Water Conservation Program

1. Executive Summary

For over ten years, the City of Bellingham (City) has run a successful Water Conservation Program that continues to yield strong results from its community outreach and education programs. The diversity of the City's programs has proven to have a positive impact on the public and has generated interest in learning more about our water source and conservation measures. As demonstrated in the information to follow, City of Bellingham water customers continue to use our water supply in a responsible manner by exercising sound water use. Data shows consumption has remained steady despite continued population growth inside and outside the city. With this response, the City's goal has been to maintain, improve, and expand its programs, with a continued effort and commitment to conservation of our valuable resource for current and future use.

2. Background/Objectives

A water conservation program is an important component to a City of Bellingham's water system plan. A conservation program helps outline steps for achieving water savings in harmony with future water demand projections. It also plays an imperative role in planning possible water treatment plant expansions and/or upgrades; a successful and well-planned water conservation program can potentially prolong such expensive projects. In 2003, Washington State passed the Municipal Water Law, (MWL), which gives municipal water suppliers certain benefits and obligations. This law directed the Department of Health (DOH) to adopt an enforceable Water Use Efficiency Program, (WUEP), which went into effect in January 2007. New rules and guidelines require municipal water suppliers to meet certain responsibilities. The Water Use Efficiency Program can be found in the appendix at the end of this document. This summary is a follow-up to the previous Water Conservation Program summary completed in February 2002 and updates water consumption data and conservation programs from 2002 to 2006. Objectives of the Water Conservation Program are to use the compiled information to facilitate programs that are widely received by the public, cost-effective to the utility, and have significant positive impacts to our water supply. The objectives are also aimed at educating the public

about the source of our water supply, environmental factors associated with it, and how actions individually and collectively impact the source.

3. Water Consumption Data

The City of Bellingham's water treatment plant serves approximately 91,000 residents of the City of Bellingham and 11 water districts in and around Bellingham. Fifty-six percent of the water produced by the city's water treatment plant is metered. Thirty percent of the remaining water is consumed by flat-rate, single family residents and about 15% is non-revenue water use. (Figure 2)

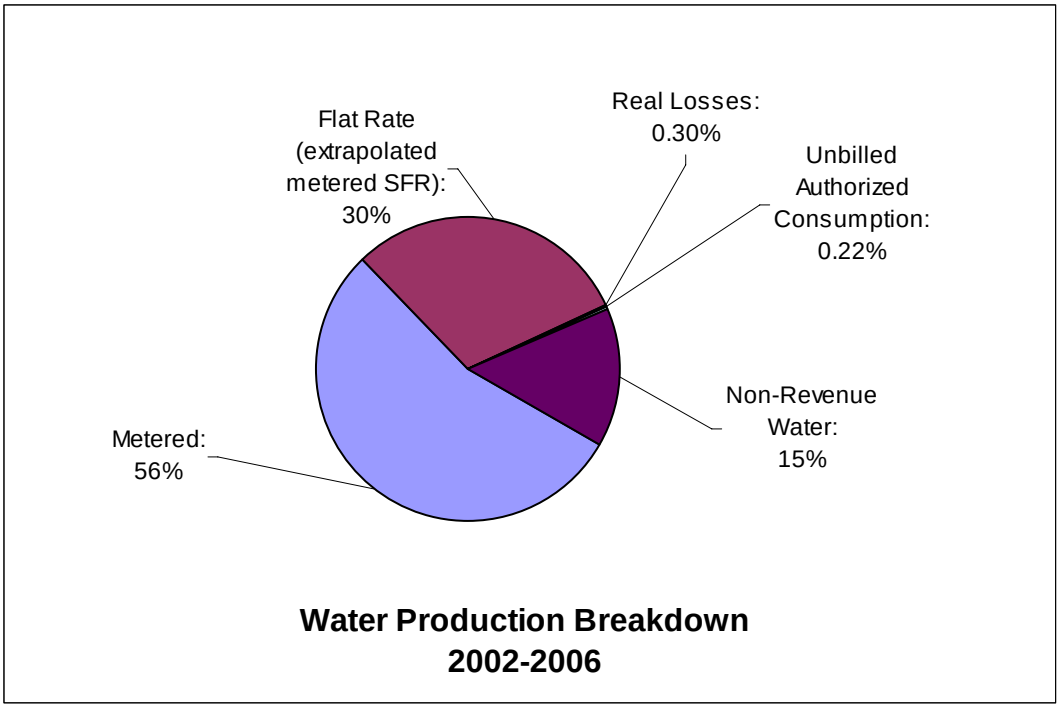


Figure 2. Total water treatment plant production and consumption billing allocation

Definitions for these percentage breakdowns are as follows:

- **Metered**: Metered customers include industrial, commercial, institution, irrigation, colleges and universities, water districts, multi-family residences and some single-family residences.

- **Flat-rate:** Flat-rate single-family residences within city limits.

- **Non-Revenue Water:** Water that is not billed and does not produce revenue; water loss volume for the system.

