at all points in the distribution system under all conditions of flow.

Further guidelines are provided in the Ten State Standard:

> 8.2 SYSTEM DESIGN
>
> 8.2.1 Pressure
>
> All water mains, including those not designed to provide fire protection, shall be sized after a hydraulic analysis (is completed) based on flow demands and pressure requirements. The system shall be designed to maintain a minimum pressure of 20 psi (140 kPa) at ground level at all points in the distribution system under all conditions of flow. The normal working pressure in the distribution system should be approximately 60 to 80 psi (410 - 550 kPa) and not less than 35 psi (240 kPa).

3.0 WAUKESHA WATER SYSTEM

Water system pressure varies throughout a distribution system due to topography and water demands. The service area for the Waukesha Water Utility has a varied topography (with elevations ranging from approximately 780 feet to 1,050 feet. To accommodate this topography change, the Waukesha Water Utility water distribution system is divided into eight pressure zones. Each pressure zone was developed to maintain system pressure within regulatory requirements.

As part of the Water System Master Plan, a detailed evaluation of the water system pressure in each pressure zone was performed. To assist in the evaluation of water system pressures and available fire flow, a detailed hydraulic model of the Waukesha water system was developed. The model allowed system pressures and fire flows to be evaluated under a range of existing and future water demand and operating conditions.

The evaluation confirmed that water system pressures were adequate to meet customer needs and fire flow requirements. One of the recommendations resulting from the evaluation was to readjust some of the pressure zone boundaries to better serve residents. The Waukesha Water Utility has implemented the recommended pressure zone boundary realignments; that realignment has improved system pressure, and from a hydraulic prospective the water system pressures are optimized.

4.0 BENEFITS OF LOWER SYSTEM PRESSURES

The previous section discussed the hydraulic reasons for the current water system pressures to ensure adequate flow to customers and the required fire flows. However, operating a water system at a lower water system pressure can have the following benefits:

1. Reduction in the number of water main failures (breaks/leaks)
2. Reduction in loss of water at leaks

These benefits and their impact on the Waukesha water system are addressed in greater detail in the following sections.

4.1. Reduction in Water Main Failures

Water mains are designed to withstand a specific pressure in excess of the pressure the pipe will experience. As with most assets, as the water main ages, its condition deteriorates, and the water main will eventually fail. Water utilities are continually replacing/rehabilitating water mains to minimize water main failures. Table 1 provides details of the number of water breaks that the Waukesha Water Utility has repaired since 2005. To benchmark this with industry guidelines, the failure rate has been converted to number of breaks per 100 miles, based on the 330 miles of water main that comprise the Waukesha water system.

Table 1. Water Main Breaks

Year	Total Number of Water Main Breaks	Water Main Breaks/100 miles of Water Mains
2005	23	7.0
2006	10	3.0
2007	21	6.4
2008	31	9.4
2009	32	9.7
2010	30	9.1

Many factors besides water main pressure—such as pipe material and corrosion—affect water main failure rate, so it is not possible to provide a standard for the allowable number of water main breaks per 100 miles. However, research from the Water Research Foundation provides the data in Table 2 regarding criteria for water main breaks/leaks.

Table 2. Criteria for Water Main Breaks/Leaks

Reference	Criteria
Distribution System Performance Evaluation American Water Works Association (AWWA) Research Foundation, 1995	Typical goal: 25-30 breaks and leaks per 100 miles
Benchmarking Performance Indicators for Water and Wastewater Utilities: 2007 Annual Survey Data and Analysis Report, AWWA, 2007	Top quartile performance range: 14.9–21.7 breaks and leaks per 100 miles
Water Audits and Loss Control Programs, AWWA M36, 2009	Performance goals: no more than 15 reported breaks and leaks per 100 miles

Therefore, the Waukesha Water Utility is well below the criteria presented in Table 2 and it does not appear that water system pressure is a major contributor to water main failure.

4.2 Reduction in Loss of Water at Leaks

The volume of water that is lost from a leak depends on water system pressure. The higher the system pressure, the greater the volume of water that will be lost through the leak; therefore, reducing system pressure reduces the volume of water lost. However, it is important to note that reducing pressure does not eliminate existing leaks.

Typically water loss, or unaccounted-for water (UFW), is specified as a percentage of water supplied, and that is how water loss is reported to the Public Service Commission (PSC) in Waukesha's annual reports. Table 3 provides a summary of UFW from 2005 to 2009.

Table 3. Unaccounted-for Water

Year	Percentage of UFW
2005	7
2006	5
2007	6
2008	4
2009	7

The PSC requires the utility to take action to reduce UFW when it reaches 15 percent. The Waukesha Water Utility is below the action level of 15 percent, and pressure does not appear to be major contributor to water loss.

AWWA (Water Audits and Loss Control Programs – M36) recommends an approach that looks at the volume of water lost and uses an Infrastructure Leakage Index (ILI) as a benchmark to compare how well a utility is managing leakage. The lower the ILI, the better the utility is managing water loss, with 1 generally being considered the lowest that is economically obtainable. As part of Waukesha's 2006 Water Master Plan, water loss was evaluated using this methodology, an ILI of 1.3 was determined for Waukesha.

Figure 1 is a reproduction from Lambert, A.O. and Dr. R. D. McKenzie, Practical Experience in using Infrastructure Leakage Index, International Water Association Conference 'Leakage Management: A Practical Approach', Lemesos, Cyprus, November 2002. The figure illustrates the ILI of seven North American systems compared to the International Water Association (IWA) International data set.

Table 4 is a reproduction from Water Audits and Loss Control Programs, AWWA M36, 2009 summarizing guidelines for the use of the ILI as a preliminary leakage target-setting tool.

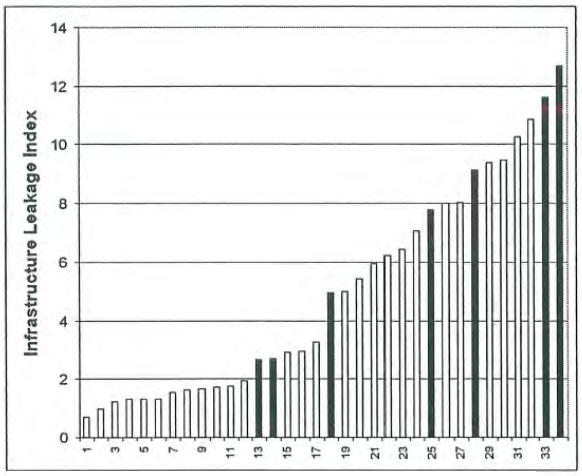


Figure 1. ILI Comparison

5.0 CONCLUSION

The Waukesha water Utility has divided the water distribution into eight pressure zones to ensure that pressure is maintained above regulatory requirements under current and projected water demand and operating conditions. Hydraulic modeling has confirmed that the current system pressure is adequate to ensure that the needed fire flows can be delivered. Historical water main breaks and leakage levels are below acceptable norms.

Table 4. Guidelines for Use of the Level Infrastructure Leakage Index as a Preliminary Leakage Target-Setting Tool (in lieu of having a determination of the system-specific economic level of leakage)

Target ILI Range	Water Resources Considerations	Operational Considerations	Financial Considerations
1.0 - 3.0	Available resources are greatly limited and are very difficult and/or environmentally unsound to develop.	Operating with system leakage above this level requires expansion of existing infrastructure and/or additional water resources to meet the demand.	Water resources are costly to develop or purchase; ability to increase revenues via water rates is greatly limited because of regulation or low ratepayer affordability.
3.0 - 5.0	Water resources are believed to be sufficient to meet long-term needs, but demand management interventions (leakage management, water conservation) are included in the long-term planning.	Existing water supply infrastructure capability is sufficient to meet long-term demand as long as reasonable leakage management controls are in place.	Water resources can be developed or purchased at reasonable expense. Periodic water rate increases can be feasibility effected and are tolerated by the customer population.
5.0 - 8.0	Water resources are plentiful, reliable, and easily extracted.	Superior reliability, capacity, and integrity of the water supply infrastructure make it relatively immune to supply shortages.	Cost to purchase or obtain/treat water is low, as are rates charged to customers.
Greater than 8.0	While operational and financial considerations may allow a long-term ILI greater than 8.0, such a level of leakage is not an effective utilization of water as a resource. Setting a target level greater than 8.0-other than as an incremental goal to a smaller long-term target-is discouraged.		
Less than 1.0	In theory, an ILI value less than 1.0 is not possible. If the calculated ILI is just under 1.0, excellent leakage control is indicated. If the water utility is consistently applying comprehensive leakage management controls, this ILI value validates the program's effectiveness. However, if strict leakage management controls are not in place, the low ILI value might be attributed to error in a portion of the water audit data, which is causing the real losses to be understated. If the calculated ILI value is less than 1.0 and only cursory leakage management controls are used, the low ILI value should be considered preliminary until it is validated by field measurements via the bottom-up approach.		
Source: Water Audits and Loss Control Programs, AWWA M36, 2009.			

Appendix C
Water Use Audit

APPENDIX C
WATER BALANCE AND EVALUATION OF SYSTEM LOSSES

As part of the Water System Master Plan, an evaluation of water loss was performed. This appendix summarizes the results of the evaluation and will provide the following:

1. Establish the current level of water loss
2. Establish the economic level of leakage
3. Identify appropriate active leakage control (ALC) approach

C.1 BACKGROUND

In the United States, guidelines for preparing a water audit are provided in AWWA Manual M36, which provides a water audit worksheet for the establishment of the level of UFW and associated leakage within a water distribution system. The water loss committee that is responsible for updating and maintaining the guidelines provided in AWWA M36 are in the process of adopting international standards for water audit and loss reduction strategies (Journal AWWA, August 2003). The revised approach to the standards will be based on work performed by the International Water Association (IWA) Water Loss Task Force. This revised approach is a radical change to the current philosophy presented in AWWA M36. A number of new terms have been introduced, but the main difference is the concept of moving away from using the term UFW and expressing UFW as a percentage of water pumped into the system to discuss leakage as an overall volume loss. For the UFW program for Waukesha Water Utility, the new approach being developed by the Water Loss Committee of AWWA, based on the IWA's Public Utilities Water Loss Task Force recommendations, will be adopted.

With the adoption of AWWA's new approach for evaluating water loss within a water distribution system, it is important to provide definitions of some of the terms currently not widespread in the industry that now will be used. The end of this appendix includes definitions of terms for reference. The definitions are based on IWA's Blue Pages for Losses from Water Supply Systems Standard Terminology and Recommended Performance Measures.

C.2 WATER BALANCE

A water balance displays how quantities of water flow into and out of the distribution system and to the customer. Figure C-1 and Table C-1 illustrate the components of a water balance based on IWA recommended best practice. All data in the water balance is expressed as a volume per year. Each component of the water balance is specifically defined in the definition of terms provided at the end of this appendix.

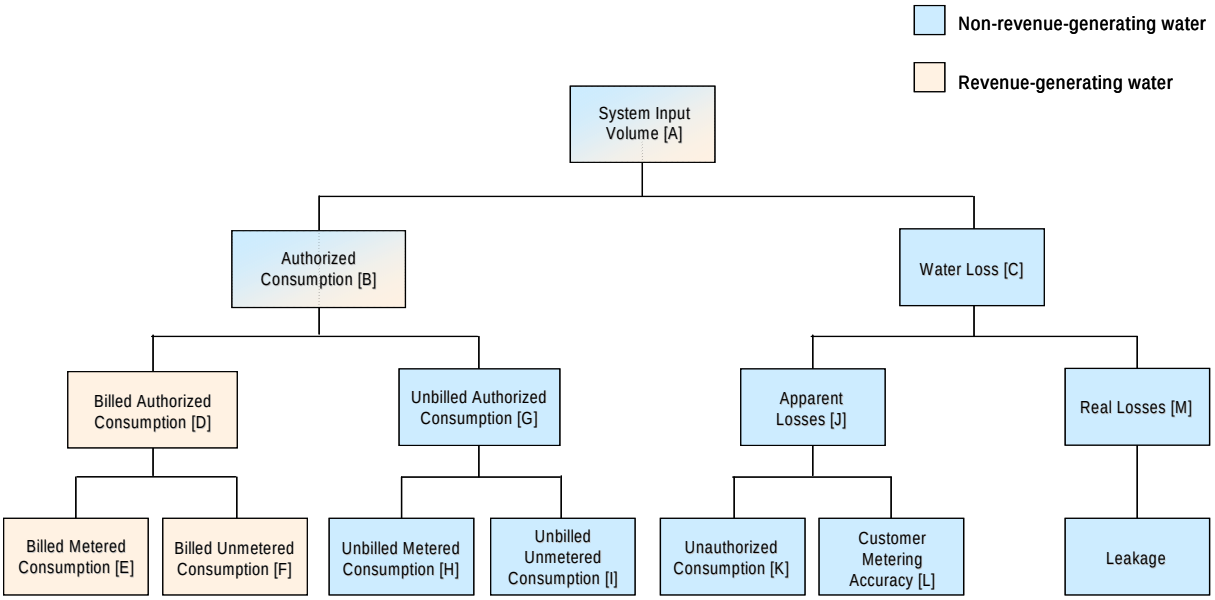


FIGURE C-1: COMPONENTS OF A WATER BALANCE

TABLE C-1
COMPONENTS OF A WATER BALANCE

System Input Volume [A]	Authorized Consumption [B]	Billed Authorized Consumption [D]	Billed Metered Consumption [E]	Revenue-Generating Water
			Billed Unmetered Consumption [F]	
		Unbilled Authorized Consumption [G]	Unbilled Metered Consumption [H]	Non-Revenue-Generating Water
			Unbilled Unmetered Consumption [I]	
	Water Losses [C]	Apparent Losses [J]	Unauthorized Consumption [K]	
			Metering Inaccuracies [L]	
		Real Losses [M]	Leakage on Transmission and/or Distribution Mains	
			Leakage and Overflows at Utility's Storage Tanks	
			Leakage on Service Connections up to Point of Customer Metering	

C.2.1 System Input Volume [A]

The system input volume (SIV) for Waukesha is the volume of water entering the distribution system. The information on the SIV was obtained from the 2004 Public Service Commission (PSC) Report.

The total SIV in 2004 was 2,699 MG.

C.2.2 Authorized Consumption [B]

Authorized consumption is any water used for all uses approved by the Utility. Most authorized consumption is metered, however, some is not. Authorized consumption is comprised of the following components:

1. Billed Authorized Consumption [D]
    a. Billed Metered Consumption [E]
    b. Billed Unmetered Consumption [F]
2. Unbilled Authorized Consumption [G]
    a. Unbilled Metered Consumption [H]
    b. Unbilled Unmetered Consumption [I]

C.2.2.1 Billed Authorized Consumption [D]

Billed authorized consumption is the annual volume of billed metered and unmetered water taken by registered customers and others who are authorized by the Utility for residential, commercial, public, and industrial purposes. Billed authorized consumption is comprised of the following two components:

1. Billed Metered Consumption [E]
2. Billed Unmetered Consumption [F]

C.2.2.2 Billed Metered Consumption [E]

Billed metered consumption is the component of billed authorized consumption that is metered. The billed metered consumption for Waukesha for the year 2004 was 2,529 MG.

C.2.2.3 Billed Unmetered Consumption [F]

No billed unmetered consumption was reported for Waukesha in 2004.

C.2.2.4 Unbilled Authorized Consumption [G]

Unbilled authorized consumption is the annual volume of unbilled metered and unmetered water taken by registered customers and others who are authorized by the Utility for residential, commercial, public, and industrial purposes.

Unbilled authorized consumption varies from community to community but generally covers the water needed to operate and maintain a water system and water used for public services such as swimming pools and irrigation. Unbilled authorized consumption is comprised of the following two components:

1. Unbilled Metered Consumption [H]
2. Unbilled Unmetered Consumption [I]

Table C-2 summarizes the Utility's unbilled water use (metered and unmetered) for public services and general operations.

TABLE C-2
UNBILLED CONSUMPTION

Description	Consumption
Unbilled Metered Consumption [H]	0 MG
Unbilled Unmetered Consumption [I]	6.2 MG
Total	6.2 MG

The unbilled metered and unmetered consumption for Waukesha for the year 2004 was 6.2 MG.

C.2.3 Water Losses [C]

Water losses are equal to the difference between the system input volume and authorized consumption. The IWA defines two categories under which all types of water loss occurrences fall:

1. Apparent Losses [J]
2. Real Losses [K]

Using the formula of "water losses = system input volume - authorized consumption" results in overall water losses of 164 MG for the year 2004 for Waukesha.

C.2.3.1 Apparent Losses [J]

Apparent losses are essentially "paper" losses and consist of water use, which is not recorded due to metering error, incorrect assumptions of unmetered use, and unauthorized consumption; therefore, the two components of apparent losses are:

1. Unauthorized Consumption [K]
2. Customer Metering Accuracy [L]

Unauthorized Consumption [K]

Unauthorized consumption includes such things as meter or meter reading tampering, illegally opened fire hydrants, unauthorized tapping into service mains, or unauthorized restoration of a water service connection after discontinuance by the Utility.

At this stage, there is no known unauthorized consumption; therefore, for 2004, the unauthorized consumption was estimated at zero.

Customer Metering Accuracy [L]

The accuracy of customer meters can have a dramatic effect on the water balance. Based on information provided by Waukesha Water Utility personnel, customer meters were assumed to have an accuracy of 99 percent; therefore, the apparent losses due to customer metering accuracy are estimated to be approximately 19 MG.

C.2.3.2 Real Losses [M]

Real losses are physical water losses in water systems up to the point of measurement of customer use. Real losses are calculated using the following equation:

Real Losses = Water Losses - Apparent Losses

Table C-3 summarizes the calculation of real losses for Waukesha for the year 2004. The estimated real losses for Waukesha for the year 2004 are 145 MG.

TABLE C-3
REAL LOSSES

Real Losses		Volume
System Input Volume	[A]	2,699 MG
Authorized Consumption	[B]=[D]+[G]=[E]+[F]+[H]+[I]	2,535 MG
Water Losses	[C]=[A]-[B]	164 MG
Apparent Losses	[J]=[K]+[L]	19 MG
Real Losses	[M]=[C]-[J]	145 MG

C.3 EVALUATION OF SYSTEM LOSSES

The previous sections described in detail the components of water balance for the Waukesha Water Utility for 2004. The water balance establishes the real losses for Waukesha. This section discusses in detail the process of evaluating leakage levels for Waukesha.

The following performance indicators are discussed:

1. Technical Indicator for Real Losses (TIRL)
2. Unavoidable Annual Real Losses (UARL)
3. Infrastructure Leakage Index (ILI)

The parameters used for the evaluation of system losses are consistent with the IWA Water Loss Task Force.

C.3.1 Water System Information

To evaluate Waukesha's system losses using the parameters used by the IWA Water Loss Task Force, the water system parameters summarized in Table C-4 are required.

TABLE C-4
WATER SYSTEM INFORMATION

Description	Entire System
Length of Water Main	305 miles
Number of Service Connections	19,159
Distance Customer Meters are Located from Edge of Street	10 feet
Percent of Time System Pressurized	100 percent
Average System Pressure	65 psi

C.3.2 TIRL

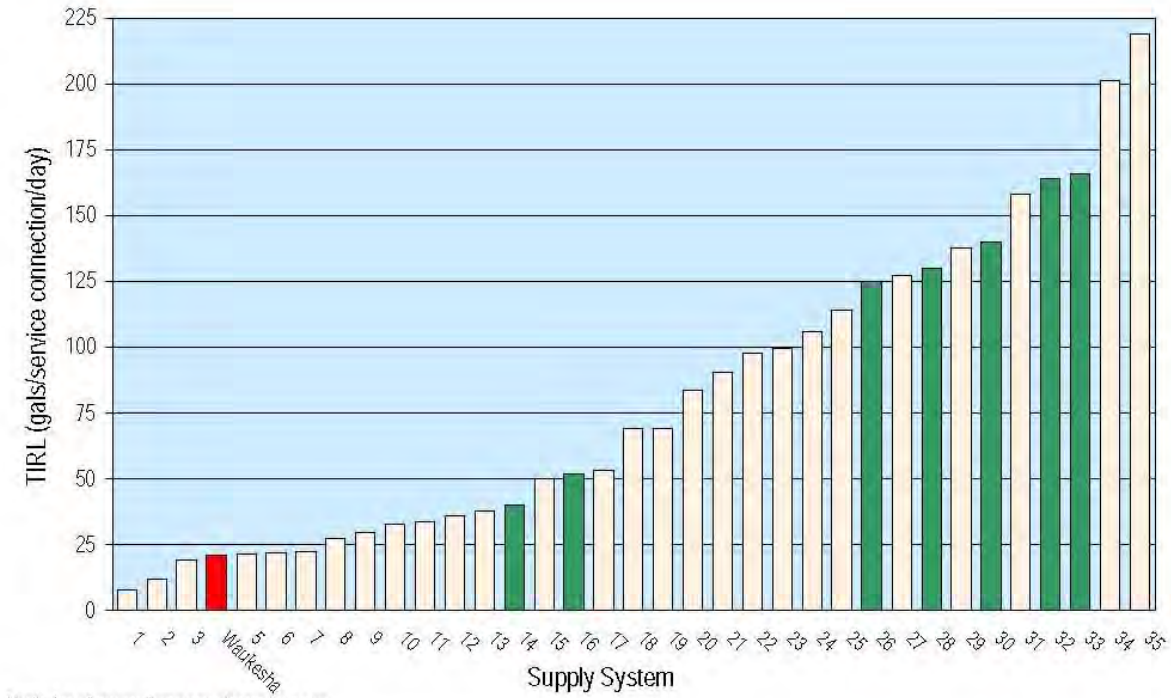
The TIRL is a performance indicator of the total volume of losses in a water distribution system. Typically, this has been defined as the percentage of the amount of water entering the distribution system. In the new approach of looking at water losses, it is recommended that TIRL be expressed in gallons per service connection per day. Table C-5 summarizes the TIRL calculation for Waukesha.

TABLE C-5
TIRL

Calculation of TIRL	Entire System
Annual Volume of Real Losses	145 MGD
Percent of Time System Pressurized	100 percent
Number of Service Connections	19,159
TIRL	21 gallons/service connection/day

Using the estimated real losses determined in the water balance of 145 MGD, the total number of service connections is estimated at 19,159, and the TIRL for Waukesha is approximately 21 gallons per service connection per day.

Figure C-2 compares the Waukesha TIRL with the TIRL of other communities throughout the world. The seven TIRLs indicated in green on the figure are North American communities. From this figure, it can be seen that the level of real losses for Waukesha is in the middle of those surveyed and on the lower end of the North American communities.



North American systems are shown in green.
Supply systems composed of 34 systems surveyed in 20 countries.
Source: Lambert, A., D. Huntington, and T.G. Brown, Water Loss Management in N.America: Just How Good Is It?, Water Loss Control Manual, 2002.

FIGURE C-2: TIRL

C.3.3 UARL

The water industry has long recognized that it is impossible to achieve zero leakage. Previous terms that have been used to describe the level of leakage that cannot be completely recovered include the following: background leakage, intrinsic leakage, and non-recoverable leakage. The term UARL has been introduced to define the level of leakage which could be achieved at the current operating pressure if there were no financial or economic constraints on the level of ALC. Similar to TIRL, UARL has the unit of gallons per service connection per day.

The UARL consists of the following main elements:

1. Background losses from undetectable leaks
2. Losses from reported leaks
3. Losses from unreported leaks

Using an approach adopted in the United Kingdom, an average UARL can be calculated for an individual water system. The parameter values used to calculate the UARL are based on published international data for minimum background loss rates, typical burst flow rates, and frequencies for infrastructure in good condition. The calculated values of the UARL for each component of infrastructure are shown in Table C-6.

The calculated UARL should be only used as a guide. Once ALC has been implemented, the background losses and reported and unreported leaks can be better defined for the Waukesha water system, and a more accurate UARL can be established.

The Table C-6 values presented as an equation in the most basic form is presented below.

$$UARL = (5.39 \times Lm + 0.15 \times Nc + 7.47 \times Lp) \times P$$

Where: *Lm* is the length of water mains in the distribution system (miles)
Nc is the number of service connections
Lp is the total length of pipe between the edge of the street and the customer meter (feet)
P is the average operating pressure (psi)
UARL is in gallons per day (gpd)

The following characteristics of the Waukesha water distribution system were used for the UARL calculation:

1. Approximately 305 miles of water main
2. Approximately 19,159 service connections
3. Average system pressure of 65 psi
4. Average length of service connection between street and water meter of 10 feet

The total UARL for Waukesha was calculated to be 16 gallons per service connection per day (312,000 gpd).

