2. BASIC PLANNING DATA AND WATER DEMAND FORECASTING

The purpose of this chapter is to define basic planning data and project future land use and water demands so that the City can adequately plan to accommodate its water needs. Water demand projections are necessary to plan for capital improvements and evaluate water resource needs.

This chapter presents the projection of four different criteria that are used in subsequent chapters of this WSP to determine the capacity of the existing water system and size new facilities:

Equivalent Residential Unit (ERU). An ERU is defined as the amount of water consumed by a typical full-time single family residence. Data collected from City billing records are used to calculate the usage by single family residences on a gallons-per-day basis. In the following chapters, the capacity of facilities and water rights is equated back to a number of ERUs that the facility can support. For example, Chapter 3 shows that the existing storage volume of 1 million gallons (MG) is enough to support 3,657 ERUs. In other words, enough storage is available to support 3,657 single family residences or a mixture of commercial, industrial, and residential customers that generate a water demand equivalent to 3,657 single family residential units.

Average Day Demand (ADD). ADD is the average volume of water withdrawn from the ground on a daily basis. Projected future ADD is used to estimate future maximum day and peak hour demands. ADD is also used to check that the annual water rights (Qa) held by a water system are adequate.

Maximum Day Demand (MDD). MDD is the maximum volume water withdrawn from the ground in a day over the course of a year. Past MDD data are collected from well pumping records; future MDD is projected based on historical records of the ratio between ADD and MDD. MDD is used to size storage and treatment facilities and the capacity of transmission and distribution mains.

Peak Hour Demand (PHD). PHD is an estimate of the maximum volume of water that needs to be supplied in a single hour. PHD is typically greater than the capacity of the wells in the system. PHD is used to size reservoirs and distribution and transmission facilities.

2.1 Historical Population and Consumption Data

Current population and water use are discussed in this section; current water production and consumption data will be used for forecasting future water use.

2.1.1 Current Population

The current population of Yelm was obtained from the Washington State Office of Financial Management (OFM). OFM's April 2007 population estimate of 4,845 people is used in this WSP to represent the current Yelm population. The population served by the water system does not have a significant seasonal variation.

Table 2-1 presents Yelm's historic population growth.

Table 2-1. Historic Population Growth of Yelm[1,2]		
Year[3]	Population	Average Annual Growth
1930	384	-
1940	378	-0.2%
1950	470	2.2%
1960	479	0.2%
1970	632	2.8%
1980	1,294	7.4%
1990	1,337	0.3%
2000	3,289	9.4%
2001	3,420	4.0%
2002	3,485	1.9%
2003	3,830	9.9%
2004	4,150	8.4%
2005	4,455	7.3%
2006	4,565	2.5%
2007	4,845	6.1%

[1] *Reference: http://www.ofm.wa.gov/pop/april1/finalpop2007.pdf.*

[2] *Reference: http://www.ofm.wa.gov/pop/decseries/historicalpop.xls.*

[3] *OFM estimates the population in 2008 was 5,150.*

In addition to providing service within Yelm city limits, the water system also provides service to areas outside city limits, both inside and outside the Yelm UGA. Estimation of the population served outside city limits is documented in a technical memorandum presented in Appendix 2A. Table 2-2 presents the estimated residential population served by the water system by the end of 2007.

Table 2-2. Estimate of Population Served by Yelm Water System (2007)	
Area	Estimated Population
Inside city limits	4,845
Outside city limits, inside UGA	257
Outside UGA	414
Total	5,516

2.1.2 Water Production and Consumption

The following water use data are currently being collected or calculated by the City:

- Daily source meter readings, which enable the City to calculate and track daily, monthly, and annual production totals.
- The number of connections in the water system, which are metered and categorized by class; service meter readings are taken monthly.
- Calculation of annual unaccounted-for water totals.
- The City's Finance Department tracks water utility revenue data.

The following tables provide a detailed inventory of recent production and consumption data. Table 2-3 shows the monthly and annual production data for 2003–2008. Planning and projections presented in this document use production data through 2007. Data for 2008 are presented for reference. Figure 2-1 shows annual production data for 2003–2008.

Table 2-3. Annual Production Data

	Production (MG)[1]					
	2003	2004	2005	2006	2007	2008
January	11.8	12.7	15.0	14.1	15.5	15.7
February	10.8	11.4	12.5	12.1	13.4	15.3
March	12.0	14.1	14.8	13.7	15.1	16.9
April	11.6	15.0	12.7	13.4	16.9	16.2
May	13.3	17.6	17.0	22.7	19.4	19.6
June	28.1	25.7	18.1	24.9	25.0	24.7
July	31.7	32.7	22.4	39.0	33.1	33.8
August	26.4	28.9	33.2	37.0	28.8	27.1
September	23.4	16.7	21.6	26.2	22.6	25.1
October	15.1	13.3	14.8	20.0	18.0	18.2
November	10.1	13.7	12.9	13.7	15.0	14.1
December	13.8	13.3	14.1	13.1	15.3	19.8
Total production (MG)	208.1	215.2	209.1	249.7	238.1	246.4
Total production (ac-ft)	638.6	660.6	641.6	766.3	730.6	756.3

[1] *Total Production in 2009 was 264.6 MG*

Table 2-4 shows the annual production data by source.