- **Real Losses:** Known leakage on Transmission and/or Distribution water mains.

- **Un-Billed Authorized Consumption:** Maintenance on water mains, main flushing, fire department training, main replacement, and blow-offs.

Flat-rate single-family residences account for nearly three-fourths of the 23,000 water accounts. Average daily consumption has remained around 10+/- million gallons of water per day (mgd). In the summer months, average daily demand often doubles due to outdoor watering, recreation, and annual water department maintenance.

3.1 City-wide Water Consumption

From 1990 to 2006, the City of Bellingham has seen a 41% increase in water services and population. Despite these increases, average daily water production has remained steady, fluctuating by approximately 2% on average, which is equal to the annual average growth rate of 1.8% as well. (Note: Georgia Pacific closed its pulp mill operations between 2000-2002 which contributed to lower than average consumption figures during this time period)

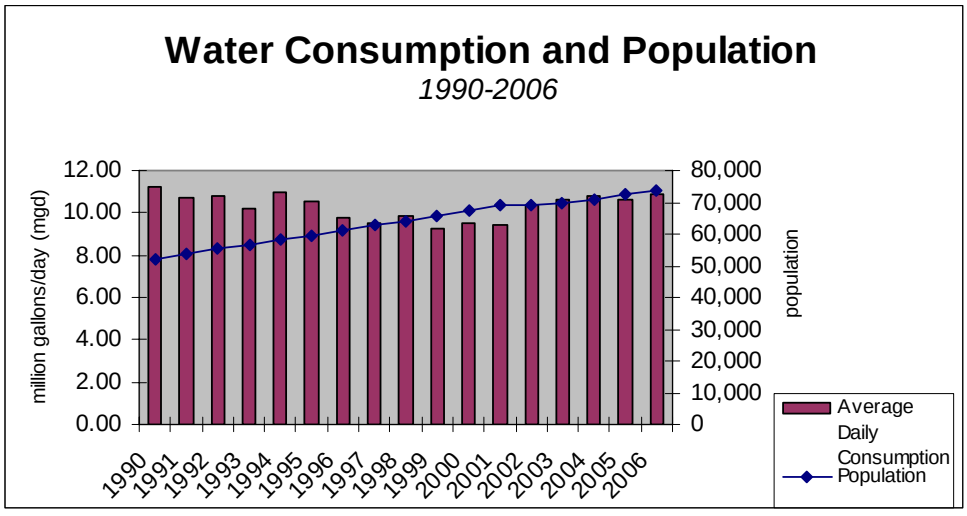


Figure 3. Water consumption and population data from 1990-2006

City water service and consumption data for 2002-2006 is shown in Figure 3 and Table 1.

Year	Population	% Change Population	# Services	% Change Services	Rainfall	ADD (mgd)	% Change Consumption
2002	69,260	0.54%	22,352	1.25%	24.00	10.38	9.73%
2003	69,850	0.85%	23,240	3.97%	34.00	10.63	2.41%
2004	71,080	1.76%	23,464	0.96%	35.83	10.80	1.60%
2005	72,320	1.74%	23,905	1.88%	31.06	10.59	-1.94%
2006	73,460	1.58%	24,210	1.28%	34.99	10.85	2.46%

Table 1. Annual population figures, number of services, rainfall and average daily demand