TABLE C-6
UARL

Calculation of UARL	Entire System					
Length of Water Main	305 miles					
Number of Service Connections	19,159					
Distance Customer Meters are Located from Edge of Street	10 feet					
Percent of Time System Pressurized	100 percent					
Average System Pressure	65 psi	Calculated Components of UARL				
Components of UARL	Total UARL	Background Losses	Reported Bursts	Unmetered Use	UARL Total	Units
Mains	106,792 gpd	2.87	1.75	0.77	5.39	gallons/mile of main/day/psi of pressure
Service Connections, Main to Curb-Stop	186,800 gpd	0.11	0.01	0.03	0.15	gallons/serv conn/day/psi of pressure
Service Connections, Curt-Stop to Meter	312,124 gpd	4.8	0.57	2.12	7.47	gallons/mile of main/day/psi of pressure
UARL	312,129 gpd					
UARL	16 gallons/ serv conn/day					

C.3.4 ILI

The difference between the TIRL and UARL represents the maximum potential for future savings in real losses. Also, the ratio of TIRL to UARL is in a useful, non-dimensional index of the overall condition and management of infrastructure. The ratio of TIRL to UARL is known as the ILI. Table C-7 summarizes the ILI calculation for Waukesha.

TABLE C-7
ILI

Calculation of ILI	Entire System
TIRL	21 gallons/serv conn/day
UARL	16 gallons/serv conn/day
ILI (ratio of TIRL to UARL)	1.3

Figure C-3 illustrates ILI along with the survey results of several other communities throughout the world. The seven ILIs indicated in green on the figure are North American communities. From this figure, it can be seen that Waukesha is in the low to mid range of communities surveyed.

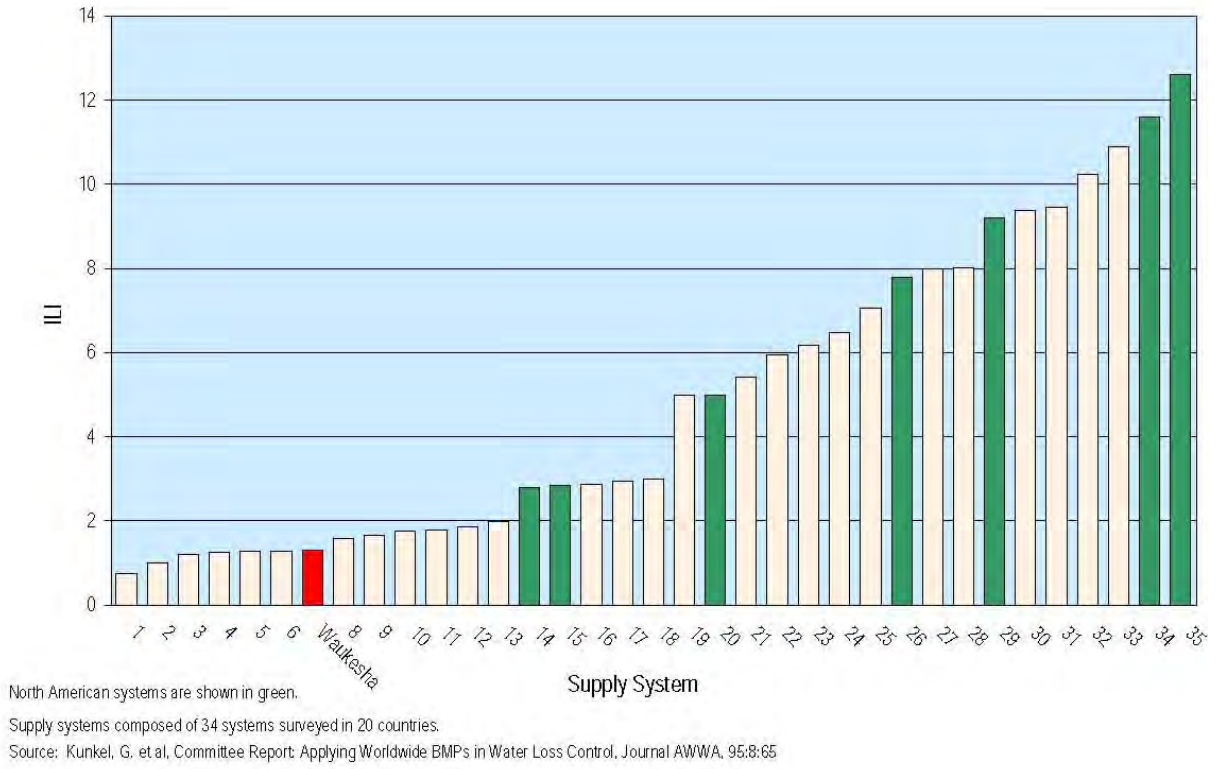


FIGURE C-3: ILI

The AWWA Water Loss Committee recently published Table C-8 as a guideline for action based on a community's ILI.

TABLE C-8
GENERAL GUIDELINES FOR SETTING A TARGET LEVEL ILI
(in lieu of having a determination of the system-specific economic level of leakage)

Target ILI Range	Water Resources Considerations	Operational Considerations	Financial Considerations
1.0 - 3.0	Available resources are greatly limited and are very difficult and/or environmentally unsound to develop.	Operating with system leakage above this level will require expansion of existing infrastructure and/or additional water resources to meet the demand.	Water resources are costly to develop or purchase; ability to increase revenues via water rates is greatly limited because of regulation or low ratepayer affordability.
3.0 - 5.0	Water resources are believed to be sufficient to meet long-term needs, but demand management interventions (leakage management, water conservation) are included in the long-term planning.	Existing water supply infrastructure capability is sufficient to meet long-term demand as long as reasonable leakage management controls are in place.	Water resources can be developed or purchased at reasonable expense; periodic water rate increases can be feasibly imposed and are tolerated by the customer population.
5.0 - 8.0	Water resources are plentiful, reliable, and easily extracted.	Superior reliability, capacity, and integrity of the water supply infrastructure make it relatively immune to supply shortages.	Cost to purchase or obtain/treat water is low, as are rates charged to customers.
Greater than 8.0	Although operational and financial considerations may allow a long-term ILI greater than 8.0, such a level of leakage is not an effective utilization of water as a resource. Setting a target level greater than 8.0 - other than as an incremental goal to a smaller long-term target - is discouraged.		

Source: AWWA Water Loss Control Committee, *Applying Worldwide BMPs in Water Loss Control*, Journal AWWA, August 2003.

The table indicates that communities with limited water sources are currently operating near the capacity of existing infrastructure or where there are financial limitations on developing additional supply sources that should set a target ILI of 1 to 3. The guidelines discourage setting a target ILI greater than 8, as such a level of leakage is not an effective utilization of water as a resource; therefore, Waukesha is much lower than the maximum target ILI recommended and is near the minimum target ILI.

C.4 SUMMARY

This summarizes the completion of the water balance and evaluation of system losses, and determination of potential actions to be taken based on the water balance. Figure C-4 summarizes the components of the 2004 water system balance.

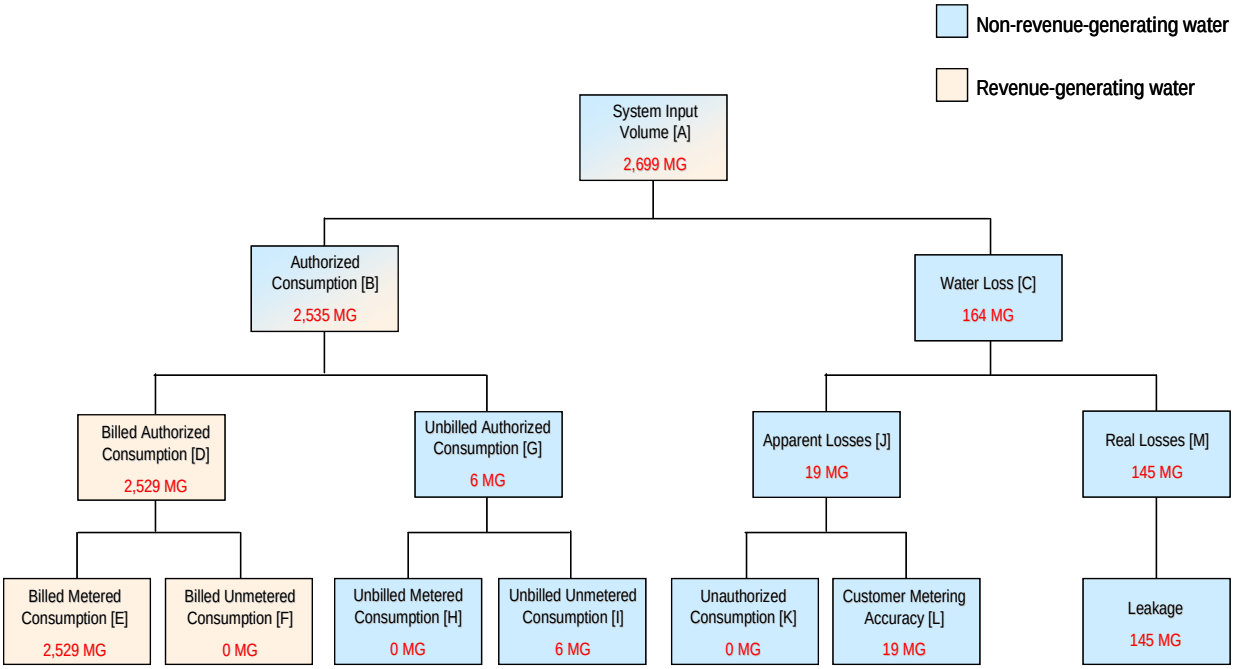


FIGURE C-4: SUMMARY OF 2004 WATER BALANCE

The following summarizes the findings from this analysis:

1. The 2004 TIRL for Waukesha is approximately 21 gallons per service connection per day. For the 34 communities surveyed throughout the world, TIRL varied from approximately 10 gallons per service connection per day to approximately 215 gallons per service connection per day, with an average of approximately 70 gallons per service connection per day; therefore, benchmarked against other communities, the TIRL for Waukesha is below average.

2. The 2004 ILI (ratio of TIRL to UARL) for Waukesha is approximately 1.3. For the 34 communities surveyed throughout the world, the ILI varied from approximately 1 to approximately 13, with an average of approximately 5; therefore, benchmarked against other communities, the ILI for Waukesha is very low.

3. It is recommended for good accounting practice that the Utility attempt to track and/or meter the current unmetered water usage such that the accuracy of the water balance can be improved.

REFERENCES

AWWA Water Loss Control Committee, *Applying Worldwide BMPs in Water Loss Control*, Journal AWWA, August 2003.

Flowmeters in Water Supply, AWWA Manual M33, Denver, Colorado, 1989.

Lambert, A., D. Huntington, and T.G. Brown, *Water Loss Management in North America: Just How Good Is It?,* Water Loss Control Manual, 2002.

Lambert, A. O., T.G. Brown, M. Tkizawa, and D. Weimers, *A Review of Performance Indicators for Real Losses from Water Supply Systems*, IWSA, J Water SRT - Aqua 48, 227-237, 1999.

Lambert, A., S. Myers, and S Trow, Managing Water Leakage, Economic and Technical Issues, Financial Times Energy, A Division of Financial Times Business Limited, London, England.

Losses from Water Supply Systems: Standard Terminology and Recommended Performance Measures, The Blue Pages, International Water Association, October 2000.

Thornton, Julian, *Water Loss Control Manual*, McGraw-Hill, 2002.

Various authors, UK Water Industry: Managing Leakage, Engineering and Operations Committee, October 1994.

Water Meters - Selection, Installation, Testing, and Maintenance, AWWA Manual M6, Denver, Colorado, 1999.

Appendix D
Summary of Water Requirements

AECOM

200 Indiana Avenue
Stevens Point, WI
54481

T 715.341.8110
F 715.341.7390
www.aecom.com

Final Draft Technical Memorandum

May 28, 2009

To: Nancy Quirk, Waukesha Water Utility

Copy: Richard Hope, AECOM

From: Kathy Beduhn, AECOM

Subject: **Summary of Water Requirements**
Waukesha, Wisconsin

As part of the 2006 Water System Master Plan project, historical water customer demands and pumpage records were reviewed and future water requirements were projected. This technical memorandum summarizes updated water pumpage projections considering 2006, 2007, and 2008 water pumpage and sales information and updated population projections for the City of Waukesha.

POPULATION PROJECTIONS

The Wisconsin Department of Administration estimated the 2008 population of the City of Waukesha to be 68,030.

The following table summarizes the population projections developed by the Southeastern Wisconsin Regional Planning Commission for the Waukesha water supply service area that were used to update water pumpage projections.

SUMMARY OF POPULATION PROJECTIONS

Year	Population
2028	85,800
2035	88,500
Ultimate	97,400

Source: Letter from Southeastern Wisconsin Regional Planning Commission dated March 17, 2009 (included in Attachment A).

WATER CONSUMPTION

The following sections summarize historical water consumption including water metered and sold to customers, total water pumpage, per capita water usage, and system maximum day demand.

Metered Water Sales and Water Pumpage

A summary of historical water sales and pumpage is provided in Table 1. Water sales and total pumpage have decreased slightly in the past 5 years. Over the 39-year period of data summarized in the table, water sales varied from a low of 2,366 million gallons per year (MGY) in 2008 to a high of 3,462 MGY in 1988. Total pumpage over the 39-year period has varied from a low of 2,366 MGY in 2008 to 3,607 MGY in 1988.

Per Capita Water Usage

City of Waukesha residential, commercial, and public water usage can be related to the City's population. An analysis of per capital water consumption for each of these customer classifications was performed from sales records and is summarized in Table 2. As indicated in this table, overall per capita sales to residential, commercial, and public customers have all remained fairly constant or declined slightly since the early 1990s. Figure 1 illustrates the City of Waukesha per capital consumption trends since 1970.

To project future water needs, the average daily water usage projection for customers was updated to reflect recent trends in water consumption. The per capital water consumption rate is summarized in the following table.

PER CAPITA WATER CONSUMPTION RATE

Per Capita Sales	Residential	Commercial	Public
Average 1970 to 2008	53 gpcd	32 gpcd	8 gpcd
Maximum 1970 to 2008	72 gpcd	39 gpcd	13 gpcd
Minimum 1970 to 2008	43 gpcd	19 gpcd	4 gpcd
Average 2000 to 2008	46 gpcd	36 gpcd	5 gpcd
Average 2005 to 2008	45 gpcd	34 gpcd	4 gpcd
Used for Projection	45 gpcd	35 gpcd	5 gpcd
Note: gpcd = gallons per capita per day			

System Maximum Day Pumpage

Table 3 summarizes the average and maximum day pumpage for each year from 1970 to 2008. A statistical analysis was performed of historical maximum day pumpage ratios. Two periods of analysis were examined, the entire period of 1970 to 2008, and the latest 11-year period from 1998 to 2008. Table 4 summarizes the results of this analysis.

Table 4 also includes an analysis of expected maximum day pumpage ratios for various confidence levels. To evaluation future water supply needs, a maximum day pumpage ratio of 168 percent was used which provides a confidence level of 98 percent based on maximum day pumpage ratios over the last 39 years and an approximately 96 percent confidence level over the last 11 years

WATER CONSUMPTION AND PUMPAGE PROJECTIONS

Water sales and pumpage projections were based on assumptions of water demand, coupled with estimates of future populations. A detailed summary of the individual components of the projected water sales and pumpage requirements is provided in Table 5. The industrial sales projections are based on planning data provided during the Water System Master Plan project that included an ultimate industrial acreage slightly less than the existing acreage and some large customer surveys indicating a decline in current water usage. In addition, unaccounted-for water (difference between pumpage and sales) was estimated to be 7 percent.

Figure 2 and Figure 3 illustrate the projected average and maximum day water supply requirements, respectively. The supply projections for the ultimate population projection for the City of Waukesha are illustrated as year 2050. The lower band illustrated on Figures 2 and 3 represents the projected water supply requirements based on current knowledge of water usage and population trends; however, there are uncertainties inherent to these projections. Because of the importance of not underestimating the future water supply needs, upper bands for projected water supply requirements were established. The upper bands for water supply projections illustrated in Figure 2 (average day) and Figure 3 (maximum day) are based on the following:

1. Residential per capita demand increased from 45 gpcd to 50 gpcd.
2. Commercial per capita demand increased from 35 gpcd to 39 gpcd.
3. Public per capita demand increased from 5 gpcd to 6 gpcd.
4. Increased population projection for 2028 by 10 percent to 94,380.
5. Increased population projection for 2035 by 10 percent to 97,350.
6. Increased ultimate population projection by 10 percent to 107,140.
7. Population projection was assumed to remain as projected to 2015 and then estimated linearly to the 2028 increased population projection.

It is recommended for long-term planning purpose that the upper band for average and maximum day water supply be used. It is also recommended that water supply be continually updated to ensure a proactive response to changes in population growth, development, and water demand patterns are addressed

SUMMARY

The following table summarizes the upper band of water supply needs for the City of Waukesha which is recommended to be used for planning purposes.

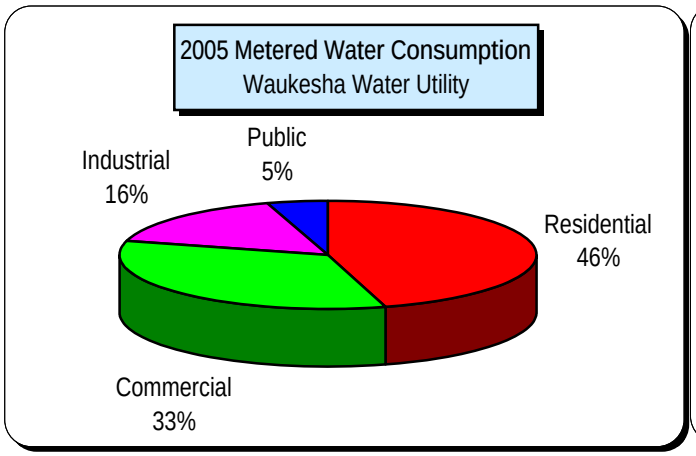
SUMMARY OF WATER SUPPLY NEEDS

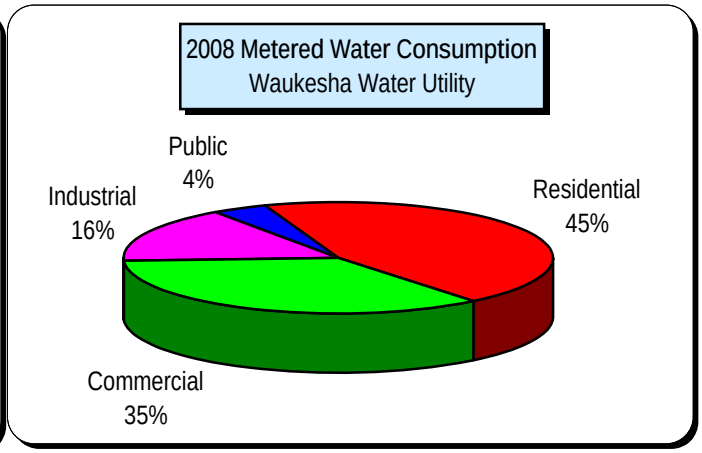
Year	Average Day Demand	Maximum Day Demand
2015	8.8 MGD	14.8 MGD
2028	10.7 MGD	18.0 MGD
2035	11.0 MGD	18.5 MGD
Ultimate (2050)	12.0 MGD	20.2 MGD
Note: MGD= million gallons per day		

TABLE 1
WATER SALES AND PUMPAGE HISTORY
WAUKESHA, WISCONSIN

Year	Annual Water Sales (MGY)					Total Sales (MGY)	Total Pumpage (MGY)	Percent Pumpage Metered
	Residential	Commercial	Industrial	Public	Other			
1970	822.892	276.190	1,535.995	169.083	11.906	2,816.1	3,006.8	93.7%
1971	890.447	280.171	1,447.088	167.631	19.188	2,804.5	3,012.4	93.1%
1972	881.497	287.192	1,565.355	172.490	31.935	2,938.5	3,072.7	95.6%
1973	975.877	323.378	1,465.842	192.700	15.252	2,973.0	3,128.1	95.0%
1974	1,025.621	328.510	1,537.468	**206.624**	13.291	3,111.5	3,242.7	96.0%
1975	1,052.895	330.920	1,594.955	187.992	21.310	3,188.1	3,336.3	95.6%
1976	1,216.208	312.331	1,539.435	192.299	**43.691**	3,304.0	3,337.7	99.0%
1977	**1,221.868**	318.338	1,528.131	186.411	25.995	3,280.7	3,297.2	99.5%
1978	1,210.372	331.961	1,575.439	192.370	25.298	3,335.4	3,376.2	98.8%
1979	1,010.523	611.688	**1,610.236**	182.680	35.070	3,450.2	3,526.8	97.8%
1980	1,006.519	610.472	1,514.522	178.821	21.278	3,331.6	3,372.4	98.8%
1981	988.866	605.862	1,381.485	181.293	28.538	3,186.0	3,137.9	**101.5%**
1982	955.905	582.575	1,167.949	173.322	31.914	2,911.7	2,983.5	97.6%
1983	1,013.178	624.780	1,125.678	190.081	21.608	2,975.3	3,025.1	98.4%
1984	992.981	624.760	1,265.934	167.928	9.780	3,061.4	3,222.1	95.0%
1985	1,046.448	636.325	1,329.419	182.512	17.915	3,212.6	3,317.3	96.8%
1986	979.119	646.851	1,266.090	171.550	16.013	3,079.6	3,172.0	97.1%
1987	1,016.124	665.474	1,283.305	186.079	17.982	3,169.0	3,348.3	94.6%
1988	1,184.474	724.986	1,346.657	189.440	16.381	**3,461.9**	**3,606.7**	96.0%
1989	1,085.159	745.900	1,166.538	169.859	16.908	3,184.4	3,239.0	98.3%
1990	1,034.574	724.123	1,030.874	160.143	1.042	2,950.8	3,076.6	95.9%
1991	1,104.334	756.742	965.288	178.332	35.004	3,039.7	3,054.8	99.5%
1992	1,060.875	794.856	745.217	101.682	0.000	2,702.6	2,873.2	94.1%
1993	1,016.286	815.077	810.622	94.230	0.000	2,736.2	2,882.5	94.9%
1994	1,076.528	846.078	769.630	104.456	0.000	2,796.7	2,974.1	94.0%
1995	1,077.515	856.522	765.975	119.209	0.000	2,819.2	3,011.5	93.6%
1996	1,087.119	860.396	763.133	120.014	0.000	2,830.7	2,892.3	97.9%
1997	1,089.493	821.105	783.390	117.377	0.000	2,811.4	2,945.3	95.5%
1998	1,109.478	837.823	796.217	116.833	0.000	2,860.4	2,974.5	96.2%
1999	1,112.499	847.914	722.097	177.408	0.000	2,859.9	3,028.4	94.4%
2000	1,067.184	848.664	660.364	108.873	0.000	2,685.1	2,816.7	95.3%
2001	1,128.475	874.030	586.552	114.492	0.000	2,703.5	2,822.0	95.8%
2002	1,185.745	**914.138**	612.856	119.173	0.000	2,831.9	2,953.2	95.9%
2003	1,176.115	895.850	461.885	120.071	0.000	2,653.9	2,795.9	94.9%
2004	1,117.325	854.624	435.004	121.601	0.000	2,528.6	2,699.0	93.7%
2005	1,193.851	874.418	428.518	120.126	0.000	2,616.9	2,831.5	92.4%
2006	1,077.127	858.062	424.603	109.846	0.000	2,469.6	2,620.5	94.2%
2007	1,086.542	846.566	404.079	110.532	0.000	2,447.7	2,618.7	93.5%
2008	1,056.650	827.543	382.413	99.646	0.000	2,366.3	2,531.0	93.5%