Table 2-4. Annual Production Data by Source

	Production (MG)					
	2003	2004	2005	2006	2007	2008
Well 1	56.0	0.02	0.06	0.002	0.03	.001
Well 1A	-	-	40.3	119.5	114.5	115.9
Well 2	152.1	215.2	168.7	130.2	123.6	130.5
Total	208.1	215.2	209.1	249.7	238.1	246.4
Total (ac-ft)	638.6	660.6	641.6	766.3	730.6	756.3

Well 1 is only used for monitoring purposes. Well 1A was completed in July 2005 and operates in conjunction with Well 2 to produce the City's water.

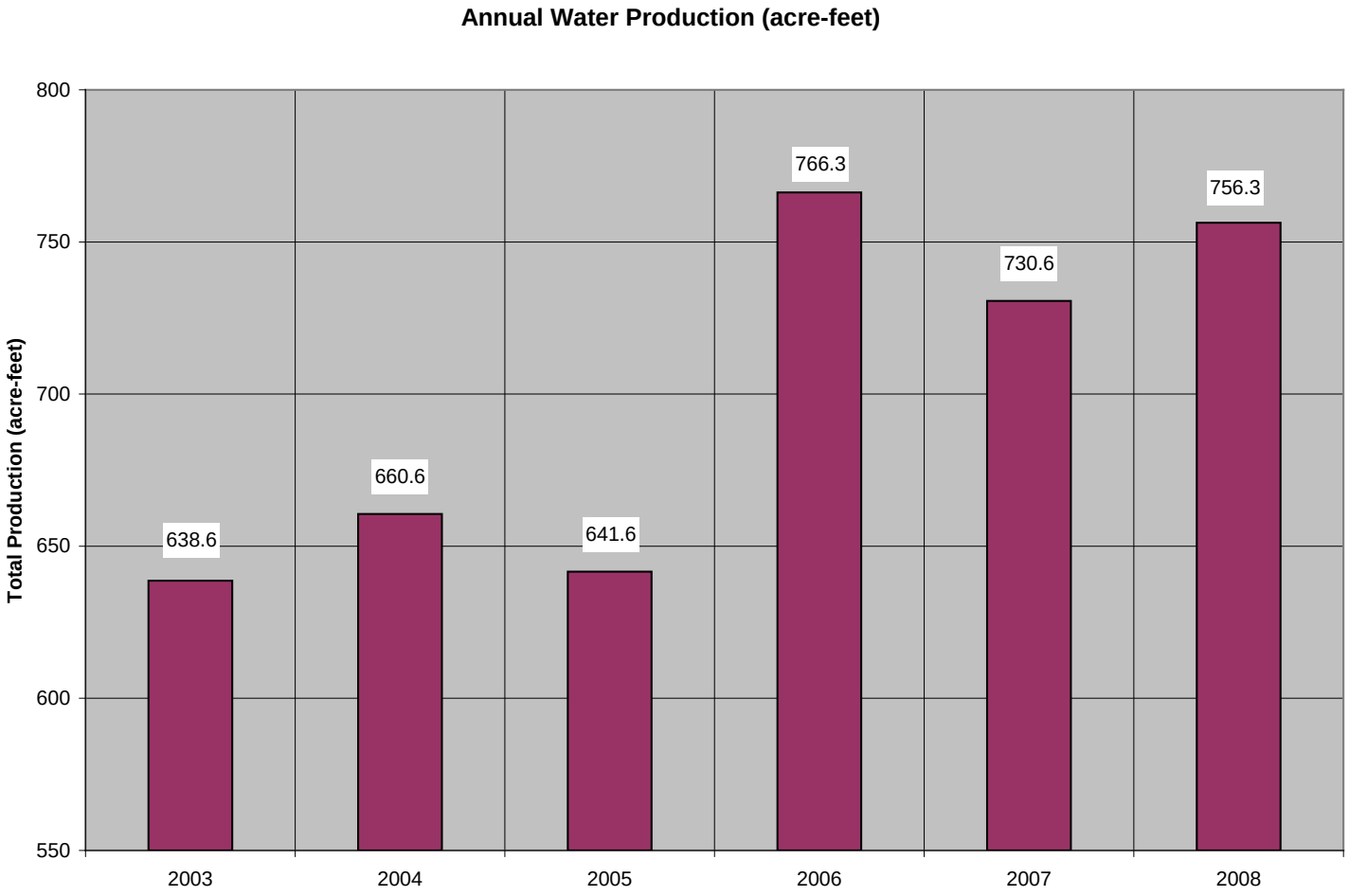

Figure 2-1. Annual Water Production (ac-ft)

Table 2-5 gives the annual consumption volumes by customer class.

Table 2-5. Annual Consumption Use by Class

	Consumption (MG)				
	2003	2004	2005	2006	2007
Single family	123.7	125.4	120.7	141.7	139.5
Multi-family	8.8	14.5	13.0	12.5	16.2
Commercial/industrial	62.7	64.6	59.5	48.4	38.4
Irrigation	-	-	2.0	30.5	25.2
Total[1]	195.2	204.5	195.2	233.1	219.9

[1] The difference between annual consumption and annual production represents distribution system leakage. See Chapter 4.

Consumption data for 2008 were not available when these statistics were generated. Appendix 2B presents a more detailed table summarizing water usage by individual classes of customers for 2007. The City began to monitor irrigation usage in 2006. Figure 2-2 shows the average water consumption by class for 2006 and 2007. This table shows that 69 percent of the water consumption in Yelm is for residential (including both single family and multifamily) uses.