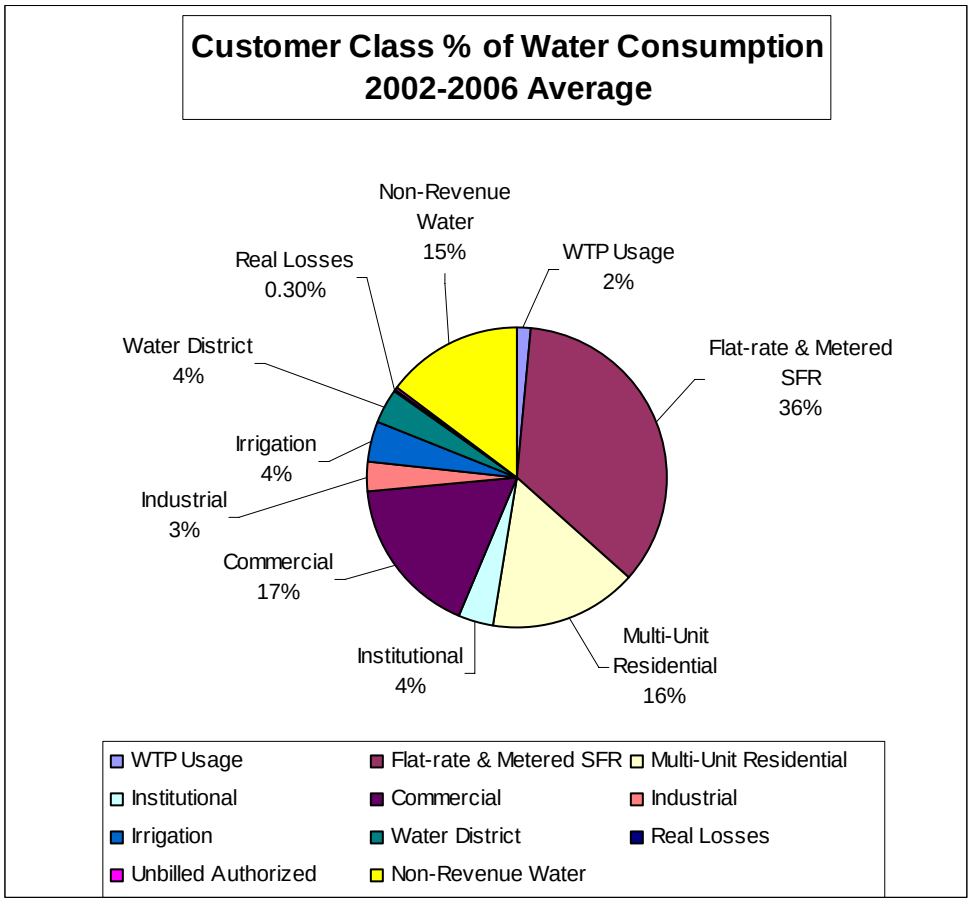


Figure 4. Water consumption percentage by customer class

The chart in Figure 4 displays a percentage breakdown of water consumption by customer class. The pie chart total of 100% is equal to the 2002-2006 city-wide average consumption of 10.65 mgd. The data displayed is used to determine which customer classes could benefit most from city-sponsored water conservation programs

to reduce overall water consumption. Further descriptions and details of these customer classes are described in the following section.

3.2 Single-family Residence Consumption

The City of Bellingham serves approximately 18,422 single-family residential (SFR) water customers. Of these, 15,977 are flat-rate services, and 2,445 are metered services. As is consistent with city-wide consumption data, water consumption has remained steady for metered single-family residences, and displays an independent relationship to number of services. For example, an increase in water services does not indicate an increase in water consumption, as is shown in Table 2a. Overall, metered SFR customers consume approximately 476,218 gallons of water per day which is less than 5% of the total city-wide consumption.

Metered SFR Water Consumption

Table 2a.	**2002**	**2003**	**2004**	**2005**	**2006**
Total mgd	0.49	0.52	0.50	0.47	0.51
# Services	2,196	2,330	2,429	2,534	2,736
gpd/service	224	222	206	186	187
gpd/cap	89	88	81	73	74
cap/service	2.53	2.53	2.53	2.53	2.53

Table 2a. Gallons per day (gpd) for each water service and gdp per capita. Per capita data obtained from 2000 census data for Washington State, Whatcom County, and Bellingham - 2.53 persons per single-family household.

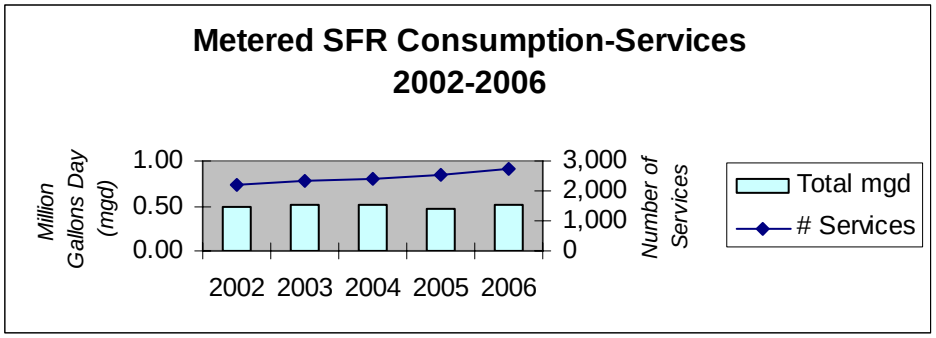


Figure 5. Metered single-family residence consumption and number of services.

As of January 1, 2005, the City of Bellingham adopted an ordinance that requires all new SFR customers to install a service meter. This will result in a decrease in the number of flat-rate services for 2006 and beyond. Reductions in flat-rate services could be affected for various reasons, one reason being water customers that switch

to a metered water service through the Voluntary Metering Program, which is described in Section 4 of this report. Flat-rate SFR water customers consume approximately 3.1 million gallons of water per day, which is roughly 30% of the total city-wide consumption. This customer class makes up the bulk of the total number of water services, and also amounts to the largest water user by customer class. Flat rate consumption is calculated by extrapolating known metered single-family residential consumption to the 15,000+ flat-rate single-family customers. Use of this method for estimating the flat-rate water customer class is substantiated by results of the City's 2000-2002 Water Meter Pilot Project study, which found that the consumption difference between flat-rate and metered single-family water customers was statistically insignificant.