Maximum Value =

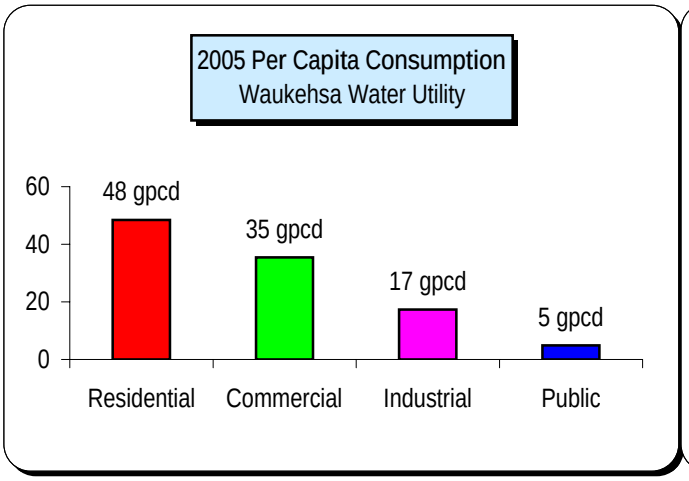




L:\work\Projects\105762\eng\demand analysis\[Chapter3_2008.xls]Table 3-02

TABLE 2
HISTORICAL PER CAPITA CONSUMPTION
WAUKESHA WATER UTILITY
WAUKESHA, WISCONSIN

Year	Estimated Population	Gallons per capita per day				
		Residential	Commercial	Industrial	Public	Total
1970	39,695	56.8	19.1	106.0	11.7	194
1971	40,762	59.8	18.8	97.3	11.3	188
1972	41,829	57.7	18.8	102.5	11.3	192
1973	42,896	62.3	20.7	93.6	12.3	190
1974	43,963	63.9	20.5	95.8	12.9	194
1975	45,030	64.1	20.1	97.0	11.4	194
1976	46,097	72.3	18.6	91.5	11.4	196
1977	47,164	71.0	18.5	88.8	10.8	191
1978	48,231	68.8	18.9	89.5	10.9	189
1979	49,298	56.2	34.0	89.5	10.2	192
1980	50,365	54.8	33.2	82.4	9.7	181
1981	51,024	53.1	32.5	74.2	9.7	171
1982	51,684	50.7	30.9	61.9	9.2	154
1983	52,343	53.0	32.7	58.9	9.9	156
1984	53,002	51.3	32.3	65.4	8.7	158
1985	53,662	53.4	32.5	67.9	9.3	164
1986	54,321	49.4	32.6	63.9	8.7	155
1987	54,980	50.6	33.2	63.9	9.3	158
1988	55,639	58.3	35.7	66.3	9.3	170
1989	56,299	52.8	36.3	56.8	8.3	155
1990	56,958	49.8	34.8	49.6	7.7	142
1991	57,613	52.5	36.0	45.9	8.5	145
1992	58,268	49.9	37.4	35.0	4.8	127
1993	58,923	47.3	37.9	37.7	4.4	127
1994	59,578	49.5	38.9	35.4	4.8	129
1995	60,232	49.0	39.0	34.8	5.4	128
1996	60,887	48.9	38.7	34.3	5.4	127
1997	61,542	48.5	36.6	34.9	5.2	125
1998	62,197	48.9	36.9	35.1	5.1	126
1999	63,027	48.4	36.9	31.4	7.7	124
2000	64,825	45.1	35.9	27.9	4.6	113
2001	65,324	47.3	36.7	24.6	4.8	113
2002	66,237	49.0	37.8	25.3	4.9	117
2003	66,807	48.2	36.7	18.9	4.9	109
2004	66,816	45.8	35.0	17.8	5.0	104
2005	67,580	48.4	35.4	17.4	4.9	106
2006	67,750	43.6	34.7	17.2	4.4	100
2007	67,880	43.9	34.2	16.3	4.5	99
2008	68,030	42.6	33.4	15.4	4.0	96
Maximum Value =						



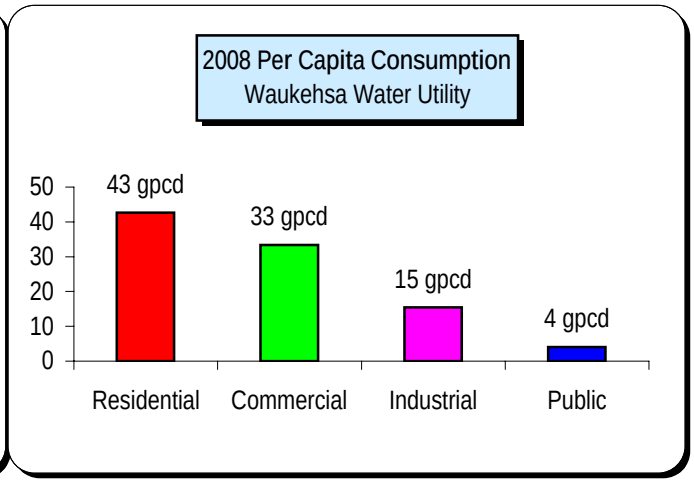


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TABLE 3
DAILY PUMPAGE VARIATIONS
WAUKESHA WATER UTILITY
WAUKESHA, WISCONSIN

Year	Avg. Day Pumpage (MGD)	Max. Day Pumpage (MGD)	Date of Maximum Day	Ratio of Max. to Avg. Day	Year	Avg. Day Pumpage (MGD)	Max. Day Pumpage (MGD)	Date of Maximum Day	Ratio of Max. to Avg. Day
1970	8.24	12.30	07/07	1.49	1990	8.43	11.67	07/17	1.38
1971	8.25	12.84	07/07	1.56	1991	8.37	12.31	08/28	1.47
1972	8.40	11.91	05/25	1.42	1992	7.85	13.86	06/11	1.77
1973	8.57	12.42	07/18	1.45	1993	7.90	10.09	08/27	1.28
1974	8.88	12.87	07/19	1.45	1994	8.15	12.40	06/19	1.52
1975	9.14	13.30	07/31	1.45	1995	8.25	12.81	06/22	1.55
1976	9.12	14.04	07/17	1.54	1996	7.90	10.66	08/14	1.35
1977	9.03	13.24	05/13	1.47	1997	8.07	11.84	06/10	1.47
1978	9.25	12.86	08/14	1.39	1998	8.15	12.79	07/14	1.57
1979	9.66	13.35	07/19	1.38	1999	8.30	11.59	07/07	1.40
1980	9.21	14.04	06/25	1.52	2000	7.72	10.15	06/27	1.31
1981	8.60	12.91	07/08	1.50	2001	7.73	12.53	07/09	1.62
1982	8.17	11.08	06/07	1.36	2002	8.09	12.78	07/17	1.58
1983	8.29	12.07	06/22	1.46	2003	7.66	11.67	08/22	1.52
1984	8.80	12.13	08/06	1.38	2004	7.39	10.48	09/13	1.42
1985	9.09	13.45	07/17	1.48	2005	7.76	12.87	06/23	1.66
1986	8.69	11.71	07/18	1.35	2006	7.18	10.23	07/18	1.42
1987	9.17	15.19	06/18	1.66	2007	7.17	9.59	06/14	1.34
1988	9.85	15.20	06/29	1.54	2008	6.93	9.93	08/19	1.43
1989	8.87	12.31	06/23	1.39					

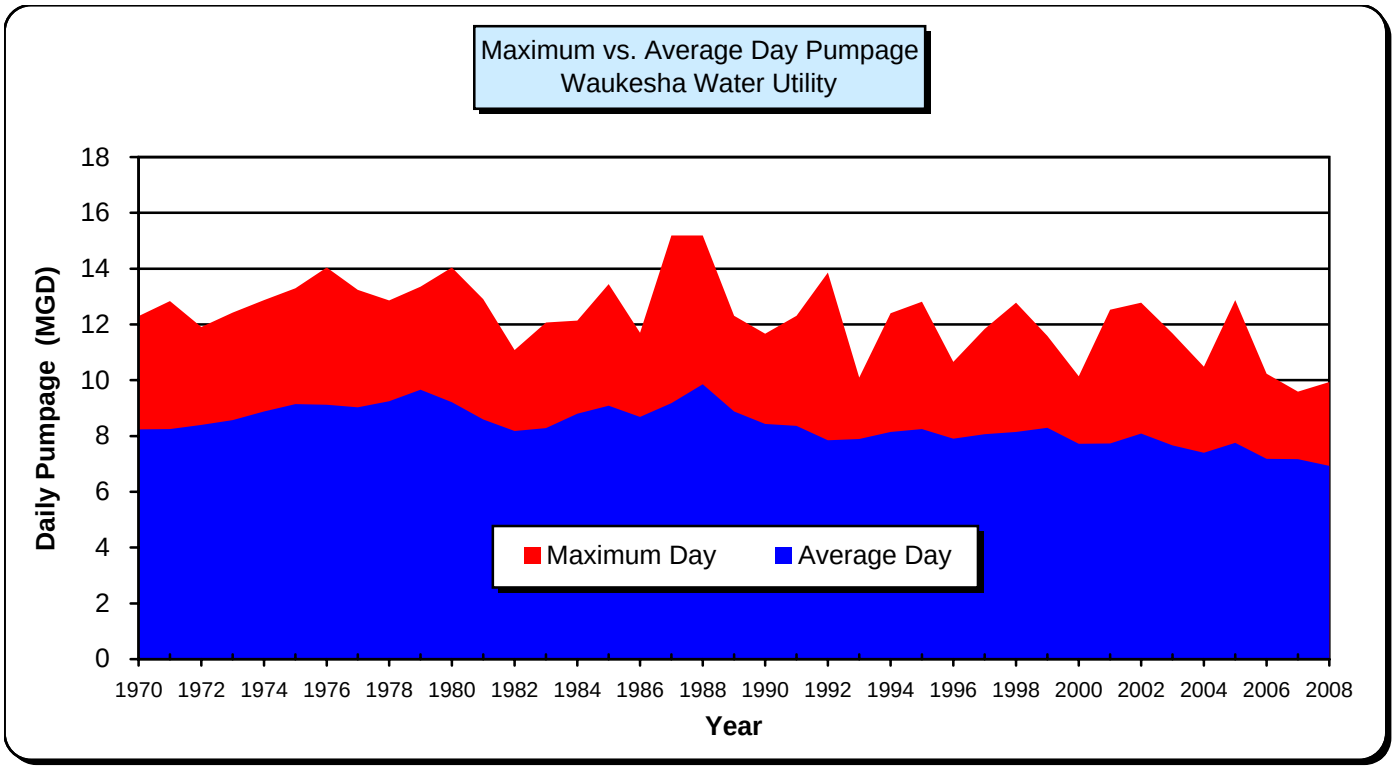

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TABLE 4

STATISTICAL ANALYSIS:
RATIO OF MAXIMUM TO AVERAGE DAY DEMAND

WAUKESHA WATER UTILITY
WAUKESHA, WISCONSIN

	1998 to 2008	1970 to 2008
Number of years of Data	11	39
Maximum Ratio - Max. to Avg. Day Pumpage	165.9%	176.6%
Minimum Ratio - Max. to Avg. Day Pumpage	131.5%	127.8%
Average Ratio Max. to Avg. Day Pumpage	148.0%	146.9%
Standard Deviation	11.1%	10.3%

Confidence Level (%)	Ratio of Max. to Avg. Day Pumpage	Ratio of Max. to Avg. Day Pumpage
80%	157%	156%
85%	159%	158%
90%	162%	160%
95%	166%	164%
98%	171%	168%
99%	174%	171%

Note

The "Confidence Level" represents the probability (%) that in any given year, the actual ratio of maximum to average day pumpage will be less than or equal to the ratio indicated in the table. The ratios in the table were determined based on a statistical analysis of historical ratios over each period of analysis, assuming a normal distribution.

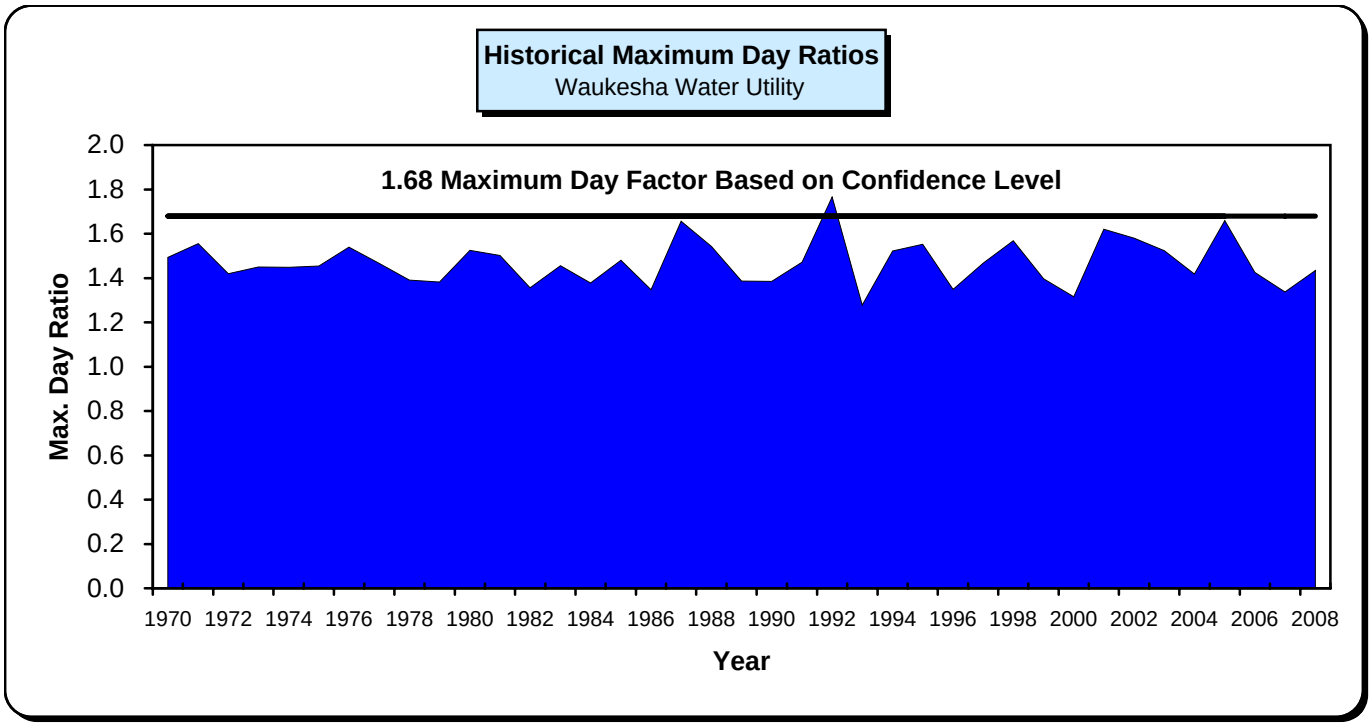

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TABLE 5

WATER SALES AND PUMPAGE PROJECTIONS

WAUKESHA WATER UTILITY
WAUKESHA, WISCONSIN

Customer Classification	Actual 2008	Projected 2028	Projected 2035	Projected Ultimate
Population Served	68,030	85,800	88,500	97,400
Residential Sales				
Per Capita Sales (gpcd)	43	45	45	45
Annual Sales (MGY)	1,057	1,410	1,450	1,600
Public Sales				
Per Capita Sales (gpcd)	4	5	5	5
Annual Sales (MGY)	100	160	160	180
Commercial Sales				
Per Capita Sales (gpcd)	33	35	35	35
Annual Sales (MGY)	828	1,100	1,130	1,240
Industrial Sales				
Annual Sales:				
Existing Sales (MGY)	382	415	400	400
TOTAL METERED SALES (MGY)	***2,370***	***3,090***	***3,140***	***3,420***
Unaccounted-For Water (MGY)	161	230	240	260
TOTAL PUMPAGE (MGY)	***2,531***	***3,320***	***3,380***	***3,680***
AVERAGE DAY DEMAND (MGD)	**6.93**	**9.10**	**9.26**	**10.08**
MAXIMUM DAY DEMAND (MGD)	**9.93**	**15.28**	**15.56**	**16.94**

Notes:

Projected populations from Southeastern Wisconsin Regional Planning Commission letter dated March 17, 2009.

Industrial sales projections based on planning data provided during Water System Master Plan project of ultimate industrial acreage slighly decreasing from existing acreage and some large customer surveys indicating decline in water usage.

Unaccounted-for water was projected at 7% of total pumpage for future years.

Maximum day demand 1.68 times average day demand.

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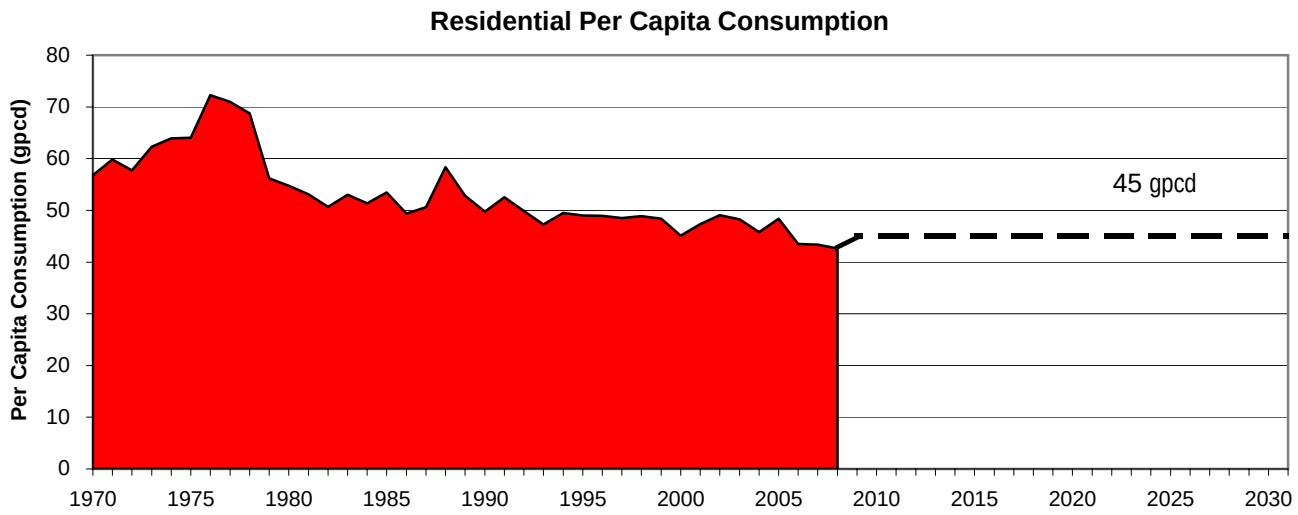

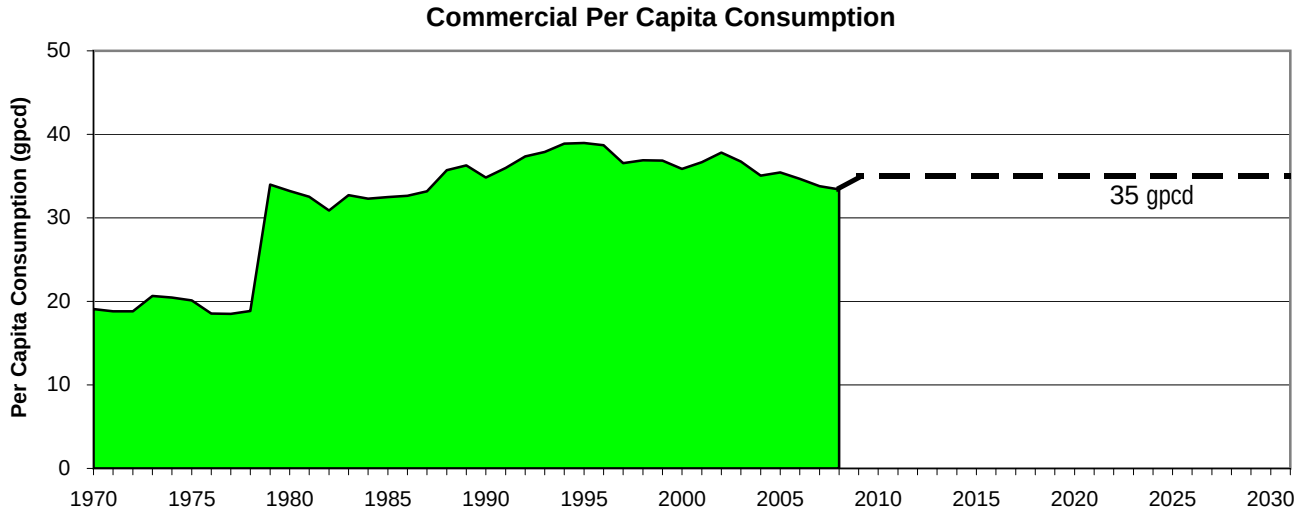

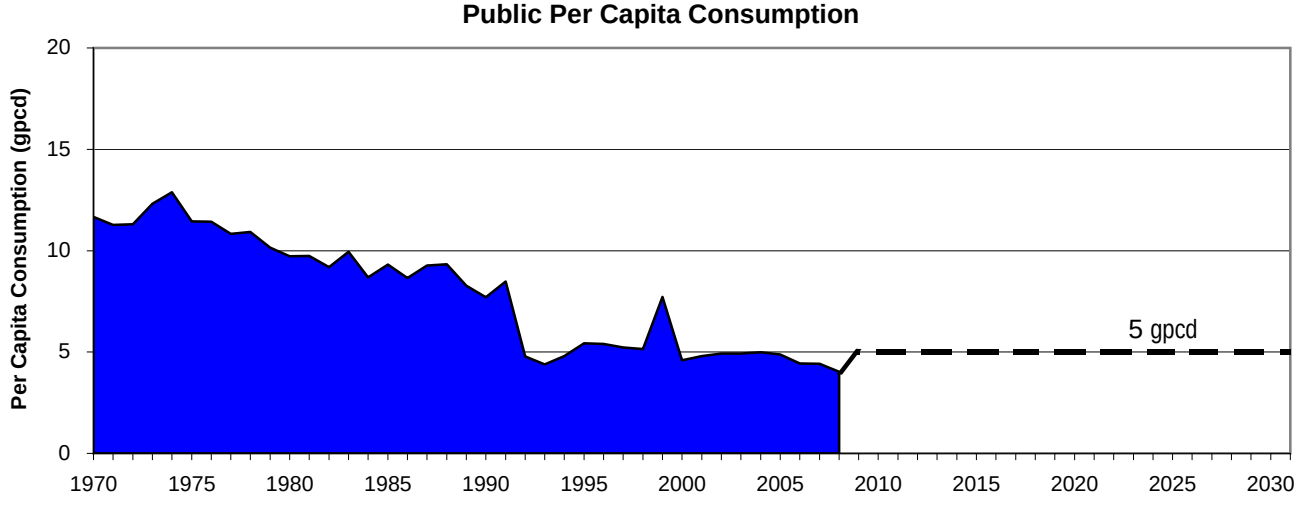

AECOM

FIGURE 1
HISTORICAL PER CAPITA CONSUMPTION
WAUKESHA WATER UTILITY
WAUKESHA, WISCONSIN

MAY 2009 105762

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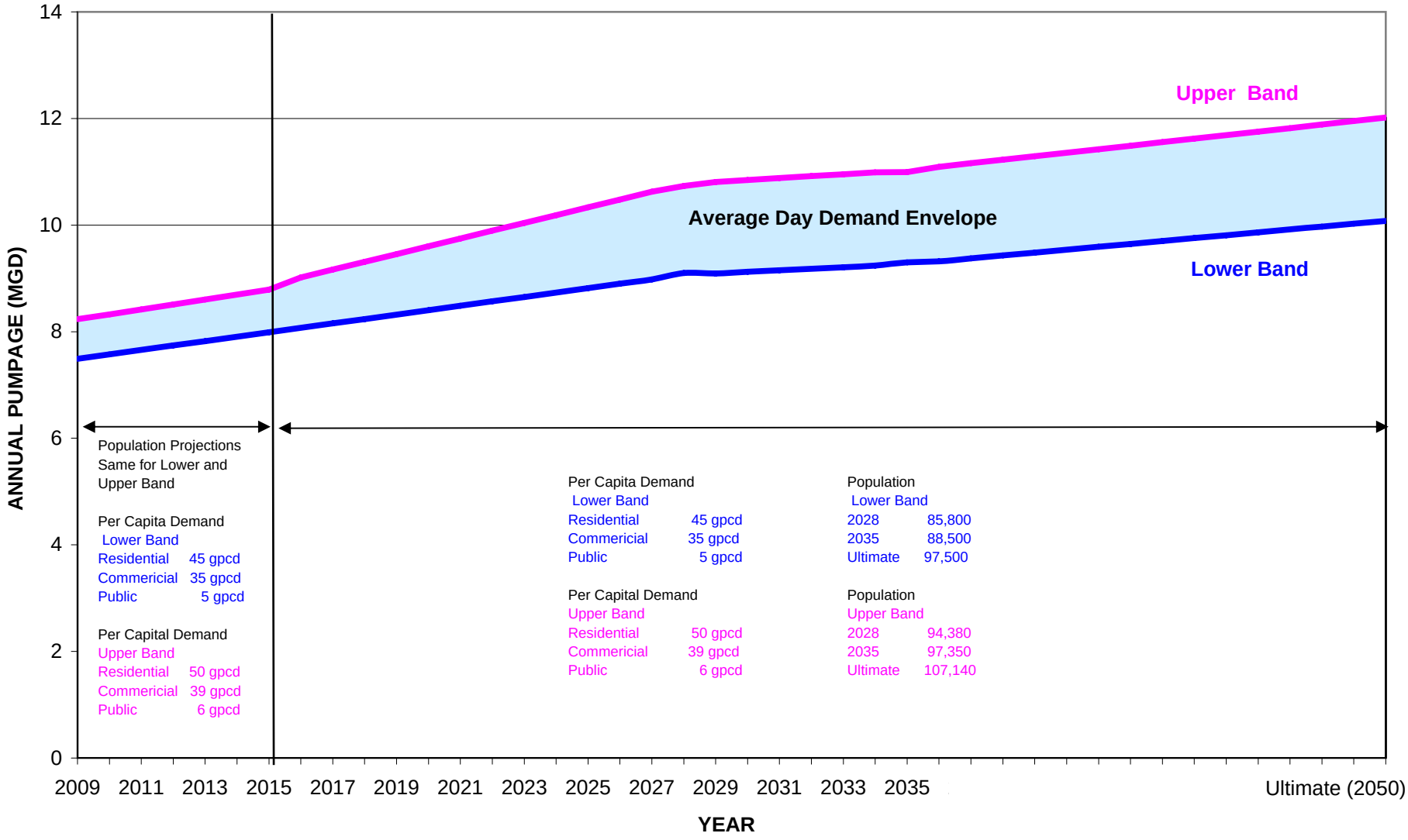
L:\work\Projects\105762\eng\demand analysis\[Chapter3_2008.xls]Figure 2