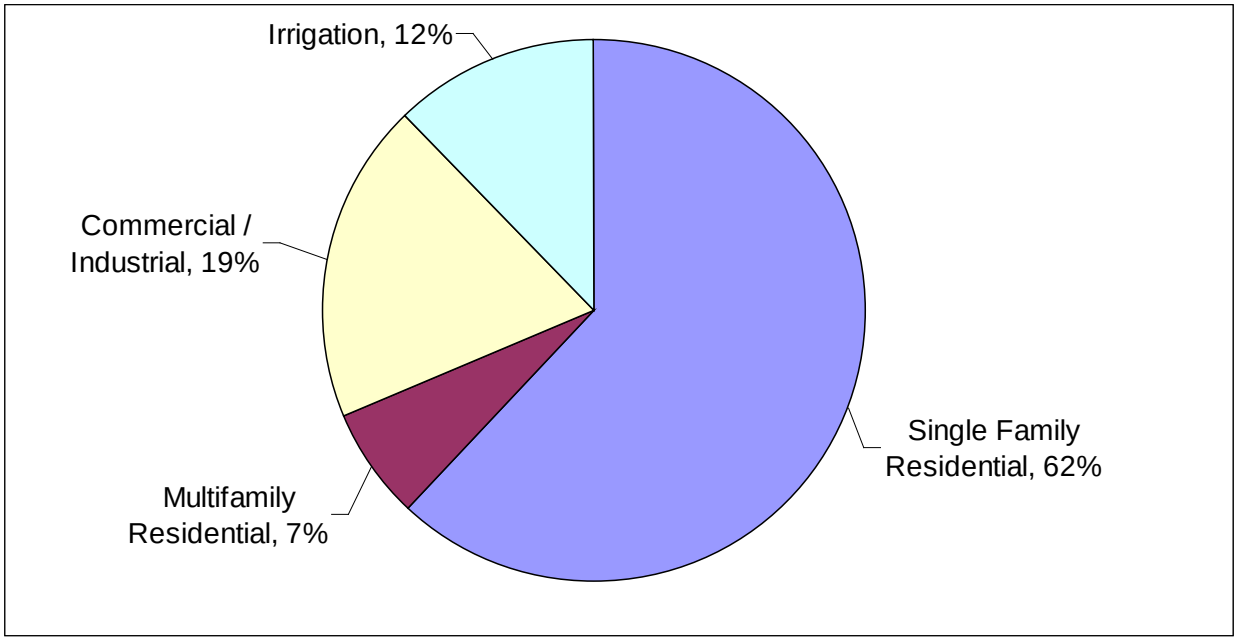

Figure 2-2. Water Consumption by Class (2006–2007)

2.1.3 Water Use Statistics

Table 2-6 provides calculated production ADD, production MDD, peaking factors, and calculated PHD for the previous 5 years. ADD is calculated by dividing the total amount produced at the wells by 365 days. Flow meter readings are taken at the wells Monday through Friday, not including holidays. Daily flow rates are estimated by interpolation for days when readings are not taken. The peaking factor is a ratio of the MDD to ADD. For the period from 2005 to 2007 the MDD:ADD peaking factor averaged 2.41; this factor will be

used to estimate future MDDs. PHD values are calculated by the following equation, per the Water System Design Manual (DOH, 2001):

PHD (gpm) = [MDD (gpd/ERU)/1440]*[(C)*(N) + F] + 18

Values for C and F are constants based on the number of ERUs served and are set at 1.6 and 225 respectively for systems with more than 500 connections. The value for N is set to the total number of service connections in ERUs. The calculation of N is presented in the following section.

Table 2-6. Annual Water Demands

Year	Total Production ERUs (N)	ADD (mgd)	MDD (mgd)	MDD:ADD Peaking Factor	PHD (gpm)
2003	2,241	0.57	1.29	2.26	1,538
2004	2,514	0.59	1.28	2.17	1,514
2005	2,726	0.57	1.29	2.25	1,526
2006	3,002	0.68	1.80	2.63	2,110
2007	3,166	0.65	1.53	2.34	1,788

2.1.4 Equivalent Residential Unit Calculation

An ERU is a unit of measure used to equate nonresidential or multifamily residential water usage to a specific number of single family residences. In this WSP, the water consumption per ERU is calculated from water meter records for single family connections using the following equation:

gallons per day per ERU = single family annual consumption/number of active single family connections

ERUs served by the water system in each year from 2003 to 2007 were calculated as shown in Table 2-7.

Table 2-7. ERU Calculations

	(1)	(2)	(3)	(4)	(5) = (1*2+3*4)/(1+3)	(6)	(7) = (6)/(5*365 days)
	Within City Limits		Outside City Limits[6]				
Year	Number of Single Family Connections[1]	Consumption Per Single Family Connection (gpd)[2]	Number of Single Family Connections[3]	Consumption Per Single Family Connection (gpd)[4]	Equivalent Residential Unit (gpd)[5]	Total Annual Production (MG)	Total Number of ERUs Served
2003	811	254	217	256	254	208	2,241
2004	879	229	218	257	235	215	2,514
2005	926	205	227	231	210	209	2,726
2006	1003	224	225	245	228	250	3,002
2007	1199	203	227	222	206	238	3,166

[1] Number of single family accounts within city limits that were in service for the full year.

[2] Average daily consumption for connections within city limits that were in service for the full year.