Flat Rate SFR Water Consumption

Table 2b.	**2002**	**2003**	**2004**	**2005**	**2006**
Total mgd	3.22	3.43	3.29	3.08	3.38
# Services	15,525	15,658	16,145	16,285	16,271
gpd/service	208	219	204	189	208
gpd/cap	82	86	81	75	82
cap/service	2.53	2.53	2.53	2.53	2.53

Table 2b. Gallons per day (gpd) for each water service and gdp per capita. Per capita data obtained from 2000 census data for Washington State, Whatcom County, and Bellingham - 2.53 persons per single-family household.

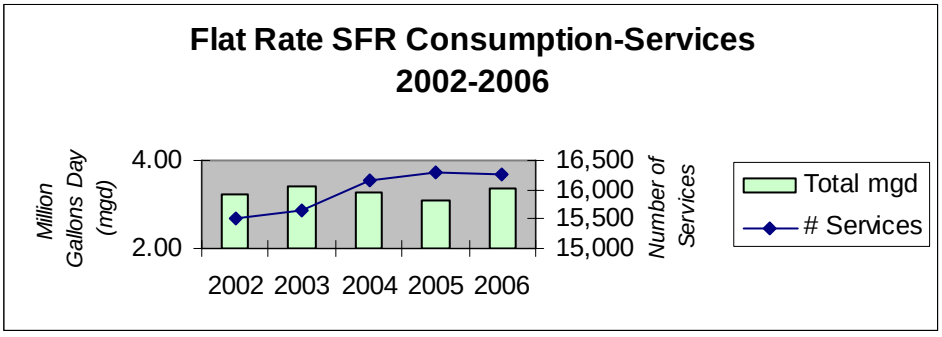


Figure 6. Flat rate single-family residence consumption and number of services.

3.3 Multi-unit Consumption

Multi-unit water customers are comprised of multi-family apartment complexes, duplexes, condos, and additional dwelling units. There are approximately 2,991 multi-unit services, with multi-family apartments making up 50% of this figure. Total

consumption is approximately 1.6 million gallons per day, or roughly 16% of city-wide consumption. In general, multi-unit residences tend to use 30% less water than single-family residences; multi-unit residences are likely to have fewer appliances such as dishwashers and clothes washers installed in each unit, and use little or no water outdoors[1]. Table 2c and Figure 2c below shows water consumption and services for all multi-unit water services.

Multi-Unit Residential Water Consumption

Table 2c.	2002	2003	2004	2005	2006
Total mgd	1.67	1.64	1.71	1.69	1.76
# Services	2,051	2,140	2,214	2,292	2,396
gpd/service	815	767	773	738	736
gpd/cap	427	402	404	386	385
cap/service	1.91	1.91	1.91	1.91	1.91

Table 2c. Multi-unit residential water consumption per capita obtained from 2000 census data for Washington State, Whatcom County, and Bellingham - 1.91 persons per multi-unit residence.

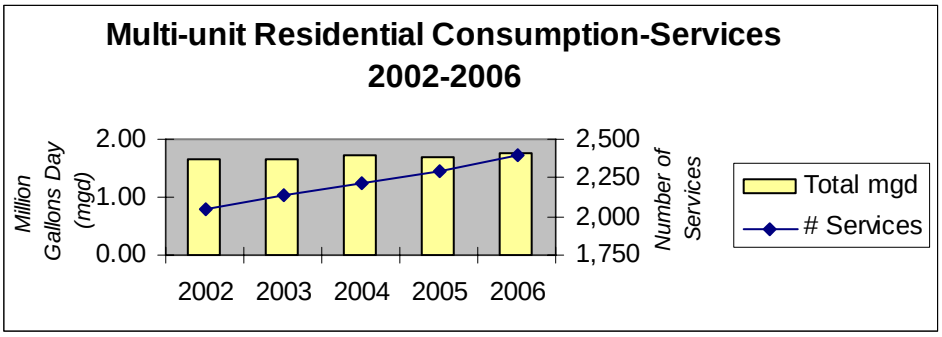


Figure 7. Multi-unit consumption and number of services

The customer class multi-family apartment complexes have shown to be the largest water consumer out of all the different multi-unit water services. These account for almost 14% of the total city-wide water consumption.

3.4 Commercial Consumption

Commercial water customers include commercial businesses, lodging, and restaurants. This customer class has approximately 1,897 services and consumes roughly 1.8

[1] *Handbook of Water Use and Conservation*, Amy Vickers, 2001

million gallons of water per day, or approximately 17% of the total city-wide consumption. Table 3 shows annual consumption and number of services.

Commercial Water Consumption

Table 3	2002	2003	2004	2005	2006
Total mgd	1.83	1.82	1.87	1.83	1.84
# Services	1,829	1,861	1,894	1,932	1,968
gpd/service	999	980	987	947	937

Table 3. Commercial customer annual water consumption

3.5 Industrial Consumption

Industrial consumption has remained steady the past four years as is shown in Table 4. Industrial customers include businesses such as fish and food processing plants, cold storage facilities, lumber mills, ship manufacturing and commercial laundry services. These customers consume about 303,000 gallons of water per day, about 3% of the total city-wide consumption.