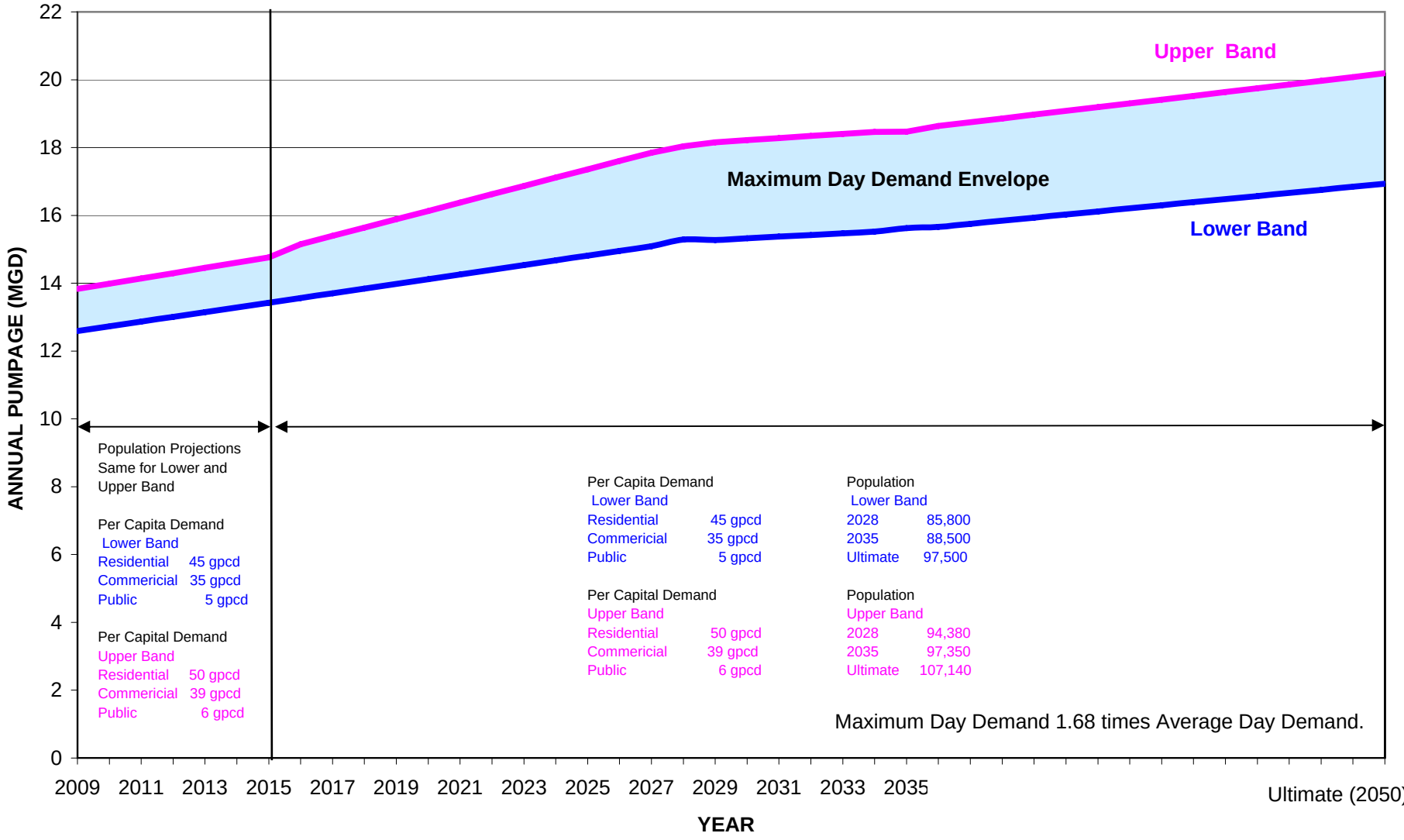


AECOM

FIGURE 2
ANNUAL AVERAGE DAY
WATER PUMPAGE PROJECTIONS
WAUKESHA WATER UTILITY
WAUKESHA, WISCONSIN

MAY 2009 105762

L:\work\Projects\105762\eng\demand analysis\[Chapter3_2008.xls]Figure 3



AECOM

FIGURE 3
ANNUAL MAXIMUM DAY
WATER PUMPAGE PROJECTIONS
WAUKESHA WATER UTILITY
WAUKESHA, WISCONSIN

MAY 2009 105762

ATTACHMENT A

POPULATION PROJECTIONS

SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION
W239 N1812 ROCKWOOD DRIVE • PO BOX 1607 • WAUKESHA, WI 53187-1607• TELEPHONE (262) 547-6721
FAX (262) 547-1103

Serving the Counties of: KENOSHA
MILWAUKEE
OZAUKEE
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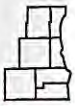
WALWORTH
WASHINGTON
WAUKESHA



March 17, 2009

Mr. Steven Crandell
Community Development Director,
City of Waukesha
201 Delafield Street
Waukesha, WI 53188-3633

Dear Mr. Crandell:

In response to your request, the Regional Planning staff has prepared an estimate of the ultimate population for the Waukesha water supply service area. The ultimate population for the water supply service is estimated at 97,400 persons. This compares to the year 2000 population of 75,500 persons and a planned year 2028 population of 85,800 persons, as set forth in the SEWRPC staff memorandum entitled "Response to Request by the City of Waukesha Water Utility to Delineate the 20-Year Planned Water Supply Service Area for the Utility." The ultimate population is an estimate of the population that could be accommodated within the water supply service area, assuming full development conditions as envisioned under the land use element of the Waukesha County comprehensive plan, with input on population densities for various residential land use categories and other aspects of the plan from your staff.

The 2028 population represents a step on the way to the 2035 population of 88,500 persons set forth in the ongoing regional water supply plan. The ultimate population within the water supply service area represents a condition beyond the 2035 planning horizon adopted for the regional water supply plan.

We trust that this responds to your request. Should you have any questions, feel free to call.

Sincerely,

Kenneth R. Yunker, P.E.
Executive Director

KRY/WJS/lgh
#143499 v1 - response to s crandell

cc: Michael G. Hahn, SEWRPC
Robert P. Biebel, SEWRPC

Appendix E
City PSC Compliance Status

Public Service Commission of Wisconsin

Eric Callisto, Chairperson
Mark Meyer, Commissioner
Lauren Azar, Commissioner

610 North Whitney Way
P.O. Box 7854
Madison, WI 53707-7854

March 9, 2011 – **VIA EMAIL**

Mr. Dan Duchniak, General Manager
Waukesha Water Utility
115 Delafield Street
Waukesha, Wisconsin 53188
dduchniak@waukesha-water.com

Re: PSC Compliance Status File: 6240

Dear Mr. Duchniak:

This letter confirms that the Waukesha Water Utility is a utility in good standing with the Public Service Commission. The utility is in compliance with its annual reporting requirements and has not been found to be in violation of the standards for water public utility service in Chapter PSC 185, Wis. Adm. Code.

Sincerely,

David Sheard

David Sheard, P.E.
Assistant Administrator
Division of Water, Compliance and Consumer Affairs

JJR:DAS:pc:w:\water\correspondence\ripp\Waukesha Compliance Letter.doc

cc: Nancy Quirk, Technical Services Manager

Appendix F

Public Education and Outreach Information


Charter Mem
WATER S
WISCONSIN
Water Star
Community

My Brown Lawn is GREEN!

This is a Waukesha Water Saving Lawn

waukesha county water utilities

Waukesha County Water Conservation Coalition

Things you can do outside:

Install rain gardens

Use rain barrels

Reduce Lawn Watering

The Waukesha Water Conservation Coalition, Inc., is a diverse group of individuals working together to educate the general public about local water resources and inspire residents, businesses and institutions to use water conservation measures to create sustainable communities in Southeastern Wisconsin.

www.wisconsinwaterwise.org

Waukesha County Water Conservation Coalition

Become a member—Join today!

Things you can do inside:

Conserve water

Use Low-Flow Showerheads and take shorter showers

Fix Leaks

Install High EfficiencyToilets

Turn the Faucet off


THE MAJORITY OF WAUKESHA WATER USERS CONSERVE!
DO YOU?
Check It Out For Yourself
Top 4 Practices Waukesha Water Users Implement To Save Water & Money
1. Follow the Sprinkling Ordinance:
Soaked
Public Education: 2007 and 2008 Street Signs
2. Use Rain Barrels:
Rain Barrels
3. Fix Leaks:
4. Install High-Efficiency Toilets & Get $25 Rebate
My Brown Lawn is GREEN!
This is a Waukesha Water Saving Lawn
My Brown Lawn is GREEN!
This is a Waukesha Water Saving Lawn
My Brown Lawn is GREEN!
This is a Waukesha Water Saving Lawn
My Brown Lawn is GREEN!
This is a Waukesha Water Saving Lawn
My Brown Lawn is GREEN!
This is a Waukesha Water Saving Lawn

Water Challenge

Newsletter for the Waukesha Water Conservation Challenge

Inside:

Challenge Sponsors

Waukesha State Bank
City of Waukesha
Culver's Frozen Custard
Kohler Co.
Little Caesars Pizza
Metropolitan Builders Association
Murfs Frozen Custard and Jumbo Burgers
Murn & Martin, S.C. Attorneys at Law
RC Graphics
Roundy's Supermarkets, Inc.
Ruekert/Mielke Engineers and Surveyors
Schoenwalder Plumbing
School District of Waukesha
Sprizzo Gallery Caffé'
Subway Sandwiches & Salads
Sunset Family Restaurant
Sunset Video
UW-Extension
Waukesha County
Wisconsin On-site Water Recycling Association

Water Conservation Challenge in Full Swing

High Efficiency Toilet Rebate Program Now Available

Great job Water Challenge contestants!!!! For the first quarter, you reduced your water consumption by approximately 15%. That is equivalent to 317,500 gallons of water. Second quarter reductions were even greater. We saved 16.5%. That is a savings of 557,800 gallons; with a combined two quarter total of 875,300 gallons. These numbers confirm that as we gain experience and change our water-use behaviors, the amount of water we conserve can grow even greater.

You helped save more than 875,000 gallons over six months. Keep up the great work!

When we compare these savings with the usage by the entire Waukesha Water Utility class of residential customers, we noticed that over the past six months, there was also a reduction. The reduction was 6.3% which amounts to just fewer than 6,994,000 gallons saved for approximately 16,680 residential customers. While, for the most part, people are conserving, the residential contestants have thus far shown a much greater reductions!

Get a toilet replacement rebate

Waukesha Water Utility is the first water utility in the state of Wisconsin to offer their customers a rebate for high efficiency toilet replacements.

Beginning on Saturday, October 18, 2008, Waukesha Water Utility is offering a $25 rebate for the first 100 people who replace a high-volume (3.5 gallon or more) toilet with a High-Efficiency Toilet that uses a 1.28 gallon/flush. Only toilets that are listed on the EPA's WaterSense Toilet model list (www.epa.gov/watersense/pp/find_het.htm) are eligible for a rebate.

Rebates are limited to one per service address and will be issued on a first-come, first-serve basis. Rebate applications will be available at the Waukesha Water Utility (in the office or here on-line) and various other places. For more information visit: http://www.ci.waukesha.wi.us/WaterUtility/toilet_rebates.html.

Replace your old water-guzzling toilet with a high-efficiency toilet and reap the rewards!

SAVE WATER ! SAVE MONEY! WIN PRIZES ! HAVE FUN!

Before purchasing these two appliances research their true water use.

Washing machines

When purchasing washing machines know what the 'Water Factor' is. The Water Factor is the number of gallons of water the washing machine uses per cubic feet of clothes being washed. The 'average' load of clothes is 2.7 cubic feet. So on "typical" washer with a water factor of 13.3 , the water usage per load would be almost 37 gallons. Some washing machines have a water factor as low as 4.5, which on a typical size load would be only 12.5 gallons per load, a savings of two-thirds water use!

Water efficient appliances can save more than just water.

Reverse osmosis (RO) units do a good job of 'filtering' water, however, for every gallon of water they filter, as much as four gallons of water can be lost down the drain as "reject" water. Some water conscious customers tell us that they use the reject or backwash water from their R.O. unit to water plants and gardens. One customer has even mentioned they use the R.O. backwash to fill their toilet tank for flushing! Great ideas!

Rain Gardens: A Beautiful Solution to Water Pollution

Rain gardens are a great way to reduce runoff pollution and increase infiltration. What is a rain garden? It is a sunken garden that receives runoff from your roof or yard. The garden captures rain water and with the aid of native plants, infiltrates the water into the ground. This is becoming increasingly important as more of our watersheds become paved, increasing the amount of runoff and likelihood of flooding.

A rain garden may be formal or non-formal. Many rain gardens are planted in an in-formal design using native grasses and sedges in combination with wildflowers. Because of the grasses and sedges, many people are left with the notion that rain gardens are weedy and unkempt. But a rain garden does not have to include sedges and grasses—the choice is entirely yours. By using shorter flowers and leaving out the sedges, a formal look can be accomplished. By designing the garden yourself, you can achieve the look you want.

Through the Graham-Martin Foundation, Waukesha County is able to offer homeowners the opportunity to receive rain garden plants at ½ the retail cost. These native prairie plants are grown by Agrecol and normally sell for $3.60 for a 3" potted plant. With this grant, homeowners may purchase plants for $1.80 per plant—1/2 the normal price.

For more information on how to plan and install a rain garden visit:

www.waukeshacounty.gov/cleanwater

and click on the rain gardens under quick Links. You will be able to link to a manual on design and installation as well as find plant lists and order forms for the grant program. To qualify for the grant, simply plan on installing a rain garden and place your rain garden plant order with Waukesha County by January 31, 2009.

Water Challenge

Save Water! Save Money! Win Prizes! Have Fun!

Waukesha Water Utility
115 Delafield Street
Waukesha, WI 53186

Phone: 262-521-5272
Email: contactus@waukesha-water.com
Web: http://www.ci.waukesha.wi.us/WaterUtility/whatyoucandotohelp.html

The Waukesha Water Conservation Coalition

In 2006, Waukesha Mayor, Larry Nelson, and County Executive, Dan Vrakas, called for a coalition dedicated to Water Conservation in Waukesha County. The coalition consists of environmental groups, county, city and municipal leaders, the Waukesha Water Utility, college and school officials, scientists, engineers, attorneys, the Milwaukee Metropolitan Sewerage District and private individuals. All share the common desire to conserve and protect Waukesha County's critical resource . . Water.

Publication: Waukesha Freeman (Conley); Date:2010 Apr 29; Section:House & Home; Page Number: 12B

Waukesha County's Guide to New Homes, Home Improvement & More!

Water & Energy Efficiency Expo coming to Waukesha

Two-day event featuring wide range of topics

WAUKESHA – The Southeast Wisconsin Water & Energy Efficiency Expo will be held May 7 and May 8 at the Waukesha County Exposition Center.

The expo will focus on the rapidly evolving water and energy efficiency arena.

Presentations of the latest trends, lunch 'n' learn demonstrations, guest speakers and exhibitions are tailored to business owners, municipal and residential customers and children.

Topics such as home energy savings, green building certification and rain gardens will be presented by experts in the field.

Presentations and speakers May 7 will focus on business, commercial andmunicipal efforts, methods, techniques and products for energy and water efficiency.

The keynote speaker will be Rich Meeusen, chairman/president/CEO of Badger Meter Inc.

The presentations and speakers May 8 will focus on residential customers.

A 'kid zone' area will be filled with hands-on activities, games and entertainment that increase awareness of our groundwater and energyresources.

Melinda Meyers, local gardening expert, TV host and the author of many gardening books, will be the keynote speaker.

The two-day event is sponsored by the Waukesha County Water Conservation Coalition. This group is dedicated to increasing public awareness of water supply issues in Waukesha County and promoting regional collaboration to increase conservation efforts and energy efficiency.

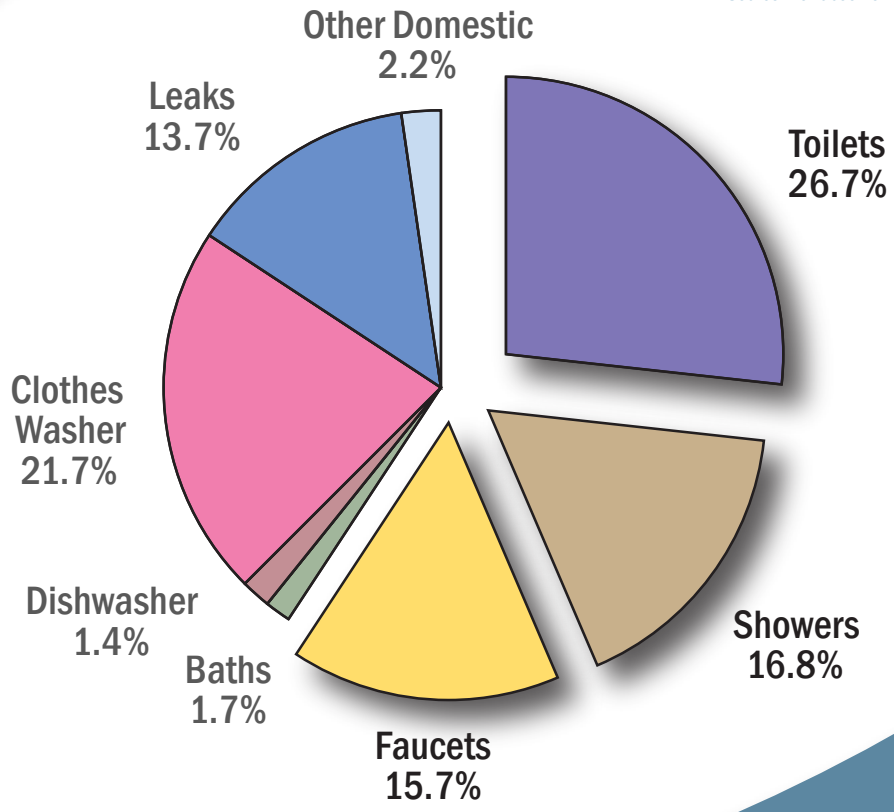
More information about the Water & Energy Efficiency Expo, including a daily schedule of events, registration information and exhibitor information can be found at .


The Waukesha County Water Conservation Coalition
presents the
2010 Water MVP Award
to
GE Healthcare
For outstanding efforts to use water in the most efficient way possible
Your leadership by example and continuing pursuit of even higher efficiencies of water use make yours a true company of distinction.
Your willingness to share your successes, and educate others, makes GE Healthcare not only an environmental leader, but also an inspiration to others.
Waukesha County
Water
Conservation Coalition
Chair-Waukesha County Water Conservation Coalition 2010

Average Indoor Water Use in a Nonconserving Home

(69.3 gallons per capita per day)

Source: Handbook of Water Use and Conservation

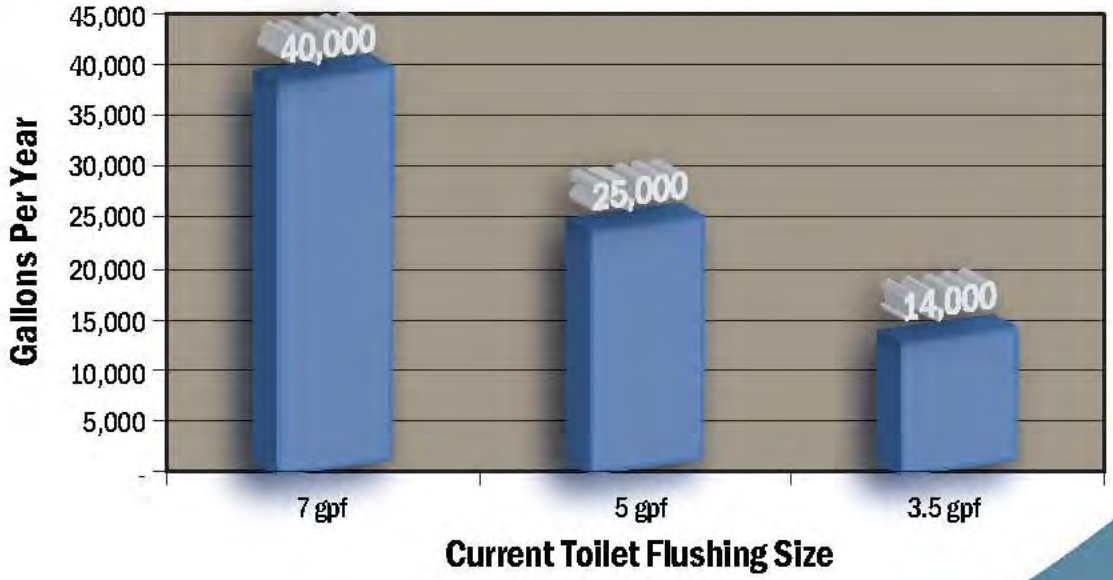


Don't flush dollar$ down the drain!

GeoSyntec Consultants

Waukesha Water Utility

Annual Household Water Savings from Updating Toilets for a Family of Four



Don't flush dollar$ down the drain!

GeoSyntec Consultants

Waukesha Water Utility

Grand Prize

Won by the entrant who achieves the greatest reduction in water use. $500.00 PLUS reimbursement of the water portion of their utility bill for the duration of the challenge!

First Place

After the Grand Prize winner, the next four largest reductions in water use win reimbursement of the water portion of their utility bill for the entire one year duration of the Challenge!

Ten 'Runner-ups'

Ten additional prize packages will be won by the ten contest entrants who had the most unique or innovative methods of reducing water use (inside or outside) of their home.

The Waukesha County Water Conservation Coalition

In 2006, Waukesha Mayor Larry Nelson and County Executive Dan Vrakas called for a coalition dedicated to water conservation in Waukesha County. The coalition consists of representatives from environmental organizations, County, City, the Waukesha Water Utility, college and schools, scientists, engineers, attorneys, MMSD, and citizens, ALL with the common goal of the conservation and protection of Waukesha County's critical resource... water.

Thanks to our generous sponsors:

GRAND PRIZE

Waukesha State Bank
The Bank of Friendly Service™
www.WaukeshaBank.com • Member FDIC

FIRST PLACE

MBA Metropolitan Builders Association

Murn & Martin, S.C.
Attorneys at Law
murnlaw.com

Wisconsin On-site Wastewater Recycling Association
wowra.com

Schoenwalder Plumbing
since 1945
Schoenwalderplumbing.com

Ruekert / Mielke
Professional engineers and land surveyors
ruekert-mielke.com

School District of Waukesha
Environmental Education Program

RC Graphics

Roundy's Supermarkets, Inc.

Sunset Video
Murf's Frozen Custard and Jumbo Burgers
Little Caesars Pizza
Sunset Family Restaurant
Culver's Frozen Custard
Subway Sandwiches & Salads
Sprizzo Gallery Café

$ave Water
$ave Money

Water Conservation Challenge

WIN
WATER FOR A YEAR!*

***The five City of Waukesha homes that reduce their water use percentage (%) over a one year period* will win. Sponsors will reimburse the winners for the water portion of their utility bill for the entire (one year) duration of the Challenge!**

*compared to the previous year

Waukesha County Water Conservation Coalition

$ave Water
$ave Money

CHALLENGE RULES

1. Participants must be customers of the Waukesha Water Utility (WWU).
2. The challenge is limited to single-family, residential customers only.
3. In case of a tie, a drawing of winners will be held.
4. Water usage is measured for one year from billing quarters beginning in 11/07, 12/07, and 1/08.
5. Contestants must register by 11-30-07
6. By entering the Challenge, the entrant gives permission for the Waukesha County Water Conservation Coalition to use water billing records for contest results.
7. Only one entrant per service address.
8. All contest results are final and are at the sole discretion of the Conservation Coalition Challenge Committee.

Learn How 2 c Onserve

Ten simple things you can do to save water:

1. Visit the Waukesha Water Utility website and follow the links to learn valuable conservation tips
2. Attend "The Secrets of Water Conservation" seminar:

-Sept. 19, 2007 7:00 p.m.to 8:45 p.m.
Waukesha Public Library
-October 13, 2007 10:00 a.m. to Noon
Carroll College Campus Center

(additional seminar(s) to be announced)

3. Repair or replace leaky faucets
4. Don't run faucet unnecessarily
5. Take shorter showers
6. Install low-flow showerheads
7. Install high efficiency toilets
8. When choosing new appliances, Energy Star appliances really save water!
9. Collect rain water to water plants and landscaping
10. Follow sprinkling ordinance

REGISTRATION

Deadline November 30, 2007

Name: _____

Address: _____

_____

Zip:_____

Home phone:_____

E-mail: _____

Account # _____
(found on water bill)

I acknowledge that by entering the Challenge, I grant the Waukesha County Water Conservation Coalition permission to use my utility bill information from the City of Waukesha Water Utility for the purposes of determining contest results.