[3] Number of single family accounts outside city limits that were in service for the full year.

[4] Consumption for accounts outside city limits that were in service for the full year.

[5] Weighted average of consumption per single family unit for units within city limits and the UGA..

[6] Including customers outside the UGA.

The 3-year (2005–2007) average ERU value is 215 gallons per day (gpd)/ERU. The three year average was used because the ERU values in 2005-2007 have fluctuated from a minimum of 206 (in 2007) to 228 (in 2005). This value will be used as the baseline for developing projections of future water demands (below) and calculating the capacity of the water system (Chapter 3).

2.2 Projected Water Demand

Future development and water demand projections are grouped into six categories: residential, commercial, industrial, schools, institutional, and irrigation. Almost 70 percent of the water demand in the City is related to residential consumption (Figure 2-2) and is directly proportional to the population served. Consequently, much of the water demand forecasting in the following sections is based on population forecasts. The demand forecasts presented in this section also evaluate the impacts of the City achieving the water use efficiency goals that it established in 2008 (see Chapter 4):

- Limit distribution system leakage (DSL) to 6 percent on a rolling 3-year average.
- Reduce average annual consumption by single family residential connections to 200 gpd within 5 years.
- Increase reclaimed water usage to reduce potable water usage.

2.2.1 Future Residential Development

Projections of the residential population to be served by the City for the 6- and 20-year planning horizons are described in detail in a technical memorandum presented in Appendix 2A. This section summarizes the calculations in that memorandum.

The 6- and 20-year population projections used in estimated future water demands are based on the TRPC population forecasts. The TRPC develops regional plans and policies for transportation, growth management, and environmental quality within Thurston County. The TRPC also acts as a regional clearinghouse for planning and demographic information and data. The most recent countywide TRPC report was published in 2005. Since that time, two large MPCs, Tahoma Terra and Thurston Highlands, were proposed for development in southwest Yelm. In order to account for these MPCs and the resulting increase in the City's population, the TRPC created a new population forecast in October 2007 as part of the Thurston County Buildable Lands Report (TRPC, October 2007).

At buildout, Tahoma Terra is projected to represent 1,200 dwelling units and Thurston Highlands is projected to represent an additional 5,000 dwelling units. TRPC estimated that in 2027 Tahoma Terra would reach buildout while Thurston Highlands would be at 67 percent of buildout.

The projected residential population to be served has been divided into four categories (based on the TRPC projections) in Table 2-8:

- Population within Yelm city limits (not counting population inside the MPCs).
- Future population residing inside the MPCs.
- Population outside city limits and inside the Yelm UGA boundary. In 2007, 101 connections were served in the UGA outside city limits.
- Population served outside the Yelm UGA boundary. Approximately 163 water utility customers are currently located outside the UGA boundary. While the City will continue to provide service to these customers, the City will not provide service to any additional future connections outside the UGA boundary.

Table 2-8. Projected Residential Population Served by Yelm Water System					
Year	City of Yelm	MPCs[1]	Yelm UGA Served by City Water	Existing Population Outside UGA Served by City Water[2]	Total Population Served by City Water
2009	5,061		339[(3)]	414[(3)]	5,815
2015	6,330	4,460	487	414	11.691
2029	9,858	10,494	1,955	414	22,721

[1] Population in Tahoma Terra already served by City water included in City of Yelm population.

[2] No additional service outside UGA boundary planned in future years.

[3] See Appendix 2A for calculation.

Table 2-8 shows an increase of 5,876 and 16,906 people served by the Yelm water system for the 6- and 20-year planning periods, yielding an annual growth rate of 10.9 percent and 6.8 percent, respectively, if the MPCs develop at the rates identified by TRPC. The technical memorandum in Appendix 2A contains a more detailed table and list of assumptions for the population projections.

One of the key assumptions for these population projections is that the population in the MPCs begins in 2010. Because the MPCs represent such a significant percentage of the total population growth projected for Yelm, the City has elected to develop water demand projections based on two scenarios: with and without development of the MPCs. These two scenarios will be used in subsequent chapters of this planning document to evaluate the impacts of the MPC-related growth on the capital and operations and maintenance needs of the City's water utility.

As described in Chapter 1, planning and permitting for the MPC are not finalized. The City has elected to base this WSP primarily on a development scenario that recognizes that the MPCs will be developed in the future but will not be included in detail in this WSP. The City will update this WSP to develop an expanded CIP and revised rate structure if it becomes clear that the initial development of the Thurston Highlands MPC is likely to begin.

Population and housing unit projections presented in the Yelm Comprehensive Plan (City of Yelm, 2006) indicate that the average household size will decrease in the future. For the year 2000, the Comprehensive Plan shows a person-per-household ratio of 2.7. The most recent TRPC Buildable Lands Report (TRPC, October 2007) identifies the current household size in Thurston County to be 2.54 people. The TRPC Buildable Lands Report predicts a lower average household size of 2.39 people in 2010. TRPC forecasts an even lower average of 2.25 people per household in 2030. A linear interpolation between the average household sizes estimated for 2010 and 2030 is used for the calculation of residential water demands in the following section.

2.2.2 Future Residential Water Demand

Future residential water demand estimates, presented in the following tables, are based on projected population and the corresponding number of single family residences. This estimate is conservative because it assumes that the entire residential population resides in single family homes. A portion of the residential population will actually reside in multifamily units which typically use less water than single family residences.