Industrial Water Consumption

Table 4	2002	2003	2004	2005	2006
Total mgd	0.30	0.32	0.31	0.32	0.33
# Services	46	46	48	48	50
gpd/service	6,471	6,969	6,394	6,734	6,669

Table 4. Industrial customer water consumption

3.6 Irrigation Consumption

Irrigation has also remained steady the past four years. Daily consumption reaches roughly 406,000 gallons per day, and makes up 4% of the total city-wide consumption. Irrigation accounts are made up of single-family residential and commercial customers who pay for a separate irrigation line, as well as City of Bellingham Parks Department that have irrigation lines at specific parks.

Irrigation Water Consumption

Table 5	2002	2003	2004	2005	2006
Total mgd	0.47	0.45	0.48	0.44	0.46
# Services	312	340	365	382	395
gpd/service	1,495	1,323	1,318	1,159	1,166

Table 5. Metered irrigation accounts water consumption

3.7 College Consumption

The City of Bellingham water system serves educational institutions such as Western Washington University, Whatcom Community College, and Bellingham Technical

College. Daily consumption for the colleges is approximately 240,000 gallons per day or 2% of the total city-wide consumption.

College Water Consumption

Table 6	2002	2003	2004	2005	2006
Total mgd	0.27	0.23	0.24	0.23	0.22
# Services	42	44	44	50	50
gpd/service	6,371	5,293	5,429	4,566	4,459

Table 6. College accounts water consumption

3.8 Institution Consumption

The institution customer class is made up of city water accounts, Bellingham School District, and includes private schools and churches. This customer class accounts for almost 1.8% of the total city-wide consumption, and uses approximately 183,000 gallons of water per day.

Institution Water Consumption

Table 7	2002	2003	2004	2005	2006
Total mgd	0.22	0.20	0.21	0.19	0.19
# Services	178	184	190	189	194
gpd/service	1,241	1,067	1,096	988	995

Table 7. Institution water consumption

3.9 Water District Consumption

There are currently 11 water districts/associations within Whatcom County that purchase water from the City of Bellingham for resale to their customers. These include Water District #2, #7, Deer Creek Water Association, Glen Cove Water Association, Montgomery Road Water Association, and Lummi Water and Sewer District, along with several smaller associations in and around Bellingham. In 2005 consumption dropped to almost 50% of historical averages due to Lake Whatcom Water and Sewer District (LWWSD) no longer purchasing bulk resale water from the City of Bellingham for its south shore service area. Lake Whatcom Water and Sewer District continues to purchase a small amount of resale water for a portion of its north shore service area.

Water District Water Consumption

Table 8	2002	2003	2004	2005	2006
Total mgd	0.50	0.52	0.50	0.29	0.33
# Services	11	11	11	11	11
gpd/service	45,802	47,251	45,488	26,662	29,630

Table 8. Water District water consumption

3.10 Georgia Pacific Consumption

Georgia Pacific (GP) operated a pulp mill and tissue mill along Bellingham's waterfront from the late 1940's until 2007. GP shut down its pulp mill operations in 2000 and most recently followed with a complete shutdown of the mill in December 2007. GP was a dual water customer from the City of Bellingham, meaning the mill received both treated potable water and untreated industrial water from the city. During the mills highest output years, it was not uncommon for the mill to use in excess of 70 million gallons (MG) of untreated water per day and another 500,000 gallons of treated potable water. Since the late 1970's and early 1980's GP's consumption has been on a continual decline with the eventual mill closure in December 2007 reducing water consumption to zero. However, there is another industrial consumer that will continue to use untreated industrial water in the near term—the Puget Sound Energy (PSE) Co-Generation Plant located adjacent the Georgia Pacific mill. The PSE plant consumes approximately 3-5 million gallons of untreated water per day and a nominal amount of potable water to operate the facility.

4. Water Conservation Programs

For the past 10 years, the City of Bellingham has had an extensive and successful public education and outreach program. Topics covering watersheds, water treatment, water quality, water quantity, and water conservation have been presented to water customers, schools, civic groups, and other community members. The city participates in regional and local partnerships and is a member of the following organizations that address water conservation issues:

- American Water Works Association (AWWA)
- Partnership for Water Conservation (PWC)
- Lake Whatcom Management Team

- Sustainable Connections

Table 9 outlines a description of programs that have been developed and implemented in the past 4 years, and a look into proposed programs in the coming future.

2002-2006 Water Conservation Program Elements Summary		
PUBLIC EDUCATION	**PROGRAMS**	**POLICY**
Presentations to garden clubs, rotary groups, other associations and group functions	Voluntary Metering Program for retrofit of older flat rate single-family residences	
Conservation brochures/info packets at public locations	Mandatory metering on all new construction (Jan 2005)	Update of Water Wasting Ordinance
Television segments	Water Conservation Kits	Adoption of elements of DOH Water Use Efficiency Rule
On-going website updates and features	Spray-head Replacement Program	
Display booth at City Hall	Rain Barrel Program	

Table 9. Water conservation program summary

4.1 School Outreach

City of Bellingham's Public Works Environmental Resources Department has been leading a highly successful education program for Grades 4-5 for several years. The Sharing Our Watershed education program is a watershed, water treatment, and wastewater treatment program for 5th-grade students. Through in-class lessons, videos, and field trips, the students learn about the water cycle, the city's water system, key terms, and the processes that go into treating both drinking water and wastewater. Listed in the table below are other resources available to teachers, students, and parents to further education about our water supply.