_____
signature

Mail this entry form to:
Waukesha Water Utility
Attn: Mary
115 Delafield Street
Waukesha WI 53188

or fax to: 262-521-5399

or enter online at: www.waukeshacounty.gov

$ave Water
$ave Money

Water Served Upon Request

By reducing water waste and detergent use our restaurant is protecting the environment.

Thank you for your cooperation and helping us do the right thing!

www.WisconsinWaterWise.org

Cut along the dashed line. Fold along dotted lines. Fold in half at the top. Fold bottom edges toward each other, and tape to make the table tent stand upright.

Water Served Upon Request

By reducing water waste and detergent use our restaurant is protecting the environment.

Thank you for your cooperation and helping us do the right thing!

www.WisconsinWaterWise.org

Cut along the dashed line. Fold along dotted lines. Fold in half at the top. Fold bottom edges toward each other, and tape to make the table tent stand upright.

Certificate of Recognition

Congratulations to:

The County of Waukesha

May 7th, 2010

For exemplary work in protecting
and improving local surface water, groundwater and recreation.

A Wisconsin SILVER Water Star Community

The Wisconsin Water Star Program guides, inspires and
recognizes Wisconsin municipalities who do exemplary work in the
areas of surface water and groundwater.

WATERSTARWISCONSIN.ORG

SPRING CITY GARDEN CLUB

COME JOIN THE FUN!

Spring City Garden Club (SCGC) meets in Waukesha at noon on the third Thursday of each month. The meeting place is determined each month and then announced.

It is the mission of SCGC to greet each season joyously because we are:

- ***Attentive to each others' needs***
- ***Good stewards of our environment***
- ***Intellectually stimulated by the study of trees, shrubs, and plants***
- ***Making our state, our community, and our homes more beautiful***
- ***Educating youth in the beauty, importance, and protection of our environment***
- ***Sharing with our community what we have and what we learn.***

At monthly meetings we share information about gardening and environmental preservation and beautification from guest experts. Light refreshments are served by members who take turns as co-hosts. The fellowship and camaraderie with people who share like values and interests is priceless.

GUESTS AND NEW MEMBERS
ARE ALWAYS WELCOME!

Spring City Garden Club was organized in Waukesha in 1943 with eleven members exchanging plants that they'd grown from seed. Today's SCGC continues a tradition of the love of flowers and a concern for the environment..

In 1965, SCGC was instrumental in the drive to secure and develop 88 acres in the heart of Waukesha, adjoining the Fox River, to be used as a sanctuary and environmental teaching area for school children. In one year (1974) members planted 1000 white pines and 1000 Norway spruce to provide a cover for birds. In addition to labor, the club donates money year after year. Today, thousands of children have learned about nature at the **Fox River Sanctuary**.

In 1983, Spring City Garden Club established a fund to buy trees and shrubs for planting around Waukesha County. The fund answers two needs. Persons wanting to honor a child's birth, graduation, an anniversary, or to make a tribute to someone who has died, can use this as a gift. The second need, to beautify and protect the local environment, is filled in a lovely way—through a **living gift**! We practice what we preach by honoring living and deceased club members and others through the program.

SCGC collects the monies from the donor, acknowledges contributions with a receipt, notifies honorees, and turns the money over to the Waukesha County Department of Parks and Land Use for its **Legacy Forest Program.** That department then purchases trees or other botanical specimens and plants them at county expense at selected sites.

In 1991, the chairman of the Fox River Development Committee spoke to Spring City Garden Club about plans and goals of a 4-stage riverfront beautification plan. SCGC became the second civic organization to give support to the project. A committee from SCGC was appointed to work with the river committee. Our proposal was to add a new dimension to the green pines and hardwoods planted in the Fox River Sanctuary—a new ecosystem!

Our club began planting a **Butterfly Garden** along the banks of the Fox River in the city of Waukesha in May of 1995, and later a **Prairie Garden** adjacent to it. Our gardens became a sparkling gem of color, visited by environmental classes of school children, the many users of the bicycle trail, hikers and walkers, senior citizens from nearby apartments, and the many members of civic clubs that meet in the E.B. Shurts Environmental Education Center up the hill from the gardens.

The Prairie Garden consisted of at least 18 varieties of prairie plants native to Wisconsin, providing nectar and larval plants for butterflies from spring through fall. The winter plants, left standing, provided shelter for small mammals through the cold months. Ice crystals clinging to the plants provided a beautiful waterscape for hikers and walkers.

In 2009 it was decided that the gardens would have to be abandoned. The Fox River repeatedly destroyed the gardens by overflowing its banks. It was not feasible to continuously replace the many plantings. Instead, we are currently working to beautify the City with mass plantings in pots throughout the main streets.

Through the years, club members have signed up for seasonal maintenance, weeding, watering, mulching, and occasionally replanting our garden projects. All of our club members, whose ages range from 30 years to 90+ years, participate in some capacity.

Each year since 1995, in honor of **Arbor Day**, Spring City Garden Club has selected someone who has dedicated his or her life, by vocation or avocation, to the environment. A tree and site are selected and, in a spring or autumn ceremony, the tree is planted and dedicated in our honoree's name. Aldo Leopold, John Muir, and David Liska, Waukesha's City Forester, are among those honored.

A spring **fund-raiser** is the event that allows us to bring our environmental contributions to fruition. Club members donate plants from their own gardens, bake homemade goodies, and create garden-related crafts to sell at an annual event. It provides us with the funding for member and community education through guest speakers and outings, and for the monies to buy plants and trees for community parks and sanctuaries.

Most years the event had been held in the lobby of the Waukesha State Bank in downtown Waukesha. Since 2002 an expanded effort has made it necessary to hold the event at the E. B. Shurts Environmental Education Center at the Fox River Sanctuary. We are very grateful to all those who contribute to Spring City Garden Club and, through it, to community beautification and environmental awareness, by attending and supporting our spring fund-raiser! Watch for it, typically the Saturday after Memorial Day weekend, and…

COME JOIN THE FUN!

To speak with a club representative, call:
Chris Linder at (262) 548-9322, or
Betty Padgett at (262) 547-6923, or
Judy Pequet at (262) 968-3029.

Ban urged on watering lawns, washing cars

WATER WOES

Waukesha officials await proposed water conservation law

By KOLLIN KOSMICKI
Freeman Staff

WAUKESHA – As officials here prepare to ponder a long-term plan to curtail water consumption, Alderman Emanuele Vitale said Monday the city should ban citizens from watering lawns and washing automobiles on their properties.

Vitale called those actions a "frivolous" use of the resource, especially for a city facing problems with depletion and relatively high radium concentrations.

"People are so worried about their lawns that it's a shame. I've seen people sprinkling their lawns with an approaching storm. They know it's going to rain so why are they watering?" Vitale said. "Certainly the city should try to ban some of these frivolous usages."

Sound Off

What do YOU think? Share your thoughts anonymously about any topic and look for your comments in an upcoming issue of The Freeman.
Phone: 513-2641
E-mail: soundoff@conleynet.com

See WATER, Page 11A

Alderman Emanuele Vitale suggests the city can do more to conserve water. Some of his ideas include stopping people from washing cars and watering lawns.

Kevin Hamack/Freeman Staff

Traffic on Meadowbrook Road travels northbound away from a Waukesha Water Utility water tower on Monday. A proposal by Alderman Emanuele Vitale suggests that city water should not be used to wash cars or water lawns to help keep the city's water usage down.

Water

From Page 1A

While Vitale supports a ban on those activities, he also scoffed at citizens who use a hose to clean their driveways. But he said he would stop short of forbidding use of sprinklers to water gardens.

"This is a supreme issue as far as I'm concerned, and a lot of people, they take their fresh water for granted," he said.

Vitale's comments came as the Waukesha Water Utility plans to soon present ideas for an expansive water conservation ordinance. It is expected to anchor a planned goal to cut use by 20 percent over the next 15 years through a series of restrictions and incentive-based programs.

Dan Duchniak, general manager of the utility, said Vitale's relatively bold ideas are something officials would need to examine further.

Duchniak has not come across any other communities that completely ban lawn watering and vehicle washing, he said.

"They're interesting concepts, and I think we need to investigate all the options that are available," Duchniak said.

For several months utility officials have researched ideas for the soon-to-be introduced ordinance. Duchniak mentioned other possible ideas for the proposal. They include the following:

- Banning sprinkler use on certain days of the week
- Eliminating a program that allows residents to be credited for water that doesn't drain into the sewer system
- Requiring developers to build in a way that allows for recharge of aquifers

The city in the past has enacted temporary advisories urging people against sprinkler use – especially during drought conditions – but doesn't have a law to prohibit the activities.

Banning outright vehicle washing or lawn watering would be difficult to enforce, Vitale acknowledged.

"Let's face it: If the car's behind the house nobody's going to see you washing your car," Vitale said.

Plus, Waukesha can ill afford more police officers to enforce the law, he said. Vitale suggested that patrolling officers could start by issuing warnings.

Alderman Jeff Fowle, who referred the conservation proposal to the city's ordinance and license committee, said Vitale's ideas may be "jumping the gun." But Fowle does favor taking a "serious look" at a conservation plan.

"We can't do business like we've done in the past," he said.

(Kollin Kosmicki can be reached at kkosmicki@conleynet.com)

Waukesha Water Utility
Ordenanza de Regadío

1 de mayo al 1 de octubre

Las direcciones con números impares pueden regar el césped los días martes y sábados antes de las 9 a.m. y después de las 5 p.m.

Las direcciones con números pares pueden regar el césped los días jueves y domingos antes de las 9 a.m. y después de las 5 p.m.

Se puede usar una regadera portátil, un recipiente o manguera en cualquier momento para regar los jardines, árboles, o arbustos siempre que éstos sean utilizados manualmente y no se dejen desatendidos.

Don't Get Soaked by Overwatering Your Lawn!

For more information on the Sprinkling Ordinance or other Conservation Tips, please visit our website at

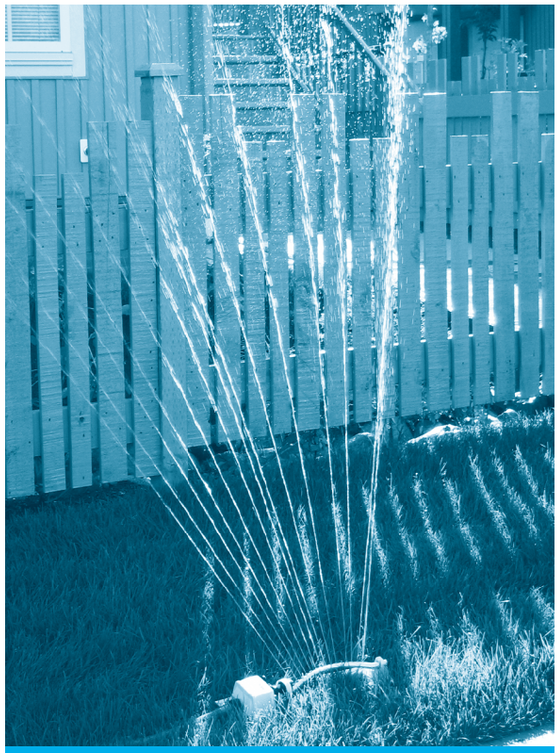
www.ci.waukesha.wi.us/waterutility/conservation

or call our Customer Service department at

(262) 521-5272

You made the difference in 2006!

- Summer water use was down 11.8% last year from 2005.
- Overall water use in the City of Waukesha was down 7.5% last year.
- The utility had only one day with total water use over 10 million gallons per day. This was down from 28 days in 2005.



City of Waukesha Water Utility Sprinkling Ordinance

May 1st – October 1st

Odd-numbered addresses – may water on Tuesdays & Saturdays prior to 9 a.m. or after 5 p.m.

Even-numbered addresses – may water on Thursdays & Sundays prior to 9 a.m. or after 5 p.m.

A hand-held water can, container, or hose may be used at any time to water gardens, trees, or shrubs, if the device is utilized manually and not left unattended.

Good watering practices can benefit you and your landscape!

Reasons for a Sprinking Ordinance

The City of Waukesha enacted a Sprinkling Ordinance that limits when Waukesha residents can water their lawns between May 1st and October 1st. Please refer to the front cover of this brochure for your watering days and times. The reasons for the Sprinkling Ordinance include the following:

- **To ensure sufficient water supply is available during summer peak usage.**
- **To protect our local resources – due to over use of the deep aquifer in southeastern Wisconsin and unique geological conditions that limit the recharge of that deep groundwater, the local water table is continuing to drop.**
- **To avoid evaporation - 40% of the water applied by a sprinkler, during the day time hours, is lost to evaporation.**

Watering New Landscape

A special variance permit is not required for sprinkling new landscapes. New landscaping may be watered at any time during the first month after installation if it is installed at the time of new construction, installed as part of a governmental entity's capital improvement project, alters more than one-fourth of the area of a small existing yard, or alters an area greater than 3,000 sq. feet of an existing yard.

Initial watering should be heavy, at least 1". Then water lightly every other day for two weeks.

Watering Established Lawns

Established lawns do best when they receive 1" of water per week (either from rainfall and/or irrigation).

When it does not rain, water your lawn the whole 1" at a time. (This takes about 30 minutes, promotes deeper roots which increases your lawn's drought tolerance, and reduces evaporation.)

To avoid over watering, set a timer for 30 minutes or set out a tuna can or container to measure when one inch of water has been applied.

Raise your lawn mower blade to at least three inches, or to the highest level. (This will protect the roots and keep moisture in the soil.)

The best time to water is early in the morning.

Use sprinklers that have larger holes – water evaporates faster with fine mist.

Avoid watering impervious surfaces or watering on windy days.

Established lawns can remain alive for up to two to three months of dormancy; color will return with late summer rains and cooler temperatures. Therefore, it is not necessary to water your lawn.

Mulching

Mulching around trees and shrubs is simple and effective. The benefits of mulching are the following:

Retains soil moisture

Encourages root development

Eliminates weeds which compete for water and nutrients

Conserves water

Preserves the health and beauty of your landscape

Conservation of this resource is the right thing to do!


City of Waukesha
Water Utility
SPRINKLING ORDINANCE
ENFORCED
MAY 1 – OCTOBER 1
(262) 521-5272 ORD. #20-06

Save Water and Receive a $25 Rebate

Beginning on Saturday, October 18, be one of the first 100 people to purchase and install a WaterSense℠-labeled toilet, and you will receive a $25 rebate.

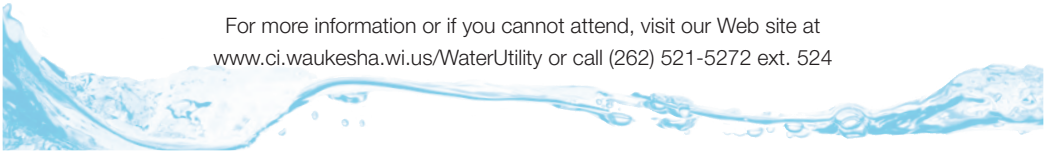
The Waukesha Water Utility and Ferguson Enterprises will host a one-time kickoff conservation event where you can learn about WaterSense-labeled toilets and receive an application for the rebate. With a WaterSense-labeled toilet, you can start saving more than 20,000 gallons of water per fixture annually.

Join us to learn more about water conservation while you enjoy refreshments and the chance to win fun prizes. WaterSense-labeled toilets will be available for purchase at participating retailers and at this event.

Saturday, October 18 – 10am to 3pm

Waukesha City Hall, 201 Delafield Street, Waukesha

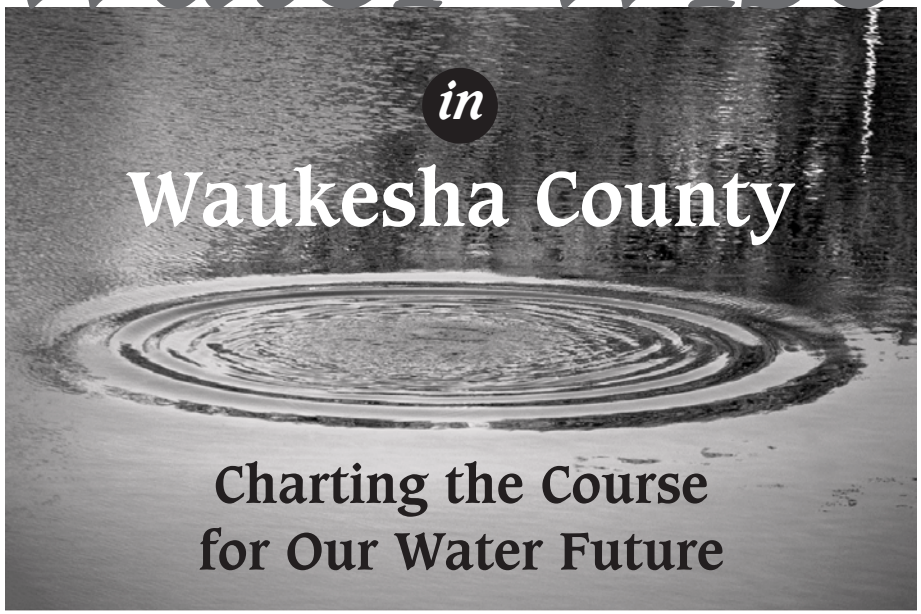
For more information or if you cannot attend, visit our Web site at www.ci.waukesha.wi.us/WaterUtility or call (262) 521-5272 ext. 524



Waukesha Water Utility
115 Delafield Street
Waukesha, WI 53188

PRESORTED STANDARD
U.S. POSTAGE PAID
STEVENS POINT, WI
PERMIT No. 56

Water•Wise



in Waukesha County

Charting the Course for Our Water Future

Saturday, March 17, 2007
8:30 a.m.– 3:00 p.m.

at

Carroll College Campus Center, Waukesha

Conserving water, improving water quality, maintaining our water supply & advocating around water issues

Come learn about the tools available for you to help protect your watershed by:

- *Using low-water landscaping*
- *Installing water-conserving technology in your home*
- *Using the water running off your roof to create a rain garden*

Discover What Is Working In Other Communities To Conserve Water Resources.

Water•Wise in Waukesha County

438 Richards St., Waukesha WI 53189

March 17
Keynote Speaker
Peter Annin

Few have researched the "water wars" as thoroughly. Annin critiques Waukesha's approach to solving its problem of high quality water. This will be useful to those seeking a peaceable solution.

Registration deadline: March 12

Keynote Speaker

Peter Annin

Author of *The Great Lakes Water Wars*

A veteran conflict and environmental journalist, Peter Annin spent more than a decade reporting on a wide variety of issues for *Newsweek*. For many years he specialized in coverage of domestic terrorism. He also covered droughts in the Southwest, hurricanes in the southeast, wind power on the Great Plains, forest fires in the mountain West, as well as the "dead zone" in the Gulf of Mexico. Since January, 2000, he has worked as Associate Director of the Institutes for Journalism and Natural Resources, a nonpartisan national nonprofit that organizes educational fellowships for mid-career environmental journalists.

Water•Wise 2007 Co•Sponsors

Carroll College
Clean Wisconsin
Friends of the Mukwonago River
Grassroots of Waukesha (GROW)
League of Women Voters
Midwest Environmental Advocates
Mukwonago River Initiative
Plowshares Education Committee
Sierra Club Great Waters Group
Town and Country RC and D
Waukesha County Environmental Action League (WEAL)
Waukesha State Bank
Waukesha Water Utility
Wisconsin League of Conservation Voters Institute

✂ **Clip and Mail** with check made payable to WEAL

✂ **Clip and Mail** with check made payable to WEAL

Registration

March 17th
Water•Wise in Waukesha County
Carroll College Campus Center, Waukesha

Please mail registration by March 12, 2007.

Name(s):_____

Name(s):_____

Affiliation (organization, community, company) :
_____

Address: _____

City: _____ County: _____

State: _____ Zip: _____ Phone: _____

Email: _____

Number attending:_____ @ $12 /person = Total $ _____

Conference includes lunch. Registration must be received no later than March 12 in order to guarantee an available lunch.

Check is enclosed. Make payable to WEAL

RETURN TO: Water•Wise in Waukesha County
438 Richard Street, Waukesha WI 53189

There are 3 ways to register:

1.) BY MAIL

2.) BY PHONE: 414-453-3127

3.) ONLINE:

www.conservationvoters.org/WLCVI/Public/index.php?regID=4&pageID=5

Water•Wise 2007 Workshops

BASIC CONSERVATION

Fixtures:
What's new in technology; how much savings can be realized; practical tips for improving conservation; how to install.
Presenter: Rob Zimmerman, Kohler Co.

Home Water Audit:
Checking for leaks; incentives?
How to do one; dealing w/ leaks.
Presenter: Dennis Briley

Exterior Watering:
Rain gardens—how do they work and what is purpose? (the conservation connection)
Installing. Natural landscaping.
Presenter: Cheryl Nenn, Friends of Milwaukee's Rivers

Green Building/Green Living:
Green roofs, green building; cisterns; cistern toilet flush; retro-fitting; permeable surfaces/pavements.
Presenter: Connie Lindholm
Green Building Alliance

Waukesha Water Utility Conservation Plan:
Overview of elements; implementation so far; savings at City Hall; what's next?
Presenter: Nancy Quirk
Waukesha Water Utility

PSC Rate Structure:
How does the current rate structure work and what are options for change?

Stormwater Toolkit; Land Use Planning and Water:
Use stormwater as a resource?
Presenter: Brent Denizen, MEA

WATER QUALITY

Toxics in Water:
Mercury, arsenic, nitrates, toxic algae.
Presenter: Laura Anderko
Environmental Nurse

Radium Problems in Waukesha and Elsewhere:
What causes it? What problems does it create? How to remove it?

Phosphorus, Pesticides, Nutrients:
Lawns don't need to be watered all summer. Best time of day to water. Chemical-free lawn techniques.
Presenter: Darrell Smith
Natural Oasis Landscaping

Pharmaceuticals in the Water:
What are they? Where do the come from? What are the problems? What can be done?
Presenter: Dr Joseph Piatt
Carroll College

Graywater:
What is it? Can it become a resource? How?

Great Lakes Restoration:
What are the challenges? What is status? Next steps?
Presenter: Emily Green, Sierra Club

REGIONAL WATER SUPPLY PLANNING

Regional Water Supply Planning Study:
Water Conservation and Related Findings and Challenges
Presenter: Bob Biebel, SEWRPC

Global Warming and Water:
The effect of climate change on water supplies; water ethics.
Presenter: Dale Olen, Sierra Club

Groundwater Advisory Committee Results:
Groundwater Management Areas; how committee's work will interface with the GL Compact.
Presenter: Jodi Habush-Sinykin
Midwest Environmental Advocates

Living Within a Water Budget:
What is real sustainability? How TIFs have been misused in ways that encourage sprawl. Protecting critical recharge areas. Land use planning and water.

Groundwater Modeling:
How do wells in SE Wis Interact with Lake Michigan? Science of groundwater flow, history; the deep water aquifer; rate of consumption.
Presenter: Daniel Feinstein, USGS

"Conserve Wisconsin" What's It All About for Water?

Healthy Waters. Healthy Economy

ADVOCACY

Open Meetings, Public Records: What Are We Entitled to Know and How Do We Access It?
Presenter: Brent Denizen,
Midwest Environmental Advocates

Great Lakes Compact: Strategies to Win
Update on status of GL Compact. How to get involved.
Presenter: Keith Reopelle
Clean Wisconsin

Demystifying the Media:
How to use media effectively in your advocacy work; Avoid the pitfalls.
Presenter: James Rowen, Writer

Working with Elected Officials:
How to ask your state and local elected officials for what you want.

The Mukwonago River:
One of the three most biodiverse rivers **on the planet** is right here in our own backyard.
Presenter: Nancy Gloe
Friends of the Mukwonago River & WEAL

The Healing Power of Water:
The emotional connection between Wisconsin people and the waters that surround us and sustain us.

Cost & Registration

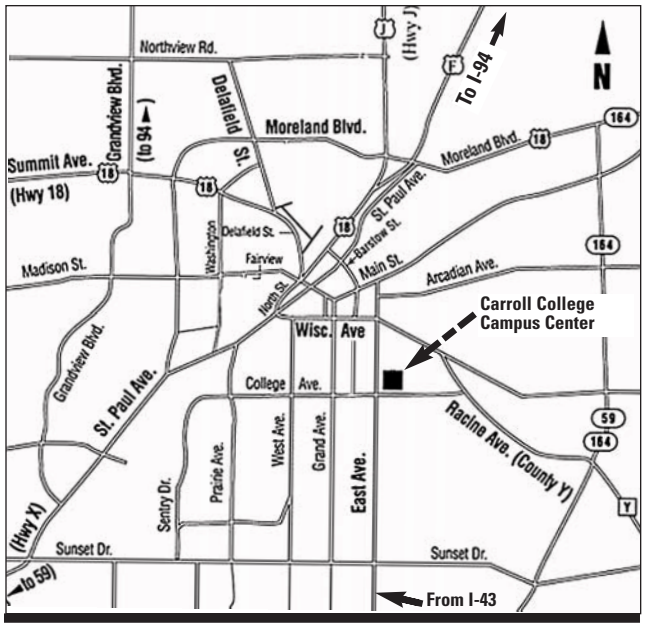
$12/person. Conference includes lunch if registration is received by Mar. 12.
Morning coffee and water will be served. Attendees are encouraged to bring your own beverage containers to reduce the amount of disposables needed.