Projected water demand is based on the calculated ERU water use of 215 gpd/ERU and includes a DSL rate of 6.9 percent (see Chapter 4), and is shown in Tables 2-9 ("with MPCs" scenario) and Table 2-10 ("without MPCs" scenario). These tables also show the impacts to the residential demand if the City meets its established WUE goals of 6 percent DSL and 200 gpd/ERU. If the WUE goals are achieved, the projected residential water demands will be reduced by approximately 8 percent.

Table 2-9. Projected Residential Water Demand (with MPCs)					
Year	Projected Population	Household Size (people/residence)	Number of Single Family Residences	Annual Residential Water Use (MG)	
				215 gpd/ERU and 6.9% DSL	200 gpd/ERU and 6% DSL
2009	5,815	2.39	2,433	205	189
2015	11,691	2.35	4,975	419	386
2029	22,721	2.26	10,068	849	782

Table 2-10. Projected Residential Water Demand (without MPCs)					
Year	Projected Population	Household Size (people/residence)	Number of Single Family Residences	Annual Residential Water Use (MG)	
				215 gpd/ERU and 6.9% DSL	200 gpd/ERU and 6% DSL
2009	5,815	2.39	2,433	205	189
2015	7,231	2.35	3,077	259	239
2029	12,227	2.26	5,418	457	421

The technical memorandum in Appendix 2A contains a detailed list of assumptions for the projected populations served by the water system. Some of the key assumptions are:

- All residents inside city limits (including residents of the MPCs) will be served by the water system.
- The water system will serve all new development within the UGA. No additional future connections outside the Yelm UGA will be served.

2.2.3 Future Commercial Development

Two studies (Yelm Retail and Commercial Development Opportunities [E.D. Hovee and Co., October 2005] and Yelm Industrial Area Market and Development Assessment [E.D. Hovee and Co., July 2001]) analyzed the potential for future commercial and industrial development in Yelm, not including the MPCs. Commercial development within the MPCs was projected in the planning documents for the individual MPCs. Yelm's projected commercial development is shown in Table 2-11 and is described in detail in the technical memorandum presented in Appendix 2C.

Table 2-11. Projected Commercial Development Served by City of Yelm Water System[1]			
Year	Within City without MPCs (sq ft)	with MPCs (sq ft)	Total (sq ft)
2009	591,056	0	591,056
2015	962,408	312,000	1,274,408
2029	2,017,067	760,000	2,777,067

[1] Reference: Yelm Retail and Commercial Development Opportunities (E.D. Hovee and Co., October 2005) and Yelm Industrial Area Market and Development Assessment (E.D. Hovee and Co., July 2001).

The technical memorandum in Appendix 2C contains a detailed table of the commercial development projections and a list of assumptions that were made to prepare these projections. Some of the key assumptions for this projection are:

- All of the development currently in review with the City's Community Development Department will be built.
- All of the development that has had pre-submission conferences with the City will be built.
- Thurston Highlands commercial development is based on the preferred alternative identified in the planning and permitting documents for that MPC, is assumed to begin in 2010, and is further assumed to be 70 percent complete in 20 years (640,000 square feet developed in 2029). It is assumed that Tahoma Terra commercial development will begin in 2010 and will take 6 years to complete (total development of 120,000 square feet).

2.2.4 Future Commercial Development Water Demand

In 2007, commercial water usage in Yelm was 27.2 MG. This usage calculation is based on billing records for all commercial accounts and does not include water used for irrigation, which was measured by separate irrigation meters. This figure corresponds to a daily usage of 74,530 gpd. For a developed commercial area of 556,250 square feet in 2007 (see Appendix 2C), the daily commercial water consumption is calculated to be approximately 135 gpd/1,000 square feet of commercial development. This value will be used to project future commercial water usage.

Table 2-12 shows the future commercial water demand for all commercial development including the MPCs. Table 2-12 also presents the future commercial water demand projected if the WUE goal of 6 percent DSL is achieved.

Table 2-12. Projected Commercial Water Demand (with MPCs)

Year	Projected Commercial Developed Area (sq ft)[1]	Annual Water Demand without WUE Goals (MG)[2]	Annual Water Demand with WUE Goals (MG)[3]
2009	591,056	31.3	31.0
2015	1,274,408	67.5	66.8
2029	2,777,067	147.0	145.6

[1] Appendix 2C.

[2] Based on commercial usage of 135 gpd/1,000 sq ft and 6.9 percent DSL. Demand = Area x Usage/(1-DSL), typical.

[3] Based on commercial usage of 135 gpd/1,000 sq ft and 6.0 percent DSL.

Table 2-13 shows a comparison of projected water consumption with and without the WUE goals for commercial users without development of the MPCs.

2.2.5 Future Industrial Development

Yelm currently has only three industrial water users (Table 2-14): Lasco, Cal-Portland (previously Glacier), and Livingstone Boats (previously Amtech).

Table 2-13. Projected Commercial Water Demand (without MPCs)

Year	Projected Commercial Developed Area (sq ft)[1]	Annual Water Demand without WUE Goals (MG)[2]	Annual Water Demand with WUE Goals (MG)[3]
2009	591,056	31.3	31.0
2015	962,408	50.9	50.4
2029	2,017,067	106.8	105.7

[1] Appendix 2C.

[2] Based on commercial usage of 135 gpd/1,000 sq ft and 6.9 percent DSL.