Videos	Brochures	Curriculum
Stormdrain Kits	Water Quality Kits	Car Wash Kits

4.2 Presentations and Community Events

Garden clubs, community groups, co-housing members, and non-profit groups occasionally request presentations about the city's water supply system, and for information on how to be good stewards of this resource. The city provides materials on its indoor and outdoor water conservation programs, water supply system

overview, and useful links to other organizations. The city participates in several community events throughout the year, in the form of booths, displays, and informational exhibits on water conservation.

4.3 Outdoor Water Conservation Programs

Like many cities across the nation, Bellingham experiences peak water consumption during the drier months of May through September, when it is not uncommon for daily consumption to double during this time. Consumption throughout the year stabilizes at about 10-12 mgd, and during the summer months peaks at about 18-22 mgd. In response to this, the city has focused on providing education and outreach to the community about outdoor watering and conservation during these drier times of the year.

4.3.1 Rain Barrel Program

In March 2001, the City of Bellingham completed a Residential Roof Rainwater Collection Feasibility Study. The report evaluated the costs and benefits associated with a city-sponsored Roof Rainwater Collection program for single family residences within the city's water service area. The purpose of the program is to encourage the collection and storage of rainwater for later use in irrigating landscapes, especially during summer dry periods when outdoor watering creates the heaviest strain on our municipal water supply. It was determined that a city-wide rain barrel program would not be cost-effective, but a smaller scale program would be worthwhile. The city allotted a $10,000 budget for 2002 and 2003 to cover intern labor and materials for a Rain Barrel Pilot Project. The 2002-03 Rain Barrel Pilot Project resulted in 150 90-gallon barrels sold to the public for $25 in 2002 and $45 in 2003 with a very high response rate. This amount of funding was not available for 2004 and 2005, so a different approach was taken to continue providing information about rain barrels and outdoor water conservation to the public. A brochure on how to make a rain barrel was created, and in partnership with Washington State University's Whatcom County Extension, a series of workshops on teaching participants how to make their own rain barrel began. The city has expanded the number of workshops each year and incorporates a presentation on water conservation to participants. Collaboration with WSU Whatcom County Extension and the RE Store has been on-going and will continue in the future for other water conservation activities. Other events that the

city participates in to promote rain barrels is with the local non-profit organization Sustainable Connections. As part of their annual Home and Landscape Tour, the city sets up a booth at a participating home that features rain barrels. The event and rain barrel sales have been received well and a highlight on the tour, based on participant surveys.

Estimated water savings with rain barrel installations from city sales over the past five years is estimated to be about 40,221 gallons.

4.3.2 Television Segments

Several Public Service Announcements (PSA's) pertaining to water conservation have been produced and then featured on Bellingham Television Channel 10 (BTV10). These have proven to be effective in providing the public with information about water conservation and water issues. The first PSA was a 10-minute advertisement for the city's 2002-03 Rain Barrel Pilot Project, promoting the first year of the program. Approximately 17% of the rain barrels sales were due to learning about the program through BTV10. The second PSA was a short feature in part with *Inside Bellingham*, a series produced by the city that gives viewers a glimpse of city government programs, activities, and people. The 10-minute feature focused on city water consumption and interviews with local citizens who utilize rain barrels for conserving water during the summer months. The third PSA is a 30-minute segment titled "Every Drop Counts", an outdoor water conservation segment that focuses on educating the public about the city's water source and supply, climate effects, city-wide consumption, and practices the public can adopt in conserving our natural resource. The segment aired throughout the 2007 calendar year on BTV10. The city will continue funding other PSA's focusing on water conservation.

4.4 Voluntary Metering Program

The City of Bellingham is one of the last cities of its size in Washington State where flat-rate water accounts still exist for single-family residences. Bellingham presently has over 15,000 of these flat-rate accounts. Beginning January 1, 2005, the City Council adopted the Voluntary Metering Program (VMP) to help promote water conservation and offer city residents the opportunity to potentially save money on their water utility bill. The VMP is available through the Public Works Department to any single-family residential flat-rate water customer inside the city limits. Cost to

participate in the program is a one-time fee of $150 that pays for the water meter. The city financially supports the remaining costs associated with the installation of the meter and any upgrades to the water service for the meter. These costs can vary, depending on the resident, but generally are in between $300 and $600 per VMP request. Thereafter, participants are charged a base rate and metered rate per cubic foot of water used which is similar to all other existing metered customers. Since inception, 75 residences are participating in the VMP.