Registration must be received by March 12.

For updates and information visit:
www.conservationvoters.org/WLCVI/Public/index.php?regID=4&pageID=5
Or call: 414-453-3127

DIRECTIONS

FROM MILWAUKEE:



Take I-94 West. Proceed past the Hwy. 18 Waukesha exit. Exit on Hwy. F (formerly Hwy. 164), turn left going south. At Moreland Boulevard, do not follow Hwy. F. Cross Moreland Boulevard and continue south on the same highway – now numbered Hwy. 18 West – to Barstow Street (which is 2.5 miles south of I-94). Turn left on Barstow St., which will dead-end on College Avenue. Turn left on College Ave. Turn left on East Avenue. Parking will be on your right. Carroll College Campus Center is on the northeast corner of College & East Avenues.

FROM MADISON: Take I-94 east and exit on Hwy. F (formerly Hwy. 164), turn right going south., then follow directions from Milwaukee.

FROM I-43: Take I-43 to Hwy. 164 (Waukesha-Big Bend exit). Exit on Hwy. 164 North. At Hwy. 59 when signs for Hwy. 164 tell you to turn right, DO NOT. Cross Hwy. 59 and continue straight on what is now East Avenue. Follow approx. 2 miles. Carroll College Campus Center is on the northeast corner of College & East Avenues. Cross College Avenue. Parking will be on your right.

Schedule of the Day

8:30 a.m.	Registration & Coffee
9:00 a.m.	Introduction & Welcome
9:15 a.m.	Keynote Speaker: Peter Annin Author of *The Great Lakes Water Wars*
	15 minute break
10:30 a.m.	Workshops – 1 (45 mins.)
	15 minute break
11:30 a.m.	Lunch & Speaker Jack Kaestner, Exec. Chef, Oconomowoc Lake Club Making the Connection: *Food and Water*
12:45 p.m.	Workshops – 2 (45 mins.)
	15 minute break
1:45 p.m.	Workshops – 3 (45 mins.)
2:45 p.m.	Wrap-up & Drawing *(Must be present to win)*

2nd Annual Wisconsin Groundwater Festival

Waukesha Water Utility participated in the 2nd Annual Wisconsin Groundwater Festival, which took place at the Waukesha County Expo, by being a part of the Festival Planning Committee, sending press releases to the media, coordinating the Festival Program, and assisting at the Festival itself.

Over 600 fifth and sixth grade students, and many teachers and chaperones, attended from various communities throughout Wisconsin. This event included hands-on activities where students learned about groundwater, surface water, pollution, and the human connection to these resources. The purpose of this Festival was to increase groundwater awareness; through public education and personal responsibility, together we can help protect Wisconsin's groundwater.

The special guests that appeared at the Festival included the following: Senator Neal Kedzie, who co-authored Assembly Bill 926 to protect groundwater, Dan Feinstein, who is with the U.S. Geological Survey, and Ann Rowland, who is a veteran entertainer at Groundwater Festivals throughout the Midwest and also a former opening act for Ricky Skaggs.

Senator Kedzie gave an Earth Day address about the Governor's signing of new groundwater legislation; Dan Feinstein spoke on the interaction of groundwater with Lake Michigan and demonstrated a computer model that traces the movement of rainwater through the ground, not only to Lake Michigan but also to the deep wells - like the ones we have here in Waukesha; and Ann Rowland performed a variety of songs having to do with water. One of her famous elementary songs that has been received nationwide, and that she sung at the Festival, is "Excuse Me, Sir, That's My Aquifer."

The Festival rotates each year to different geographic areas in order to increase accessibility for students and citizens throughout Wisconsin. Last year the Festival was held in Stevens Point. The next two years' rotation will be in northwest Wisconsin in 2005 and southwest Wisconsin in 2006.

The major sponsors for this year's Festival included the Wisconsin Ground Water Association, Sta-Rite Pumps, and the Wisconsin Groundwater Guardian Association.

Water Utility

Department Home
Conservation
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FAQ's
Toilet Rebate Program
Ordinances/Codebook
Contact Us
Related Sites
Rates
Payment Locations
Commission
Employment
Water Quality
Annual PSC Report
Radium
Leaks
Payment Options
What's Happening at the Waukesha
Water Utility
Utility Financial Documents
Prequalification Forms
Directions
Hours of Operation

WHAT YOU CAN DO TO HELP CONSERVE WATER

Repair Leaks.
Leaks not only waste a lot of water, but they also waste a lot of money - especially leaks that occur in toilets. Click on leaks to learn how to locate a leak, calculate the amount of water being wasted, read customer experiences regarding leaks, and find easy and economical repair suggestions.

Practice Sprinkling/Outdoor Conservation. Learn about sprinkling and lawn care tips. Learn how much water your grass and vegetable gardens really need. Receive information about rain harvesting and rain gardens. In addition, find out what you can do to conserve water in regard to your pool/spa and vehicles.

Install Aerators/Low-Flow Showerheads/Toilet Displacement Devices/Low-Flush Toilets. For approximately $35, the average homeowner can install low-flow aerators on faucets, install two low-flow showerheads, and put a toilet displacement bottle in the toilet tank. This will help you conserve water and lower your water bill.

Purchase High Efficiency Appliances That Use Less Water. Whether you're in the process of remodeling, replacing old appliances, or buying appliances for the first time, remember high-efficiency appliances conserve water and, at the same time, save you money on both your water and energy bills.

Develop And Practice Daily Conservation Habits. Here are some more great water-saving ideas that we all can implement into our daily lives. These ideas will help conserve water and lower water bills. Remember, every little bit helps.

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CONSERVATION -

SAVE $$ AND PROTECT OUR WATER SUPPLY

Things You Can Do To Lower Your Water Bill

There are many things that you can do in and around your house to help conserve our most precious resource. Using our water saving tips will help to protect our water supply, and at the same time, save money.

Why Is Conserving Our Water So Important?

The deep sandstone aquifer is Waukesha's primary source of water. It supplies over 65,000 people with high quality drinking water. The benefits of conserving water, to ensure that we will have an adequate supply for the future, are too valuable to ignore.

Appendix G
Water System Pressure Management

AECOM
200 Indiana Avenue
Stevens Point, WI 54481
www.aecom.com

715 341 8110 tel
715 341 7390 fax

Final
Memorandum

To	Nancy Quirk, Waukesha Water Utility
CC	Kathy Beduhn, AECOM
Subject	Distribution Water System Pressure Waukesha Water Utility
From	Richard Hope, AECOM
Date	February 25, 2011

1.0 INTRODUCTION

The City of Waukesha has submitted an application to the Wisconsin Department of Natural Resources (DNR) for the diversion of Lake Michigan water. The DNR has requested additional information on and clarification of the application. Specifically, Wisconsin Administrative Code NR 852 (Table 2) requires the review of distribution system pressure management to determine if opportunities exist to reduce water system pressure and minimize water loss, and the DNR has requested clarification of whether Waukesha Water Utility is operating the water system within acceptable water system pressures, especially with respect to minimizing water loss. This memorandum responds to that specific request for clarification.

The Wisconsin Administrative Code NR 852 requiring the review of the distribution system pressure management is documented below.

Table 2. Required Conservation and Efficiency Measures
Wisconsin Administrative Code NR 852

CEM #	Description	Required Elements
Public Water Supply Water Use Sector (PWS)		
PWS-R1	Distribution System Pressure Management	Analyze distribution system pressure management to identify opportunities to reduce water use and minimize plumbing fixture leaks.

AECOM prepared the Water System Master Plan (August 2006) for the Waukesha Water Utility. As part of the Water System Master Plan a calibrated hydraulic model was developed and used to assist in the evaluation of system capacity and water system pressure throughout the water system. AECOM has the experience in the evaluation of water systems and specific knowledge of the Waukesha water system to provide an opinion on the whether the water system is being operated within acceptable water system pressures.

2.0 WATER SYSTEM PRESSURE

A water system needs to be designed so that adequate water system pressure is available to meet customers' needs and to provide required fire flows. In addition, regulatory requirements specify minimum pressure requirements because of health concerns that can results from the ingress of water into the water mains.

Wisconsin Administrative Code Clause 811.70 (4) discusses system pressure:

> (4) PRESSURE. All water mains, including those not designed to provide fire protection, shall be sized after a hydraulic analysis based on flow demands and pressure requirements. The minimum and maximum normal static pressure in the distribution system shall be 35 psi and 100 psi, respectively, at ground level. The system shall be designed and operated to maintain a minimum residual pressure of 20 psi at ground level at all points in the distribution system under all conditions of flow.

Further guidelines are provided in the Ten State Standard:

> 8.2 SYSTEM DESIGN
>
> 8.2.1 Pressure
>
> All water mains, including those not designed to provide fire protection, shall be sized after a hydraulic analysis (is completed) based on flow demands and pressure requirements. The system shall be designed to maintain a minimum pressure of 20 psi (140 kPa) at ground level at all points in the distribution system under all conditions of flow. The normal working pressure in the distribution system should be approximately 60 to 80 psi (410 - 550 kPa) and not less than 35 psi (240 kPa).

3.0 WAUKESHA WATER SYSTEM

Water system pressure varies throughout a distribution system due to topography and water demands. The service area for the Waukesha Water Utility has a varied topography (with elevations ranging from approximately 780 feet to 1,050 feet. To accommodate this topography change, the Waukesha Water Utility water distribution system is divided into eight pressure zones. Each pressure zone was developed to maintain system pressure within regulatory requirements.

As part of the Water System Master Plan, a detailed evaluation of the water system pressure in each pressure zone was performed. To assist in the evaluation of water system pressures and available fire flow, a detailed hydraulic model of the Waukesha water system was developed. The model allowed system pressures and fire flows to be evaluated under a range of existing and future water demand and operating conditions.

The evaluation confirmed that water system pressures were adequate to meet customer needs and fire flow requirements. One of the recommendations resulting from the evaluation was to readjust some of the pressure zone boundaries to better serve residents. The Waukesha Water Utility has implemented the recommended pressure zone boundary realignments; that realignment has improved system pressure, and from a hydraulic prospective the water system pressures are optimized.

4.0 BENEFITS OF LOWER SYSTEM PRESSURES

The previous section discussed the hydraulic reasons for the current water system pressures to ensure adequate flow to customers and the required fire flows. However, operating a water system at a lower water system pressure can have the following benefits:

1. Reduction in the number of water main failures (breaks/leaks)
2. Reduction in loss of water at leaks

These benefits and their impact on the Waukesha water system are addressed in greater detail in the following sections.

4.1. Reduction in Water Main Failures

Water mains are designed to withstand a specific pressure in excess of the pressure the pipe will experience. As with most assets, as the water main ages, its condition deteriorates, and the water main will eventually fail. Water utilities are continually replacing/rehabilitating water mains to minimize water main failures. Table 1 provides details of the number of water breaks that the Waukesha Water Utility has repaired since 2005. To benchmark this with industry guidelines, the failure rate has been converted to number of breaks per 100 miles, based on the 330 miles of water main that comprise the Waukesha water system.

Table 1. Water Main Breaks

Year	Total Number of Water Main Breaks	Water Main Breaks/100 miles of Water Mains
2005	23	7.0
2006	10	3.0
2007	21	6.4
2008	31	9.4
2009	32	9.7
2010	30	9.1

Many factors besides water main pressure—such as pipe material and corrosion—affect water main failure rate, so it is not possible to provide a standard for the allowable number of water main breaks per 100 miles. However, research from the Water Research Foundation provides the data in Table 2 regarding criteria for water main breaks/leaks.

Table 2. Criteria for Water Main Breaks/Leaks

Reference	Criteria
Distribution System Performance Evaluation American Water Works Association (AWWA) Research Foundation, 1995	Typical goal: 25-30 breaks and leaks per 100 miles
Benchmarking Performance Indicators for Water and Wastewater Utilities: 2007 Annual Survey Data and Analysis Report, AWWA, 2007	Top quartile performance range: 14.9–21.7 breaks and leaks per 100 miles
Water Audits and Loss Control Programs, AWWA M36, 2009	Performance goals: no more than 15 reported breaks and leaks per 100 miles

Therefore, the Waukesha Water Utility is well below the criteria presented in Table 2 and it does not appear that water system pressure is a major contributor to water main failure.

4.2 Reduction in Loss of Water at Leaks

The volume of water that is lost from a leak depends on water system pressure. The higher the system pressure, the greater the volume of water that will be lost through the leak; therefore, reducing system pressure reduces the volume of water lost. However, it is important to note that reducing pressure does not eliminate existing leaks.

Typically water loss, or unaccounted-for water (UFW), is specified as a percentage of water supplied, and that is how water loss is reported to the Public Service Commission (PSC) in Waukesha's annual reports. Table 3 provides a summary of UFW from 2005 to 2009.

Table 3. Unaccounted-for Water

Year	Percentage of UFW
2005	7
2006	5
2007	6
2008	4
2009	7

The PSC requires the utility to take action to reduce UFW when it reaches 15 percent. The Waukesha Water Utility is below the action level of 15 percent, and pressure does not appear to be major contributor to water loss.

AWWA (Water Audits and Loss Control Programs – M36) recommends an approach that looks at the volume of water lost and uses an Infrastructure Leakage Index (ILI) as a benchmark to compare how well a utility is managing leakage. The lower the ILI, the better the utility is managing water loss, with 1 generally being considered the lowest that is economically obtainable. As part of Waukesha's 2006 Water Master Plan, water loss was evaluated using this methodology, an ILI of 1.3 was determined for Waukesha.

Figure 1 is a reproduction from Lambert, A.O. and Dr. R. D. McKenzie, Practical Experience in using Infrastructure Leakage Index, International Water Association Conference 'Leakage Management: A Practical Approach', Lemesos, Cyprus, November 2002. The figure illustrates the ILI of seven North American systems compared to the International Water Association (IWA) International data set.

Table 4 is a reproduction from Water Audits and Loss Control Programs, AWWA M36, 2009 summarizing guidelines for the use of the ILI as a preliminary leakage target-setting tool.

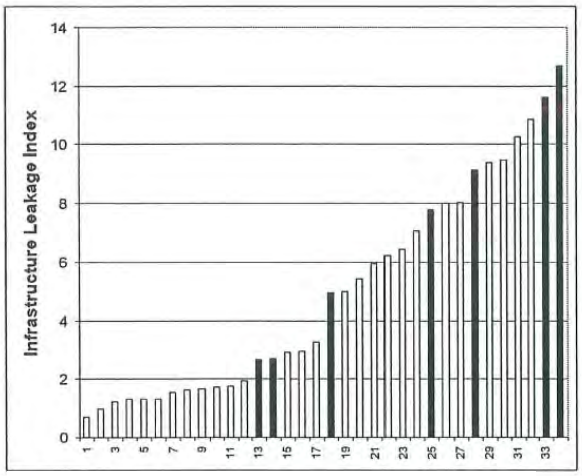


Figure 1. ILI Comparison

5.0 CONCLUSION

The Waukesha water Utility has divided the water distribution into eight pressure zones to ensure that pressure is maintained above regulatory requirements under current and projected water demand and operating conditions. Hydraulic modeling has confirmed that the current system pressure is adequate to ensure that the needed fire flows can be delivered. Historical water main breaks and leakage levels are below acceptable norms.

Table 4. Guidelines for Use of the Level Infrastructure Leakage Index as a Preliminary Leakage Target-Setting Tool (in lieu of having a determination of the system-specific economic level of leakage)

Target ILI Range	Water Resources Considerations	Operational Considerations	Financial Considerations
1.0 - 3.0	Available resources are greatly limited and are very difficult and/or environmentally unsound to develop.	Operating with system leakage above this level requires expansion of existing infrastructure and/or additional water resources to meet the demand.	Water resources are costly to develop or purchase; ability to increase revenues via water rates is greatly limited because of regulation or low ratepayer affordability.
3.0 - 5.0	Water resources are believed to be sufficient to meet long-term needs, but demand management interventions (leakage management, water conservation) are included in the long-term planning.	Existing water supply infrastructure capability is sufficient to meet long-term demand as long as reasonable leakage management controls are in place.	Water resources can be developed or purchased at reasonable expense. Periodic water rate increases can be feasibility effected and are tolerated by the customer population.
5.0 - 8.0	Water resources are plentiful, reliable, and easily extracted.	Superior reliability, capacity, and integrity of the water supply infrastructure make it relatively immune to supply shortages.	Cost to purchase or obtain/treat water is low, as are rates charged to customers.
Greater than 8.0	While operational and financial considerations may allow a long-term ILI greater than 8.0, such a level of leakage is not an effective utilization of water as a resource. Setting a target level greater than 8.0-other than as an incremental goal to a smaller long-term target-is discouraged.		
Less than 1.0	In theory, an ILI value less than 1.0 is not possible. If the calculated ILI is just under 1.0, excellent leakage control is indicated. If the water utility is consistently applying comprehensive leakage management controls, this ILI value validates the program's effectiveness. However, if strict leakage management controls are not in place, the low ILI value might be attributed to error in a portion of the water audit data, which is causing the real losses to be understated. If the calculated ILI value is less than 1.0 and only cursory leakage management controls are used, the low ILI value should be considered preliminary until it is validated by field measurements via the bottom-up approach.		
Source: Water Audits and Loss Control Programs, AWWA M36, 2009.			

Appendix H
Industrial Water Conservation

ecomagination℠

TOPICS PROJECTS TECHNOLOGIES NEWS

HOME > PROJECTS > ECOMAGINATION TREASURE HUNTS

Ecomagination Treasure Hunts

Through ecomagination, GE made a strong commitment to reducing its energy footprint.

The latest ecomagination report includes progress toward our commitments and success stories from our customers.

Tracking Ecomaginations Progress

DOWNLOAD THE REPORT (PDF 7.8MB)

GE Healthcare
Waukesha Campus

The easiest measures to implement:

1) Repair known water leaks is least expensive water savings measure

2) Train janitorial staff to report leaks.

3) Encourage employees to report leaks and improperly functioning plumbing fixtures by posting signage and communications awareness to conserve our natural resource water .

GE Healthcare
Waukesha Campus

Water reducing measures to reduce building water usage

Sink faucet aerators
0.5 (half) gallon per minute

146 sinks (93 %)
Total Investment: $4,380.00
Annual water reduction: 324, 625 gallons per year
Annual Cost savings: $1,732.00

Payback period: 2.53 years

GE Healthcare
Waukesha Campus

- Our team worked with our cleaning staff ABM and Unifirst to changethe water usage for cleaning bathrooms using a microfiber mop and bucket.

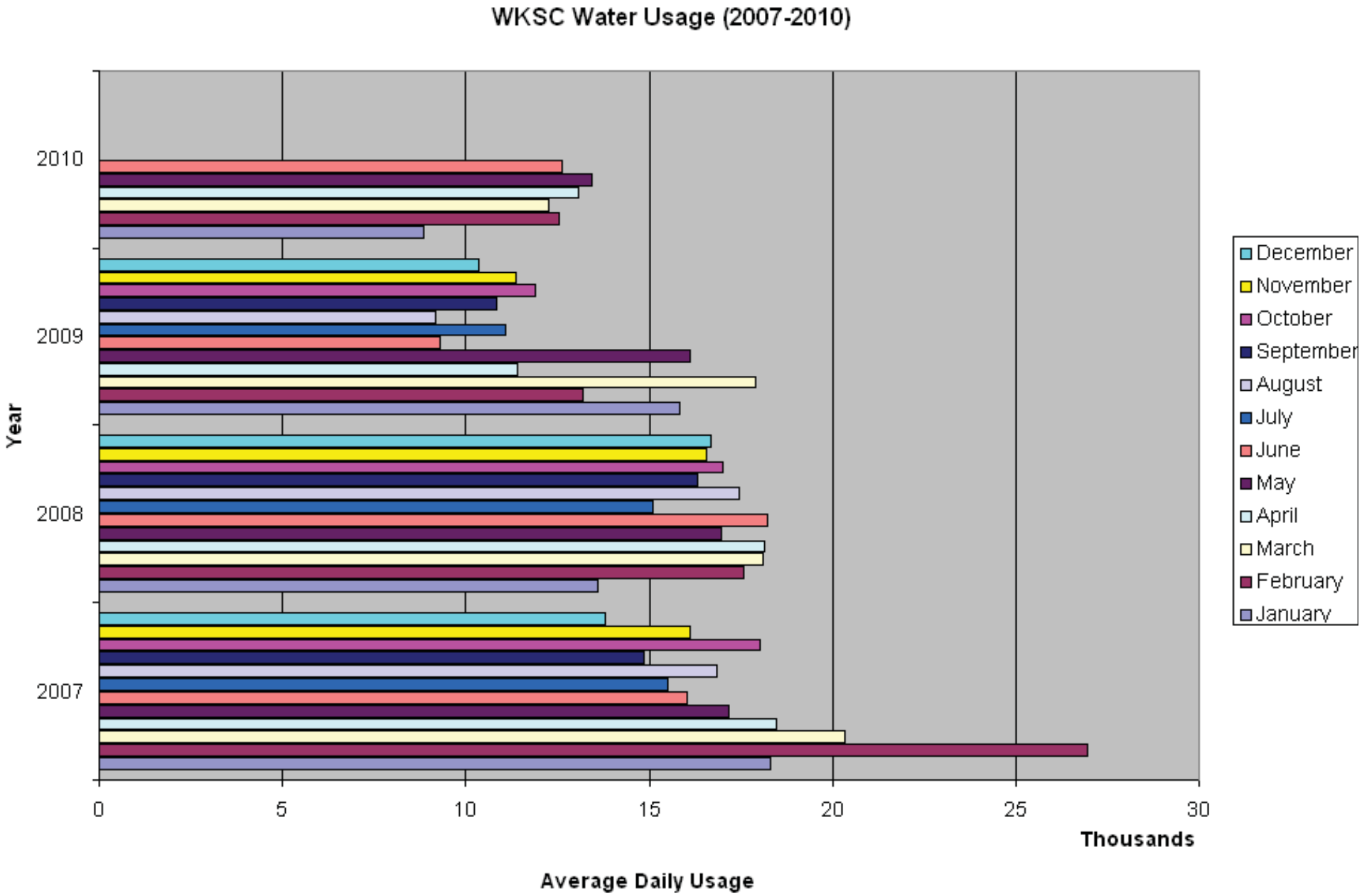
- ABM cleaning staff has embraced the use of the microfiber mops to clean bathrooms and other areas.

- This has been a major contributor to our water reduction usage and continue to review opportunities.

Estimated Water Usage Reduction:

Existing Water Usage: 5 gallons/bucket X replenished 4 times/night X 20 workers/night X 5 nights/week = 2000 gallons/week.

Current Water Usage: 1 gallon/bucket X replenished 0 times/night X 20 workers/night X 5 nights/week =100 gallons/week


WKSC Water Usage (2007-2010)
Year
2010
2009
2008
2007
0
5
10
15
20
25
30
Thousands
Average Daily Usage
December
November
October
September
August
July
June
May
April
March
February
January

Dean Foods / Golden Guernsey Dairy

- Focusing on Water Conservation for over 5 years.
- Employees play a key role in our conservation success.
- Although larger capital projects have been completed, the primary focus is on low cost / no cost conservation strategies.
- Why focus on water?
    1. Community Needs - It's the responsible thing to do as a member of the community.
    2. Water usage can be associated with all types of inefficiencies, costing more then most realize.