[3] Based on commercial usage of 135 gpd/1,000 sq ft and 6.0 percent DSL.

Table 2-14. Industrial Land Area			
Name	Products	Land Area[1] (acres)	Building Area (sq ft)
Lasco	Bath fixtures	26	137,242
Cal-Portland	Redi-mix concrete	5	7,212
Livingstone Boats	Composite products	8	53,197
Total		39	197,651

[1] *Per Thurston County Assessor's Web site: http://tcproperty.co.thurston.wa.us/propsql/front_s.asp.*

The Hovee Industrial Area Market and Development Assessment estimated a demand in 2001 for approximately 21 acres of additional industrial development in Yelm. The Yelm Comprehensive Plan shows 251 acres of industrial development available in Yelm, with demand for development of 22 of these acres by 2025. Future industrial development was estimated for water demand projections by extrapolating from the current developed area of 39.18 acres in 2008 to 61.18 developed acres (22 additional acres) in 2025. From 2025 to 2030 it is assumed that industrial development will continue to grow at this same rate (approximately 1.3 acres per year).

2.2.6 Future Industrial Development Water Demand

The water usage of the three industrial water users in Yelm in 2006 and 2007 is summarized in Table 2-15.

Table 2-15. Industrial Water Use	
Industrial User	Average Water Usage 2006–2007 (MG)
Lasco	1.34
Glacier	1.42
Amtech	0.12
Total	2.88

The average water usage over the last 2 years has been about 200 gpd per acre per year. Industrial water demands have been projected using the rates of development discussed in the previous section and an average annual water demand of 200 gpd per acre. Planning documents for the MPCs do not identify the development of industrial properties within the MPCs. Consequently, industrial water demand projections are the same for the "with MPCs" and "without MPCs" scenarios. Table 2-16 presents the projected industrial water demand and also presents the future industrial demand projected if the WUE goal of 6 percent DSL is achieved.

Table 2-16. Projected Industrial Water Demand			
Year	Projected Industrial Developed Area (acres)	Annual Water Use without WUE Goals (MG)[1]	Annual Water Use with WUE Goals (MG)[2]
2009	40.5	3.17	3.14
2015	48.2	3.78	3.75
2029	66.4	5.20	5.15

[1] *Based on industrial usage of 200 gpd/acre and 6.9% DSL.*

[2] *Based on industrial usage of 200 gpd/acre and 6.0% DSL.*

2.2.7 Future School Development and Student Population

The increasing residential population in the service area will lead to increased student population as well. The number of students currently served by the Yelm water system is estimated to be 3,530 based on statistics provided by the School District for 2006. This represents 67 percent of the total number of students in the Yelm School District.

The number of students to be served in the future was estimated using School District projections for the period 2009–2015. Beyond 2015, the number of students served was estimated assuming a student population equal to 65 percent of the residential population for the water system service area. This assumption is consistent with current population data.

Planning documents for the Thurston Highlands MPC estimate the number of students who will reside in the MPC. At buildout, this number is estimated to be 2,661 students living in 5,000 dwelling units. As described above, population projections have assumed that Thurston Highlands will be 67 percent developed in 2027. The student population in Tahoma Terra was estimated using a similar student-per-dwelling-unit ratio and the assumption that the 1,200 units in Tahoma Terra would be 100 percent complete in 2027.

These population statistics and assumptions were used to develop the projected student populations presented in Appendix 2D. Table 2-17 summarizes the projected student populations for both the "with MPCs" scenario and the "without MPCs" scenario.

Table 2-17. Future Student Population

Year	Number of Students without MPCs	Number of Students with MPCs
2009	3,733	3,733
2015	4,700	5,504
2029	7,948	10,558

2.2.8 Future School Development and Student Population Water Demand

School water use includes the six Yelm School District schools, the School District administration building, the school bus garage, and the preschool center. In 2007, the volume of water used by all Yelm School District buildings totaled 735,725 cubic feet.

Projections of future water use for schools were calculated assuming that future water use will be proportional to current usage on a per-student basis. Table 2-18 presents the projected water demand for schools.

2.2.9 Future Institutional Development

Yelm's institutional users (not including Yelm School District facilities) include 10 churches and several public buildings. Increases in water demands for these two types of connections are assumed to grow at the same rate as the residential population.

Table 2-18. Projected School Water Demand						
	With MPCs			Without MPCs		
Year	Student Population	Annual Water Use without WUE Goals (MG)	Annual Water Use with WUE Goals (MG)	Student Population	Annual Water Use without WUE Goals[1] (MG)	Annual Water Use with WUE Goals[2] (MG)
2007				3,530	5.91	
2009	3,733	6.25	6.19	3,733	6.25	6.19
2015	5,504	9.22	9.13	4,700	7.87	7.80
2029	10,558	17.68	17.51	7,948	13.31	13.18

[1] *Includes 6.9% DSL.*

[2] *Includes 6.0% DSL.*

2.2.10 Future Institutional Development Water Demand

Table 2-19 presents the projected water demand for churches and public buildings.