4.5 Spray Head Replacement Program

In December 2006, the City of Bellingham contracted with Puget Sound Energy and SBW Consulting for a water and energy savings program targeted for commercial customers that utilize pre-rinse spray heads. Facilities that provide food services typically use one or more pre-rinse spray heads in the kitchen. Existing, older spray heads use at least 2.95 gallons per minute; this program replaced these older spray heads with water and energy efficient ones at 1.6 gallons per minute. A total of 275 spray heads and 351 faucet aerators were replaced, with Puget Sound Energy paying for all retrofits to electric water customers and the city paying for all remaining (natural gas) water customers. An estimated 19 million gallons of water will be saved annually with the retrofits, with an analysis of pre and post retrofits that will be conducted during 2008.

4.6 Leak Detection Program

The City of Bellingham has been operating a leak detection program on its water system since 1994. As part of routine protocol, all distribution system valves are exercised and tested on a regular schedule, and repairs done as needed. The city has a meter maintenance crew and meter testing facilities to facilitate this process. Meters 3” and larger are tested annually, and meters 1½”-2” are tested every 5 years.

An average of 10 miles of water main in the distribution system has been tested annually since 1994. The city established leak detection zones to prioritize areas of the system that contain water mains that are older and more prone to leaks to conform to state water accountability measures. In 2005 and 2006, the city took a more efficient and aggressive approach to the traditional leak detection process, and hired a consultant to increase the mileage in leak detection and survey 16 miles in 2005 and 25 miles in 2006. Leak detection figures for 2002-03 are significantly higher

than 2005-05 due to the zone area surveyed, which were water mains constructed in the early 1900s. Table 10 below shows known system leakage for 2002-06 (Note: No leak detection performed in 2004).

Known System Leakage	2002	2003	2004	2005	2006
Estimated Annual Water Loss (mgy)	22,600,800	0	0	7,752,600	6,832,800
Estimated Daily Water Loss (gpd)	61,920	0	0	21,240	18,720
# miles surveyed	15	27	0	25	17
# city leaks	1	0	0	11	5
# other leaks	63	26	0	1	2

Table 10. Known system leakage

When the origin of a leak is determined to be on the city water main, the city repairs the leak at its own cost in a timely manner. If the leak is determined to be on the property owner's water service line, it is the responsibility of the property owner to repair the leak. Water savings from the leak detection program has been approximately 260,000 gpd over the past 5 years.

4.7 Water Conservation Survey

The City of Bellingham has conducted several water conservation surveys targeted to single-family residences and their attitudes, beliefs, and practices regarding water use and conservation. The first survey, conducted in 1994-95, was distributed via regular mail along with water conservation kit order forms. Results of this survey showed that city residents are very aware of water conservation issues and have implemented habits and practices to conserve water. Approximately 2,300 surveys were returned during the first survey. The second survey targeted participants in the Water Meter Pilot Project in 2000-02. Approximately 290 surveys were returned, and again revealed that awareness and participation in conserving water is high, and voluntary. The third survey, conducted recently (2007) by a local research firm, focused again on measuring attitudes and beliefs, but was also designed to gain input from respondents on what kinds of water conservation programs they might participate in if offered. The survey was conducted via telephone, with a survey sample size of 400. This survey was designed to help guide future program development and gain further baseline data on where education and program promotion could be improved upon. Results of that survey are forthcoming and will be released during the next water conservation program update.

5. Water Conservation Program Savings

Water conservation programs offered by the City of Bellingham are aimed to provide conservation opportunities for both indoor and outdoor water use. Because much of the program is spent on qualitative measures, such as information dissemination through television media, brochures, and presentations, it is difficult to measure water savings through these educational aspects of the program. To get a very rough estimate, an analysis of water consumption for specific customer classes as a whole can be analyzed from year to year to determine the percent increase in services related to percent increase in consumption.

The quantitative measures of the water conservation program pertain to the distribution of water conservation kits to the public, rain barrel program, voluntary metering program, and sprayhead replacement program. The city continues to provide such resources in conjunction with the above educational materials. Table 11 gives a summary of estimated water savings for the water conservation kits and rain barrel program for the past 5 years.

2002-2006 COB Water Conservation Program					
	2002	**2003**	**2004**	**2005**	**2006**
Rain Barrels	8,954	7,220	0	10,801	14,004
H20 Kits	5,314,400	5,314,400	5,314,400	13,286,000	13,286,000
Sprayhead Replacement	0	0	0	0	18,875,245
Total Annual Savings (gal)	**5,323,354**	**5,321,620**	**5,314,400**	**13,296,801**	**32,175,249**

Table 11. Estimated water conservation program savings- gallons per year

Residential customers (single-family flat-rate, metered and multi-family) have been a focal point for water conservation programs due to these customer classes using nearly 51% of the total water produced from the water treatment plant. Participation in programs like the rain barrel workshops and water conservation kits has demonstrated that Bellingham residents have an interest in water conservation because they view it as an important natural resource to protect and conserve. Approximately 30% of our water is consumed by a flat-rate customer class, which receives no financial gain for conserving water through the above measures, but yet they continue to participate in such programs.