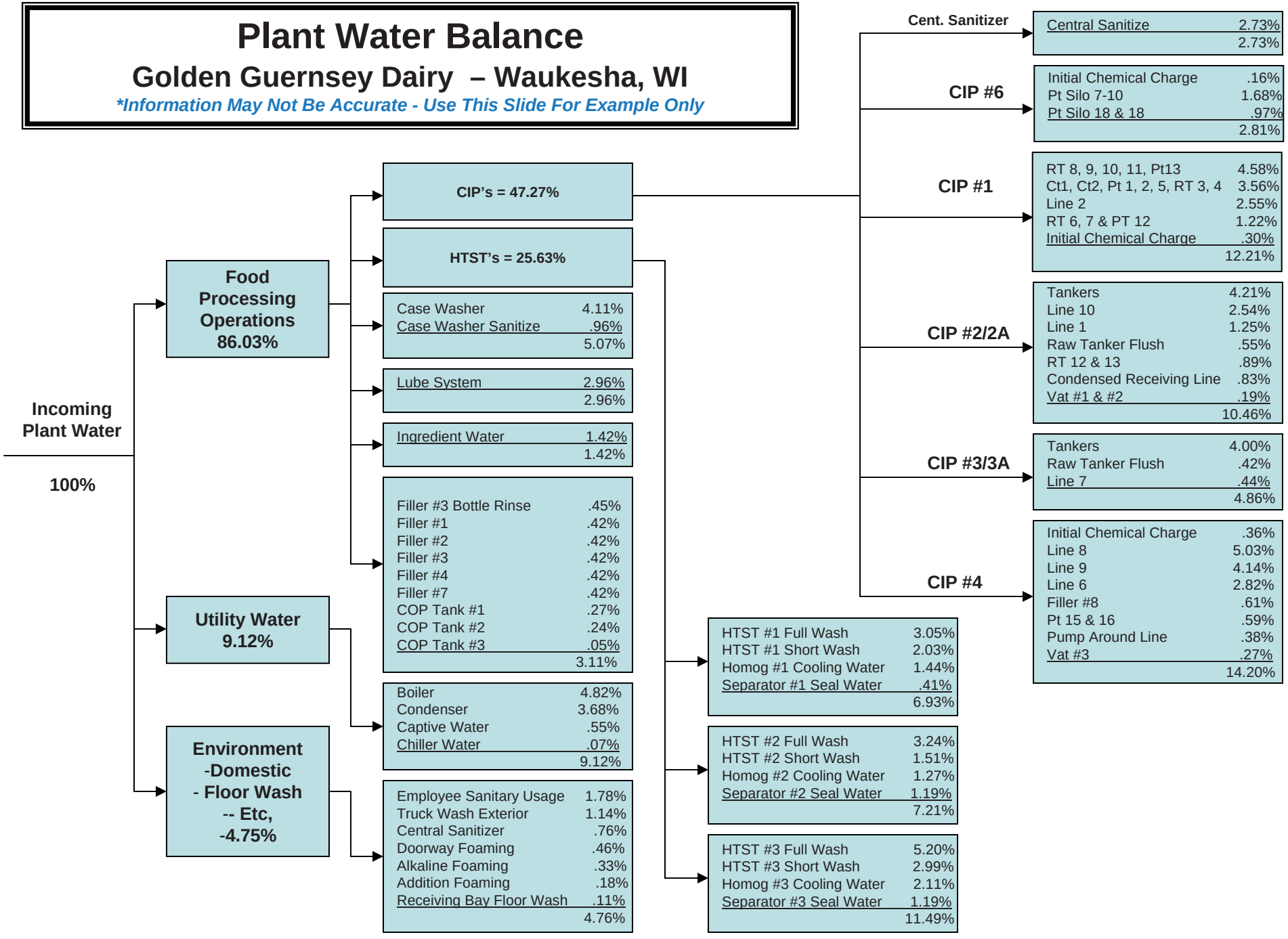
It all start's with understanding where the water usage is throughout the operation

One DeanTeam = One GreenTeam

Plant Water Balance

Golden Guernsey Dairy – Waukesha, WI

Information May Not Be Accurate - Use This Slide For Example Only



Examples of water saving ideas?

- A lube system is a detergent based lubricant mixed with water used on conveyors to keep them clean and lubricated.
- Dairy Chain is a large chain conveyor used to convey stacks of cased milk from the packaging to warehouse.

- **Turn conveyors off when not used**
- **Auto-shut offs for spray nozzles when tracks are not running**
- **Change nozzle size to reduce water / lube flow per minute.**
- **Pulse spray nozzles on and off during operating hours (example 30 seconds on / 30 seconds off)**

Annual Lube Savings =	$9,500
Estimated Electrical =	$2,500
Annual Maintenance Savings =	$3,375
Total Annual Savings =	$15,375

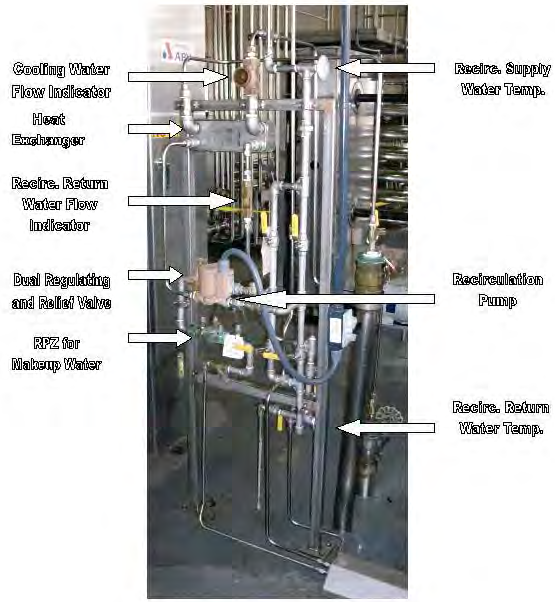
This does not include the annual $ saved for the reduction of over 250,000 gallons of water annually as a result of these low cost ideas.

One DeanTeam = One GreenTeam

Current Projects

Recirculation of cooling water used in large gearboxes on Homogenizing units.

Estimated water savings:
Over 1,000,000 gal per year.



Spinning cases as they exit the case washer shakes remaining wash water off in to a catch pan that returns the water back to the washing machine.

Estimated water savings:
Over 600,000 gallons per year.

One DeanTeam = One GreenTeam

Continuing to Produce Results

- In 2008, we enlisted the help of Ecolab, the worlds leading provider of cleaning, food safety, foodservice, healthcare and industrial sanitation products. They conducted a detailed audit of our facilities water usage.

- Eco Lab compared our water usage with 123 fluid milk plants from around the country:

The Waukesha facility ranked as the 4th most water efficient facility.

Case Study: Pure Power Technologies
Water Savings Summary 2010

Pure Power Technologies(PPT) in Waukesha, Wisconsin is owned by Navistar, a worldwide leader in the truck and engine market. In operation for over 60 years, PPT foundry produces ductile iron castings which covers all grades of ductile plus "specials". The PPT product mix includes castings from 5 lbs. to 150 lbs. in weight, complex parts, shapes, configurations, and heavily cored, if needed. Plant capacity is in excess of 42,000 tons annually.

Pure Power's Financial and Environment Impact:

23% decrease in water usage

ROI: Less than 6 months

Helped City of Waukesha save on pumping water discharge volumes

A Savings Opportunity and Solution

PPT's water shutoff control on process equipment did not exist at the time of original equipment installation. Some of the equipment was installed as early as the 1970's and over ten hydraulic water cooled heat exchangers needed water shutoff control. An updated system would control escalating water costs vital in keeping a competitive edge. The outdated system allowed water usage to occur on a continuous basis with or without Production running as well as dumping the non-contact cooling water to the discharge sanitary system.

Plant Engineering leadership conducted a water assessment, taking into consideration the necessary production schedules and found a number of areas which could be automated to include a water shutoff valve. This automation would integrate with the equipment and reduce water usage without risk to production.

PPT Maintenance resources installed the water shutoff valves at over 10 locations identified as primary targets for reducing incoming water usage. The water shutoff valves were integrated into the production process and when the system determines production is not running or the process is not used, the water is automatically shut off. PPT has installed equipment shutoff valves in 2010 to reduce their incoming water usage by over 15 million gallons of water per year which yielded a 23% reduction compared to the 2009. Another benefit was when the equipment water was shutoff, the discharge non-contact cooling water dropped significantly thus saving on discharge water costs. Water conservation efforts saved over $100,000 in 2010. After less than 6 months of using automated shutoff valves, PPT has received their full ROI and continues to save each month.

INTERNATIONAL - CONFIDENTIAL - DO NOT DISTRIBUTE

WAU Use Softened MakeUp Water to the Furnace Cooling Towers

Energy Engineer – Jim Lombardi

11/22/2010

EXECUTIVE SUMMARY

The Navistar Waukesha Manufacturing uses un-softened(hard) treated Waukesha water for the makeup water to the Furnace Cooling Towers. The hard water is much more aggressive (more sediments) and the chemical purge setpoint would be modified to a higher setting by using soft water. The end result is less water added to the system. Less purge cycles with added makeup water.

This appropriation request seeks funding to use softened makeup water to the Furnace Cooling Towers. The change requires plumbing modifications to connect the existing plant soft water to the dedicated Furnace water connection points. We may also need to upsize the water softner and purchase/design an easier method to add salt bags and possibly add electrical controls.

FINANCIAL SUMMARY

- **Projected cost: $40,000 materials & labor**
- **Projected net savings = $30,000/yr.**
- **Projected IRR = 46.3%**
- **Projected ROA = 42%**

SCOPE

Provide Engineering, labor and materials to use softened makeup water to the Furnace Cooling Towers in order to reduce our incoming water usage as well as reducing our discharge sanitary water stream.

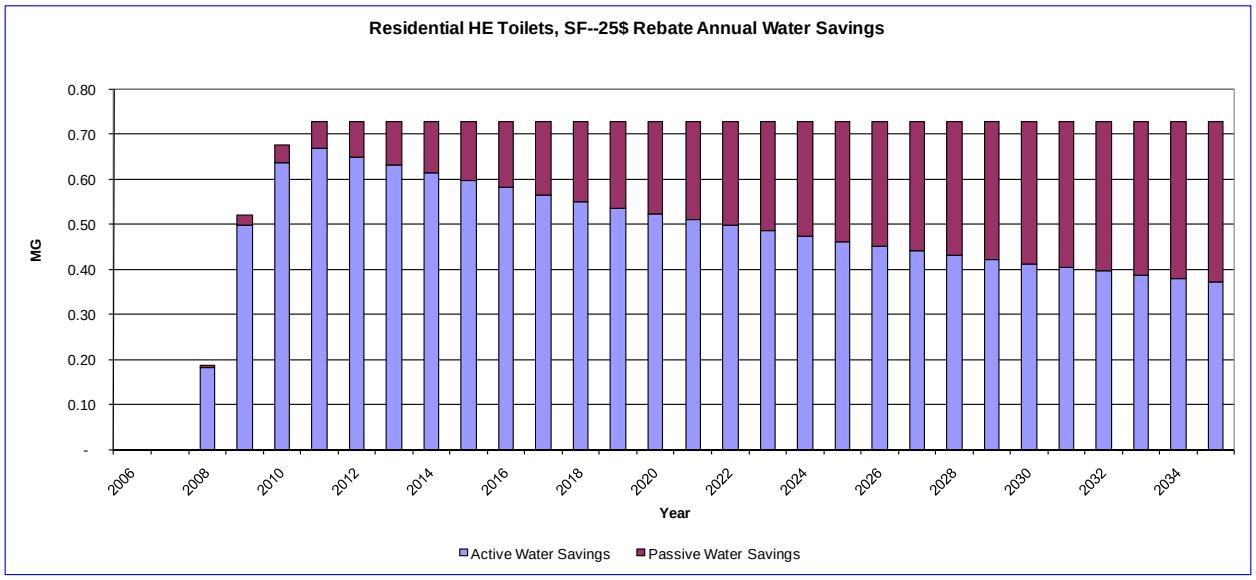
VERIFICATION OF SAVINGS

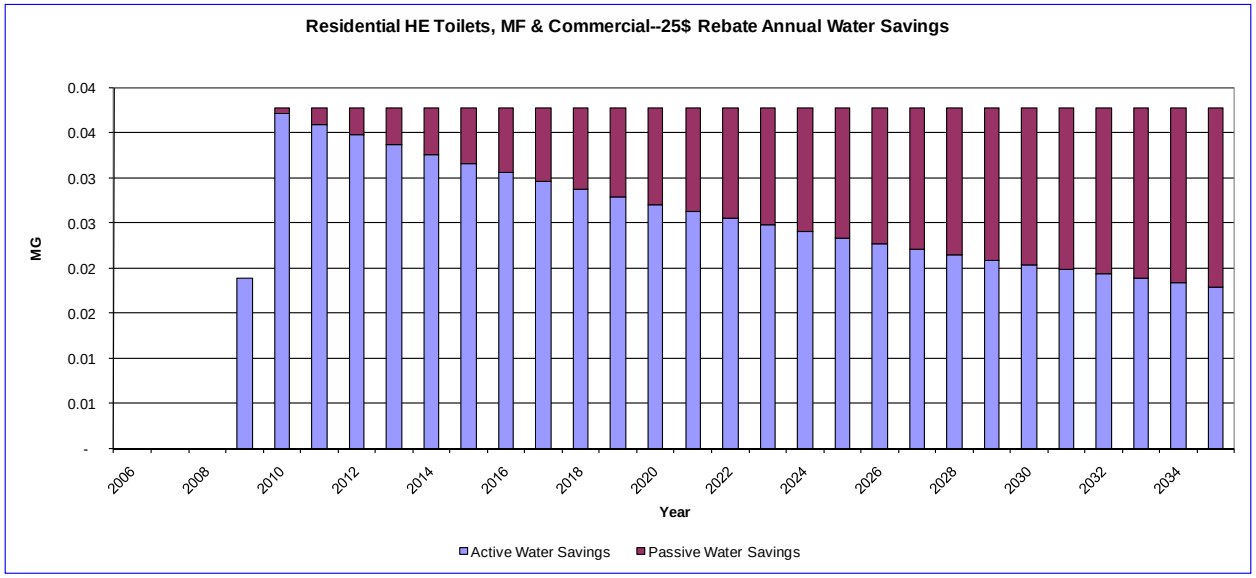
A conservative estimate of water reduction is based off of a best practice spreadsheet provided by our water chemical provider, Mitco. By using softened makeup water to the Furnace Cooling Towers, we can greatly reduce the makeup and blowdown water requirements. The current program is running at 1.5 cycles of concentration. The proposed program with softened makeup water will be 4.0 cycles of concentration. These improvements will lower operating energy cost by reducing water consumption. This project is estimated to reduce the incoming water requirements by 15,000,000 gallons of water per year. In addition, we estimate saving 15,000,000 gallons per year on water going to the discharge sewer. We estimate $30,000 per year of savings is realistic based off of the 2010 incoming and discharge water prices.

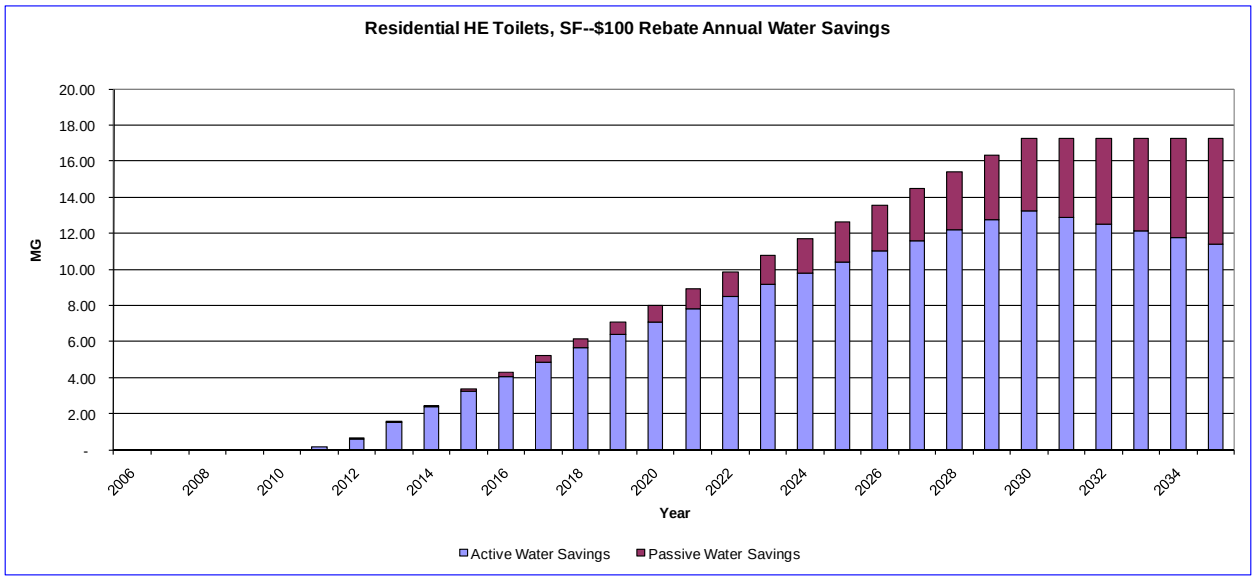
COMPLETION DATE

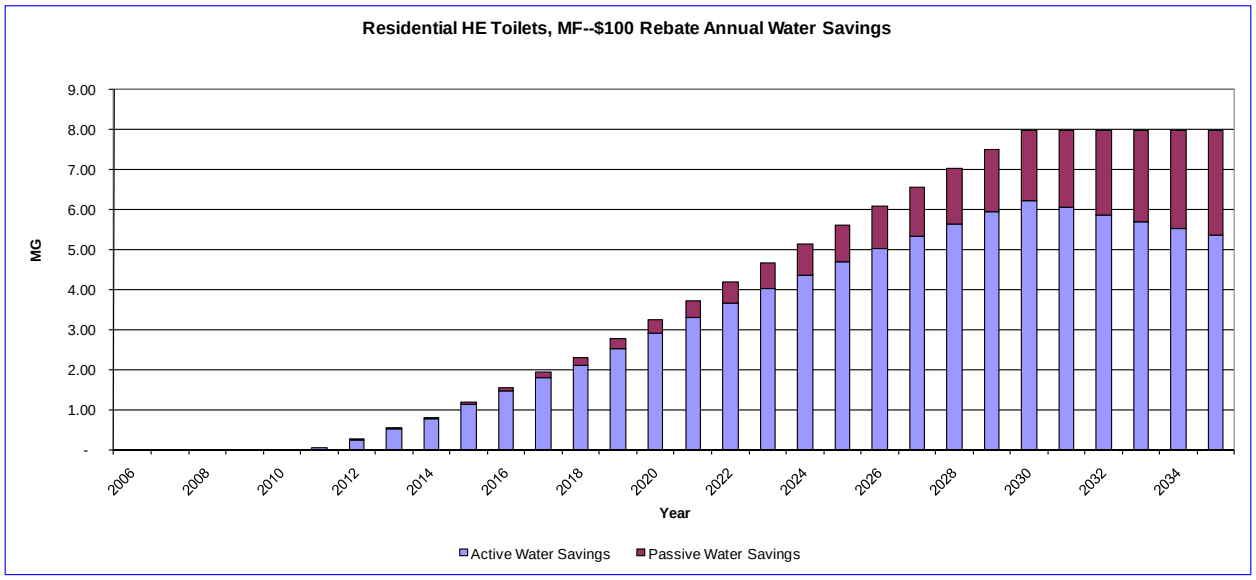
Implementation can be completed within 30 weeks of receiving approval on this project.

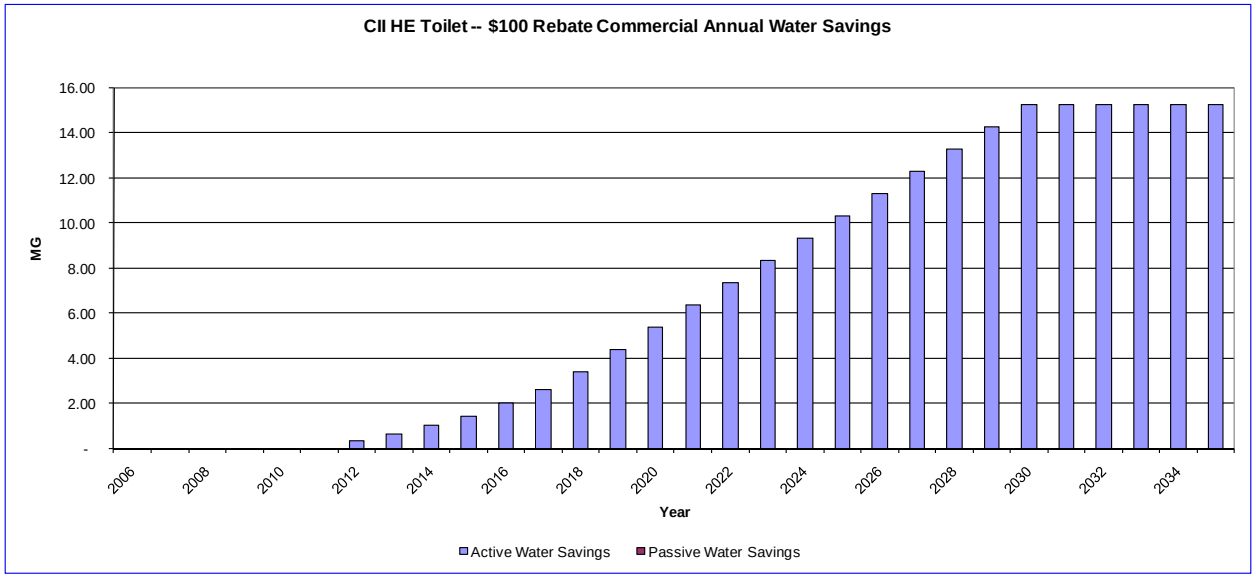
Appendix I
AWE Cost-Benefit Analysis

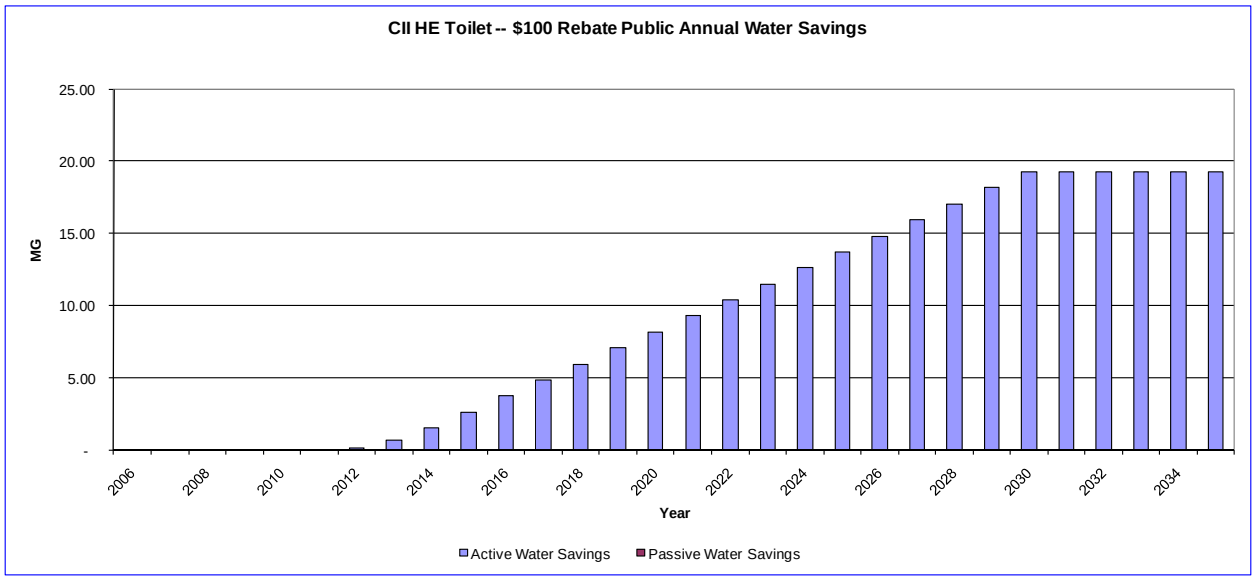

Residential HE Toilets, SF--25$ Rebate Annual Water Savings
MG
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
-
2006
2008
2010
2012
2014
2016
2018
2020
2022
2024
2026
2028
2030
2032
2034
Year
Active Water Savings
Passive Water Savings

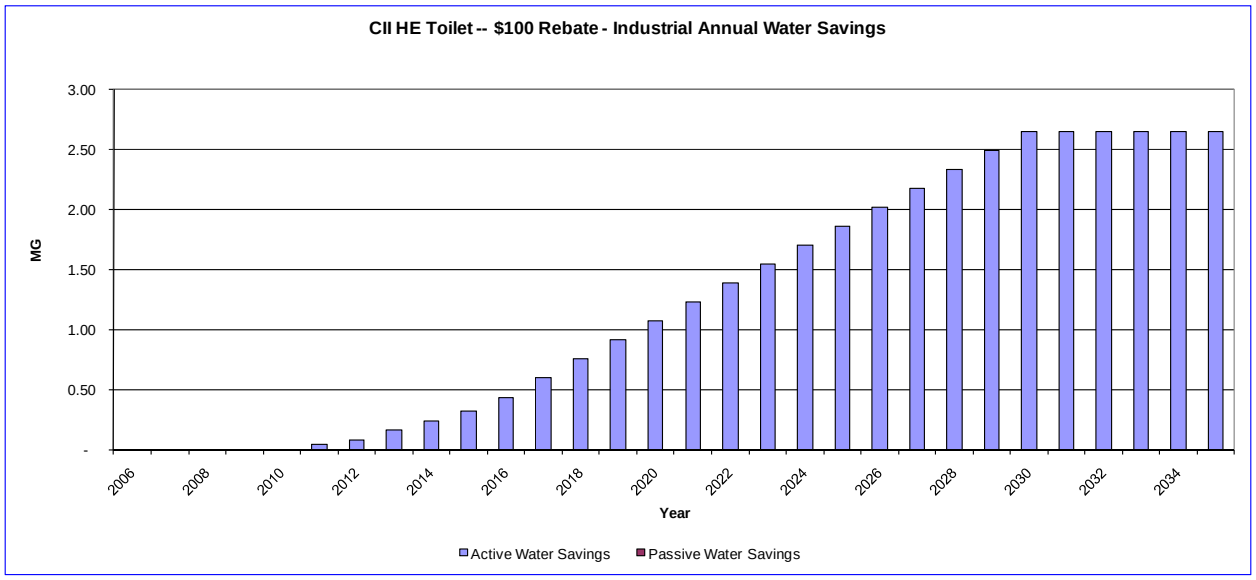

Residential HE Toilets, MF & Commercial--25$ Rebate Annual Water Savings
MG
0.04
0.04
0.03
0.03
0.02
0.02
0.01
0.01
-
2006
2008
2010
2012
2014
2016
2018
2020
2022
2024
2026
2028
2030
2032
2034
Year
Active Water Savings
Passive Water Savings