Table 2-19. Projected Institutional Water Demand				
Year	Institutional Water Demand with MPCs (MG)	Institutional Water Demand with MPCs and WUE Goals (MG)	Institutional Water Demand without MPCs[1] (MG)	Institutional Water Demand without MPCs and with WUE Goals[2] (MG)
2007			1.57	
2009	1.78	1.76	1.78	1.76
2015	3.58	3.54	2.21	2.19
2029	6.95	6.89	3.74	3.71

[1] *Includes 6.9% DSL.*

[2] *Includes 6.0% DSL.*

2.2.11 Future Irrigation Demands

Yelm began tracking irrigation usage as a separate user class in September 2005. In 2006 irrigation usage totaled 30.5 MG and in 2007 irrigation usage totaled 25.4 MG. Water demand projections presented in this WSP are made using the assumption that until additional water rights are secured irrigation usage will not increase over the level experienced in 2007. At a DSL of 6.9 percent, a consumption of 25.4 MG equates to a demand of 27.26 MG. If the WUE goal of 6 percent DSL is achieved, the irrigation water demand would be reduced to 27.0 MG. This WSP identifies programs, policies, and rate structures that the City will implement to limit irrigation usage to these levels (see Chapter 4 and Chapter 9). (In 2010 the City initiated a program to limit irrigation usage to 50% of 2009 levels.)

2.2.12 Projected Non-Revenue Water

Yelm currently has no metered non-revenue water. The City is currently in discussion with the Fire Department to meter or otherwise track water usage at fire hydrants.

2.2.13 Projected Water Demand Summary

Yelm's total projected annual water demand is shown in Table 2-20 for the "with MPCs" scenario and Table 2-21 for the "without MPCs" scenario. In 2010, the City developed a conservation program which reduced

anticipated consumption in 2010 compared to the projections developed in the draft WSP for the "without MPC" scenario. This revised projection for 2010, as well as actual demand as measured at the wells in 2007, 2008, and 2009, is shown in Figure 2-3 along with the projections shown in Tables 2-20 and 2-21 for 2011-2029.

Table 2-20. Projected Water Demand (with MPCs)

Year	Water Demand (215 gpd/ERU and 6.9% DSL)			Water Demand (200 gpd/ERU and 6.0% DSL)		
	MG/year	ac-ft/year	ERUs Served	MG/year	ac-ft/year	ERUs Served
2007	238.0	731	3,033			
2008[1]	266.8 / 246	819 / 756	3,400 / 3,140			
2009[1]	274.9 / 264	843 / 812	3,502 / 3,373			
2010	353.5	1,085	4,505	330.9	1,016	4,533
2011	386.8	1,187	4,930	362.0	1,111	4,959
2012	423.9	1,301	5,402	396.8	1,218	5,435
2013	459.3	1,410	5,853	429.9	1,319	5,889
2014	494.9	1,519	6,307	463.2	1,421	6,345
2015	530.7	1,629	6,762	496.6	1,524	6,803
2016	569.4	1,747	7,255	532.7	1,635	7,297
2017	608.3	1,867	7,751	569.0	1,746	7,794
2018	647.3	1,987	8,249	605.4	1,858	8,293
2019	686.6	2,107	8,749	642.0	1,970	8,795
2020	726.1	2,228	9,252	678.8	2,083	9,298
2021	758.9	2,329	9,671	709.5	2,177	9,719
2022	792.0	2,430	10,092	740.3	2,272	10,142
2023	825.2	2,532	10,515	771.3	2,367	10,566
2024	858.5	2,635	10,940	802.5	2,463	10,993
2025	892.0	2,737	11,367	833.8	2,559	11,421
2026	930.4	2,855	11,855	869.5	2,669	11,911
2027	975.7	2,994	12,433	912.2	2,799	12,496
2028	1,014.2	3,112	12,923	948.1	2,909	12,987
2029	1,052.8	3,231	13,416	984.1	3,020	13,481
2030	1,091.7	3,350	13,911	1,020.3	3,131	13,977