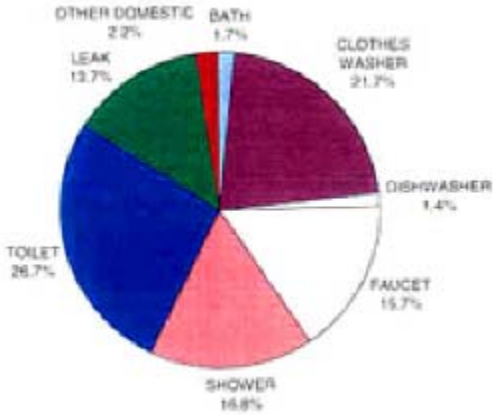
5.1 Recommended Program Implementation

As the data in this report has displayed, the largest consumer of the City of Bellingham's water supply is the residential customer class. Existing conservation programs target this class, providing information on behavioral and technical changes a person can make to reduce their water use. There are, however, other programs the city could implement that will effectively reduce water consumption, whether or not the behavioral changes are in place. In the past decade, rebate and/or retrofit programs for water conserving fixtures have become a more common practice among utility providers across Washington State. The programs established have proven to be a viable economic option to help meet current and future water demands placed on water and wastewater systems. Programs established in various cities have reported substantial savings in water consumption, the pro-longing of facility upgrades, and a greater awareness of water use habits by customers. Financial incentives offered to residential and commercial water and/or sewer customers have shown to spur the market for low-flow fixtures in the home.

5.1.2 Low-flow Toilet Rebate Program

An American Water Works Association (AWWA) study conducted in 1999 showed that toilets account for approximately 26% of indoor water consumption (Figure 8).

Figure 8. AWWA indoor per capita water consumption breakdown



In 2003, the Washington State Building Code set forth new rules for implementation of water conserving fixtures in the Uniform Plumbing Code. The code established the maximum water use allowed for all toilet flushing to be 1.6 gallons per flush (gpf) on all new construction and remodeling of residential, commercial, and industrial

facilities that contain water closets. Table 12 below displays the maximum gallons per flush (toilets and urinals) and maximum gallons per minute (faucets and showerheads) standards set forth in the Uniform Plumbing Code.

Fixture Type	*pre 1993*	*1993 - present*
Toilets	3.5	1.6
Urinals	3.0	1.0
Faucets	3.0	2.5
Showerheads	3.0	2.5

Table 12. Universal Plumbing Code maximum water usage standards for fixture types (gpf and gpm)

In the City of Bellingham, there is a high percentage of flat-rate single-family residential homes that were built prior to 1994, which likely have toilets that use nearly twice as much water as the 1.6 gpf standard. Developing and implementing a rebate and/or retrofit program for encouraging toilet replacements would result in a significant amount of water savings for Bellingham water customers. Table 13 below is a comparison between standard and low-flow toilet model gallons per flush (gpf) for both per capita and household usage. A 32% reduction in water consumption can be achieved by installation of a low-flow toilet model.

TOILET USAGE AND CONSUMPTION *Per Capita and Household*		
	STANDARD 5 gallons per flush (gpf)	**LOW-FLOW** 1.6 gallons per flush (gpf)
Per Capita Usage	5.05	5.05
Per Capita Consumption	25.25	8.08
Household Usage	12.78	12.78
2.53 people per household Household Consumption	63.88	20.44

Table 13. Standard and Low-flow toilet model water usage and consumption comparison

A summary of potential water savings per capita and per household is given in Table 14 below. Older toilet models are not only big water users, but are more prone to frequent leaks due to extensive wear and age of parts that don't often get replaced. An undetected toilet leak can waste up to 50 gallons of water per day.

WATER SAVINGS- LOW-FLOW TOILETS			
Per Capita:		**Household:**	
gallons per day	17	*gallons per day*	43
gallons per week	120	*gallons per week*	304
gallons per month	515	*gallons per month*	1,303
gallons per year	6,267	*gallons per year*	15,856

Table 14. Water savings with installation and usage of a low-flow toilet model

Implementing a toilet rebate/retrofit program would potentially result in significant water savings for single-family residential water customers, given the figures in Table 14 above. To help determine whether or not the program would be utilized by SFR water customers, information was solicited in the 2007 water conservation survey described in Section 4.

6. Conclusion

As is exemplified throughout this report, average daily water production remained steady during 2002-06, fluctuating by approximately 2%, which is equal to the average growth rate for the same period. Bellingham water customers use an average of 98 gallons per capita per day (gpcd), which is just below the national average of 101 gpcd. New rules established through Washington State's Municipal Water Law (MWL) require the City of Bellingham to maintain or decrease these consumption levels through a Water Use Efficiency Program. Data and information presented in this report are being used to develop a program that will focus on programs that can be measured more quantitatively and targeted to the customer classes that use the most water. The City of Bellingham's proposed Water Use Efficiency Program is in draft form and will be made available to the public in early 2008, outlining its goals and potential programs for 2008 and beyond.