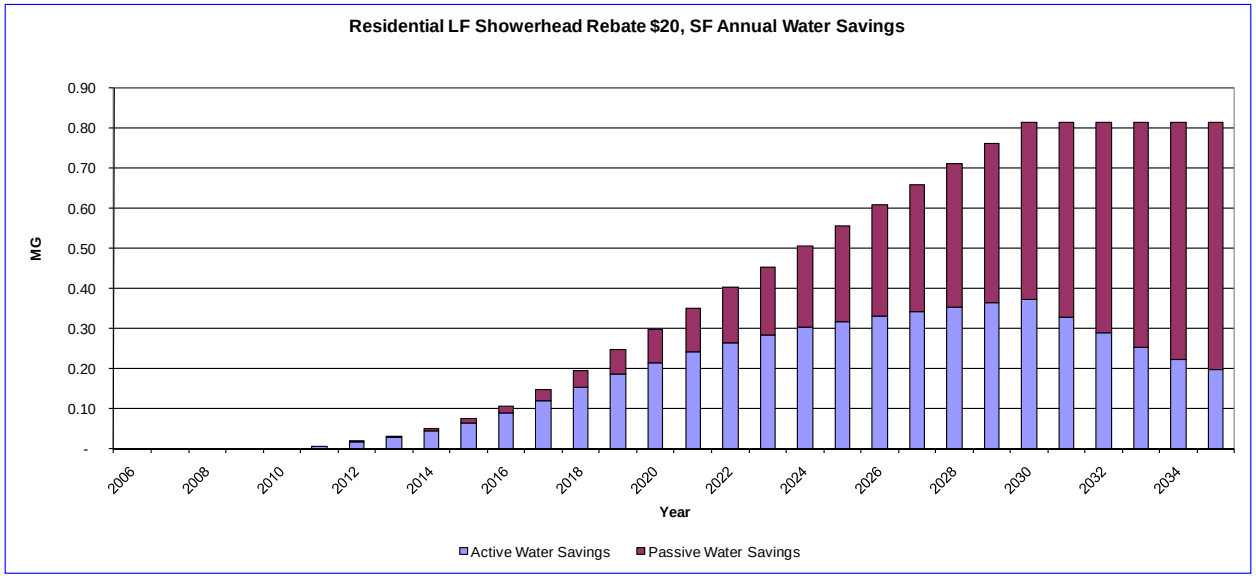

Residential HE Toilets, SF--$100 Rebate Annual Water Savings
MG
20.00
18.00
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
-
2006
2008
2010
2012
2014
2016
2018
2020
2022
2024
2026
2028
2030
2032
2034
Year
Active Water Savings
Passive Water Savings

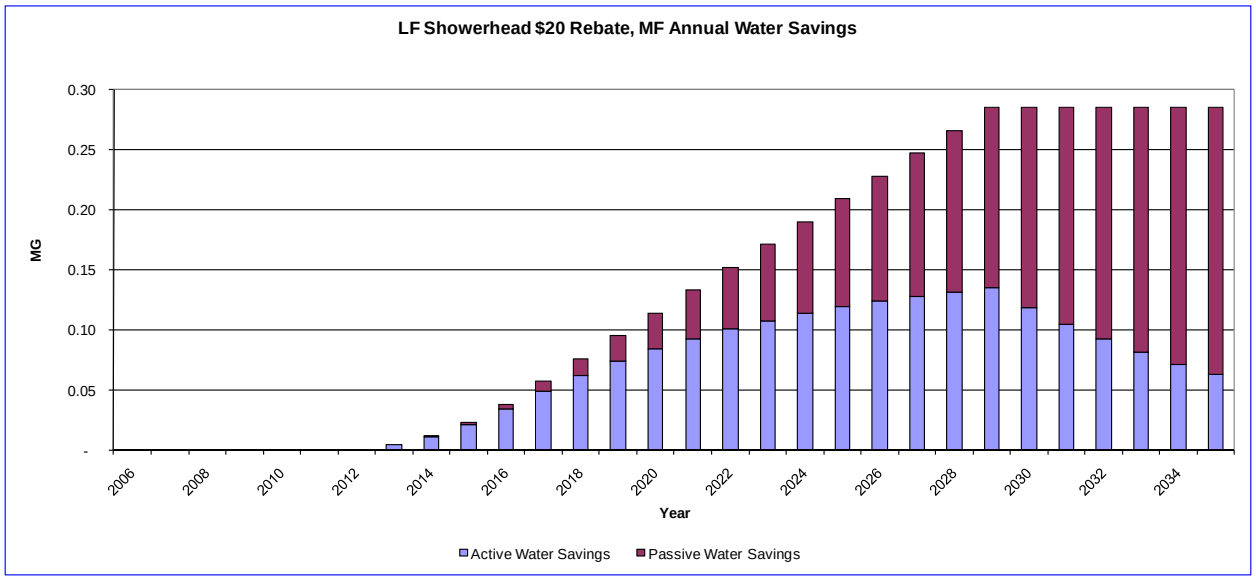

Residential HE Toilets, MF--$100 Rebate Annual Water Savings
MG
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
-
2006
2008
2010
2012
2014
2016
2018
2020
2022
2024
2026
2028
2030
2032
2034
Year
Active Water Savings
Passive Water Savings

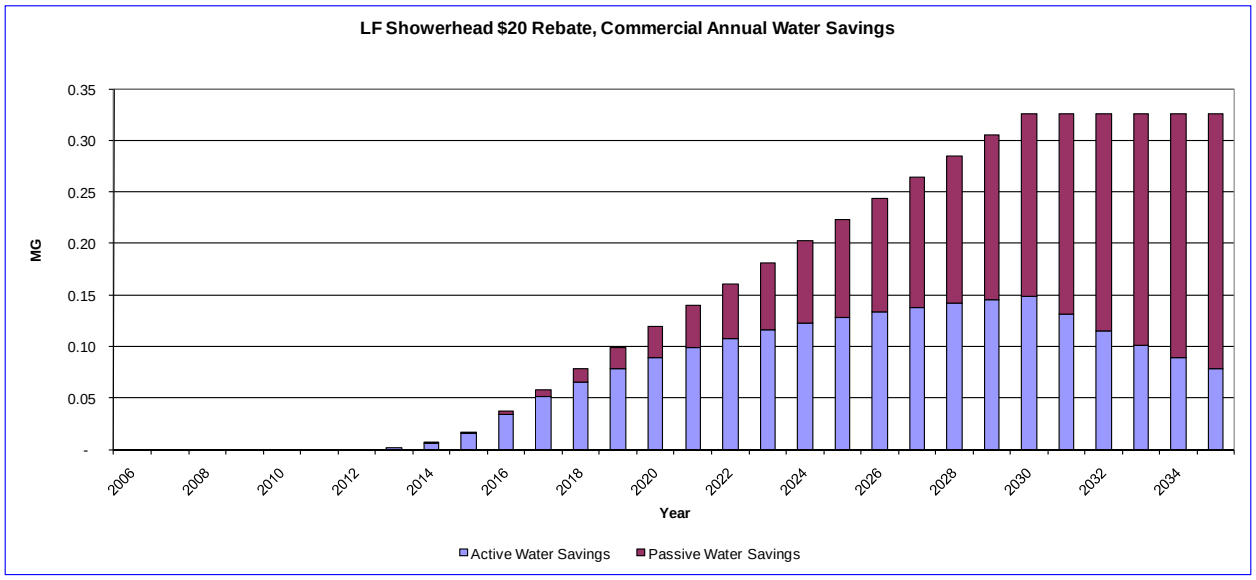

CII HE Toilet -- $100 Rebate Commercial Annual Water Savings
MG
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
-
2006
2008
2010
2012
2014
2016
2018
2020
2022
2024
2026
2028
2030
2032
2034
Year
Active Water Savings
Passive Water Savings

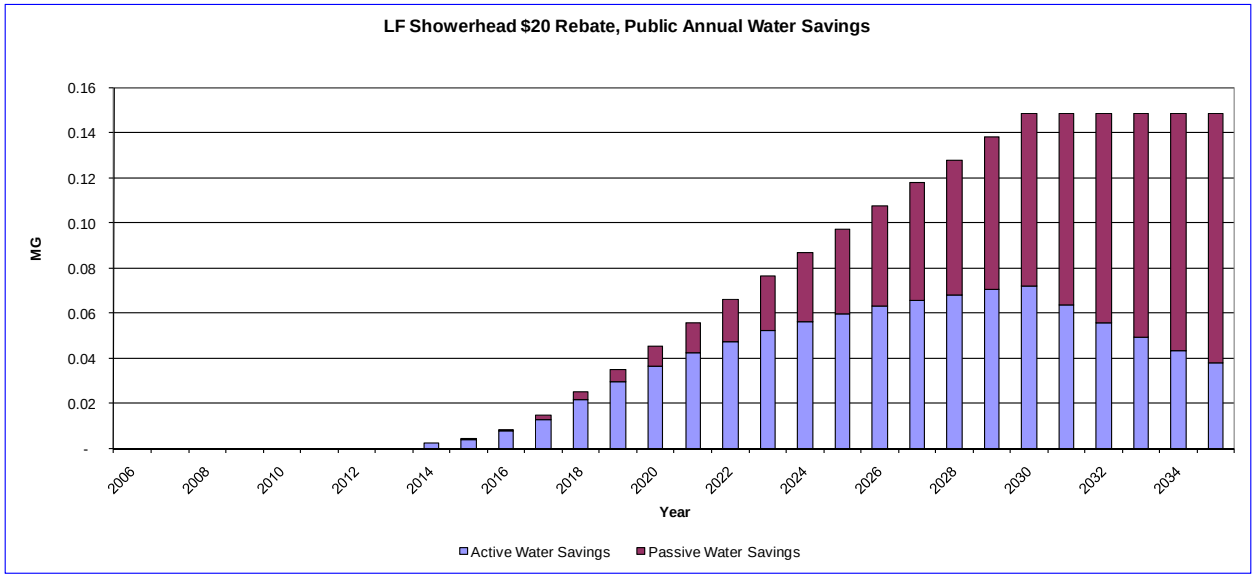

CII HE Toilet -- $100 Rebate Public Annual Water Savings
MG
25.00
20.00
15.00
10.00
5.00
-
2006
2008
2010
2012
2014
2016
2018
2020
2022
2024
2026
2028
2030
2032
2034
Year
Active Water Savings
Passive Water Savings

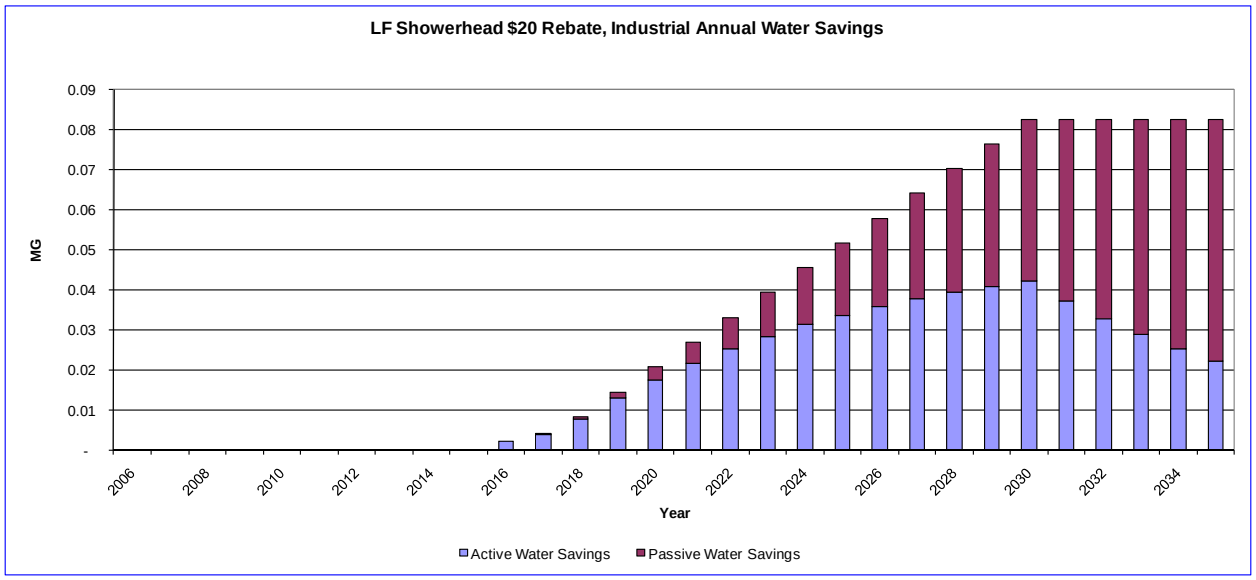

CII HE Toilet -- $100 Rebate - Industrial Annual Water Savings
3.00
2.50
2.00
1.50
1.00
0.50
-
MG
2006
2008
2010
2012
2014
2016
2018
2020
2022
2024
2026
2028
2030
2032
2034
Year
Active Water Savings
Passive Water Savings

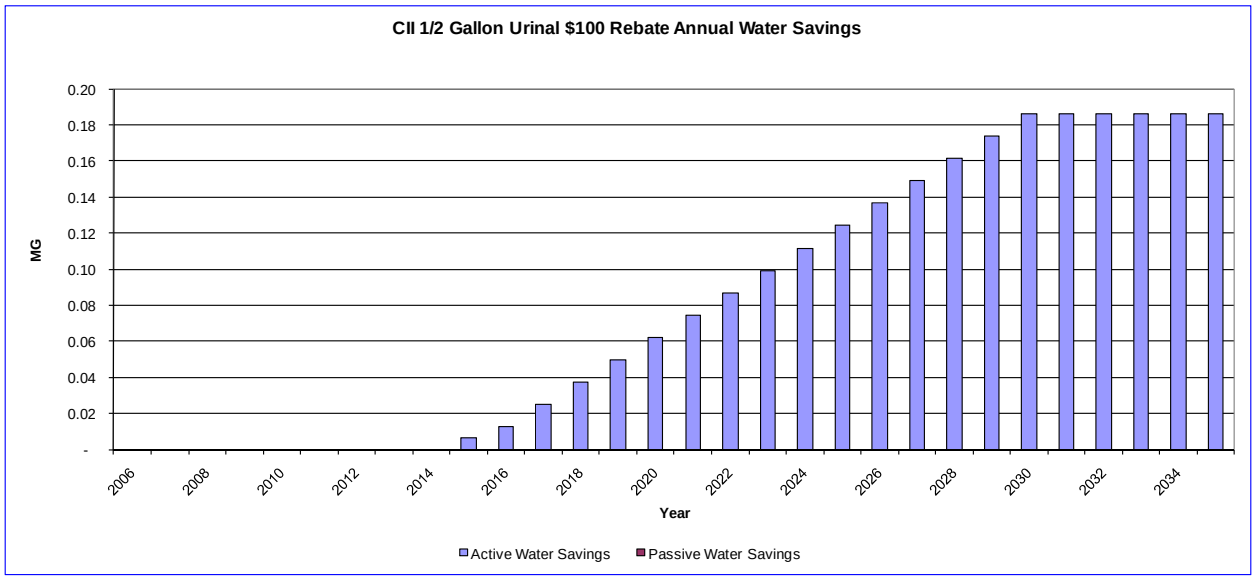

Residential LF Showerhead Rebate $20, SF Annual Water Savings
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
-
MG
2006
2008
2010
2012
2014
2016
2018
2020
2022
2024
2026
2028
2030
2032
2034
Year
Active Water Savings
Passive Water Savings

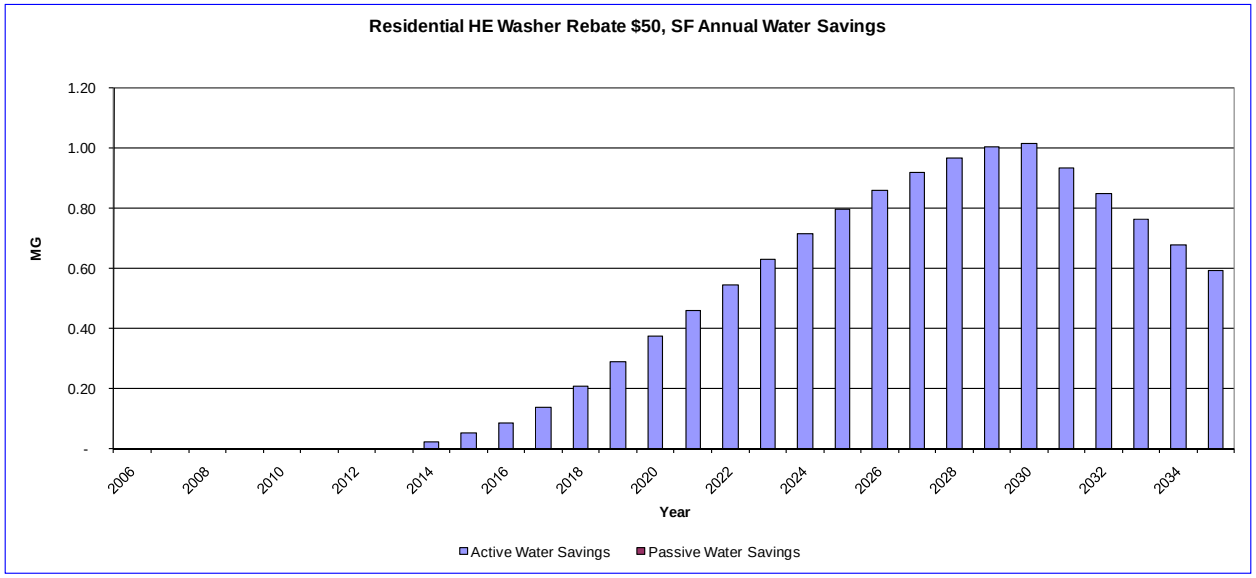

LF Showerhead $20 Rebate, MF Annual Water Savings
0.30
0.25
0.20
0.15
0.10
0.05
-
MG
2006
2008
2010
2012
2014
2016
2018
2020
2022
2024
2026
2028
2030
2032
2034
Year
Active Water Savings
Passive Water Savings

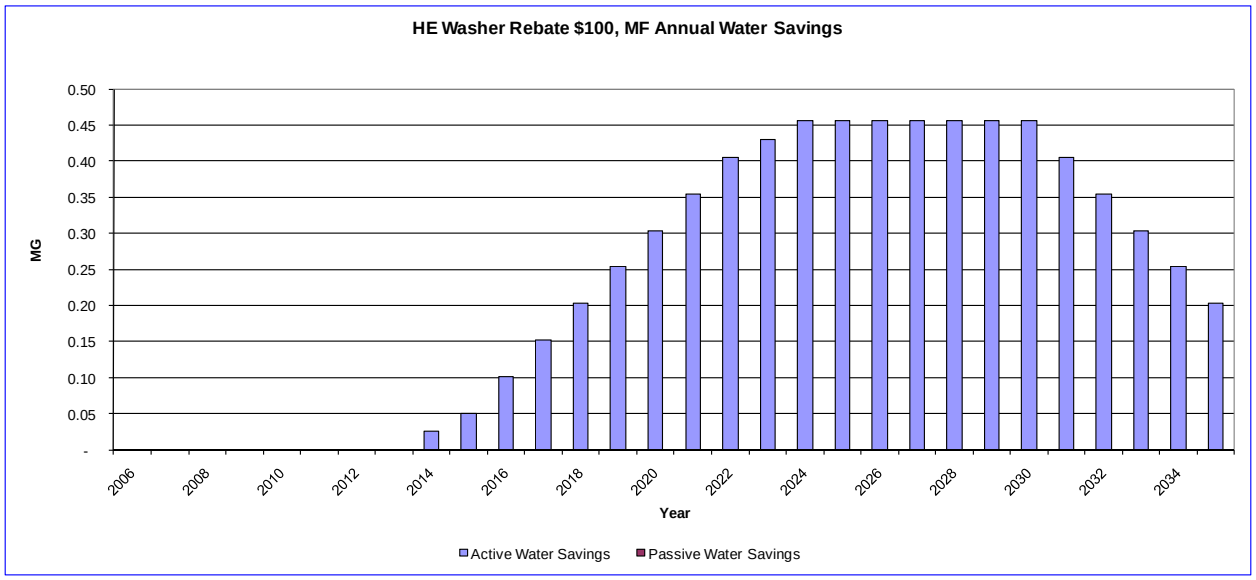

LF Showerhead $20 Rebate, Commercial Annual Water Savings
MG
0.35
0.30
0.25
0.20
0.15
0.10
0.05
-
2006
2008
2010
2012
2014
2016
2018
2020
2022
2024
2026
2028
2030
2032
2034
Year
Active Water Savings
Passive Water Savings

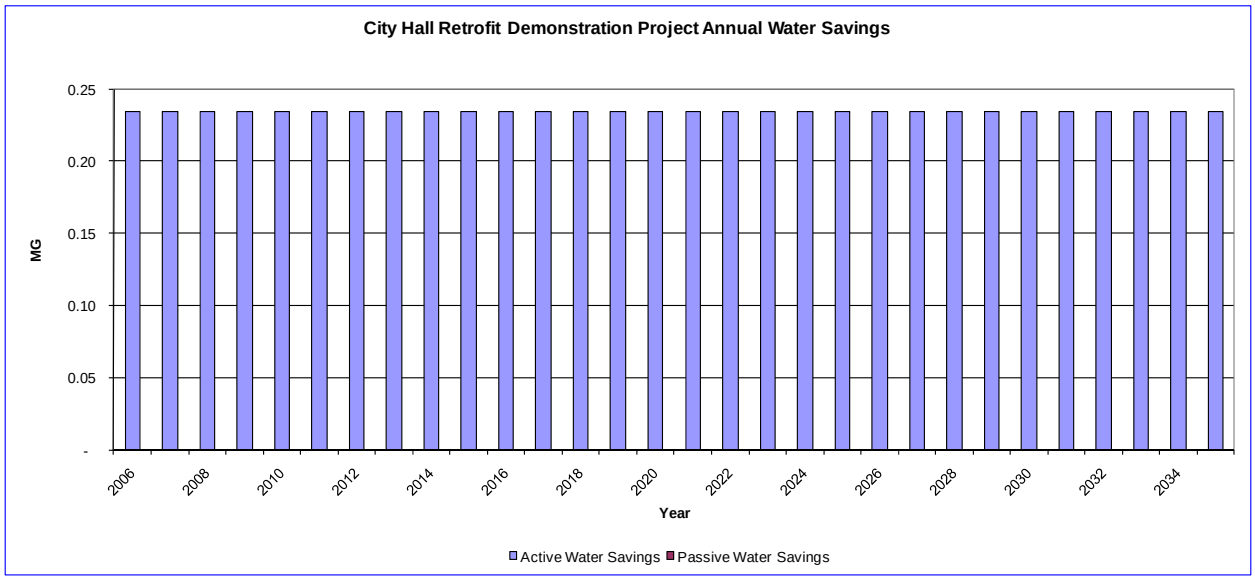

LF Showerhead $20 Rebate, Public Annual Water Savings
MG
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
-
2006
2008
2010
2012
2014
2016
2018
2020
2022
2024
2026
2028
2030
2032
2034
Year
Active Water Savings
Passive Water Savings


LF Showerhead $20 Rebate, Industrial Annual Water Savings
MG
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
-
2006
2008
2010
2012
2014
2016
2018
2020
2022
2024
2026
2028
2030
2032
2034
Year
Active Water Savings
Passive Water Savings


CII 1/2 Gallon Urinal $100 Rebate Annual Water Savings
MG
0.20
0.18
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
-
2006
2008
2010
2012
2014
2016
2018
2020
2022
2024
2026
2028
2030
2032
2034
Year
Active Water Savings
Passive Water Savings


Residential HE Washer Rebate $50, SF Annual Water Savings
MG
1.20
1.00
0.80
0.60
0.40
0.20
-
2006
2008
2010
2012
2014
2016
2018
2020
2022
2024
2026
2028
2030
2032
2034
Year
Active Water Savings
Passive Water Savings


HE Washer Rebate $100, MF Annual Water Savings
MG
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
-
2006
2008
2010
2012
2014
2016
2018
2020
2022
2024
2026
2028
2030
2032
2034
Year
Active Water Savings
Passive Water Savings


City Hall Retrofit Demonstration Project Annual Water Savings
MG
0.25
0.20
0.15
0.10
0.05
-
2006
2008
2010
2012
2014
2016
2018
2020
2022
2024
2026
2028
2030
2032
2034
Year
Active Water Savings
Passive Water Savings