[1] *Projected demand/actual demand.*

Figure 2-3
Projected Water Demands- with and without MPCs

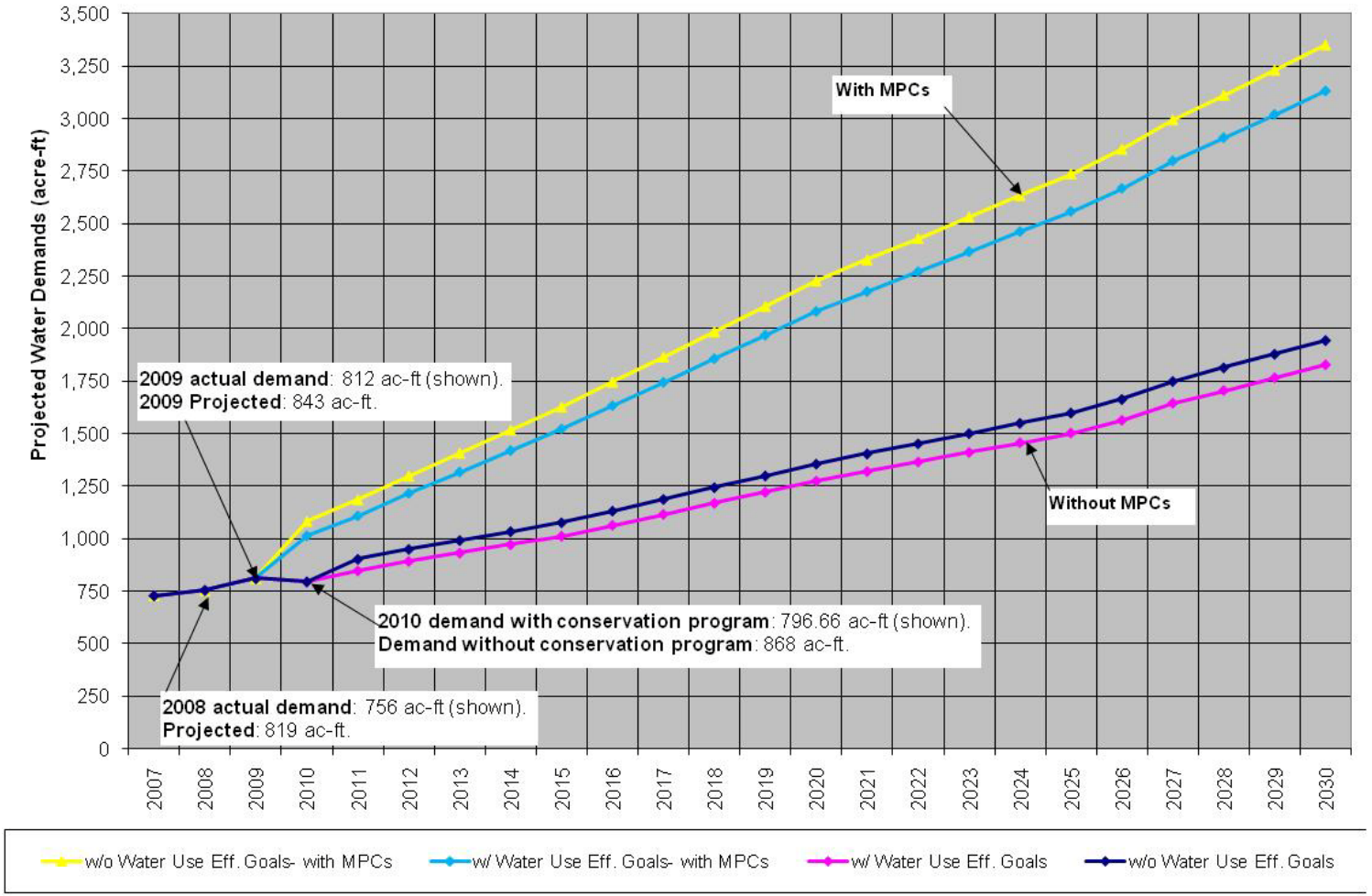

Figure 2-3. Projected Water Demands- with and without MPCs

Table 2-21. Projected Water Demand (without MPCs)						
Year	Water Demand (215 gpd/ERU and 6.9% DSL)			Water Demand (200 gpd/ERU and 6.0% DSL)		
	MG/Year	ac-ft/yr	ERUs served	MG/Year	ac-ft/yr	ERUs served
2007	238.0	731	3,033			
2008[1]	266.8 / 246.5	819 / 756	3,400 / 3,140			
2009[1]	274.9 / 264.7	843 / 812	3,502 / 3,373			
2010[2]	282.8 / 259.6	868 / 796.66	3,603 / 3,308			
2011	294.6	904	3,754	276.6	849	3,788
2012	310.1	952	3,951	291.2	894	3,989
2013	323.8	994	4,126	304.1	933	4,166
2014	337.6	1,036	4,302	317.1	973	4,344
2015	351.5	1,079	4,479	330.2	1,013	4,523
2016	369.5	1,134	4,709	347.1	1,065	4,755
2017	387.6	1,190	4,940	364.1	1,117	4,987
2018	405.8	1,245	5,172	381.1	1,170	5,221
2019	424.1	1,302	5,405	398.3	1,222	5,456
2020	442.5	1,358	5,639	415.5	1,275	5,691
2021	458.2	1,406	5,839	430.2	1,320	5,894
2022	474.0	1,455	6,040	445.1	1,366	6,097
2023	489.9	1,503	6,242	460.0	1,412	6,301
2024	505.8	1,552	6,445	474.9	1,457	6,506
2025	521.8	1,601	6,649	489.9	1,504	6,711
2026	542.9	1,666	6,918	509.6	1,564	6,981
2027	570.8	1,752	7,274	536.1	1,645	7,344
2028	591.9	1,816	7,542	555.8	1,706	7,614
2029	613.0	1,881	7,812	575.6	1,766	7,885
2030	634.3	1,947	8,083	595.5	1,827	8,157

[1] *Projected demand/actual demand.*

[2] *Originally projected demand/demand projected after conservation savings. In 2010, a conservation program was developed to reduce irrigation demands to 50 percent of 2009 levels. The resulting projected demand is 259.6 MG (796.66 ac-ft, 3,308 ERUs) for 2010.*

Table 2-22 presents the corresponding projected demands on an ADD and MDD basis. ADD is calculated by converting the demand in acre-feet to gpm and MDD is calculated by applying a peaking factor of 2.41 to the ADD. This factor represents the average peaking factor measured in Yelm at the sources over the last 3 years (see Table 2-6). PHD is calculated using the formula that was used in Section 2.1.3 to estimate past PHD.

Table 2-22. Projected ADD, MDD, and PHD (before WUE measures)						
Year	With MPCs			Without MPCs		
	ADD (MGD)	MDD (MGD)[1]	PHD (gpm)[2]	ADD (MGD)	MDD (MGD)[1]	PHD (gpm)[2]
2007				0.652	1.53	1,791
2008[3]				0.731 / 0.675	1.76 / 1.63	2,056 / 1,907
2009[3]				0.753 / 0.725	1.81 / 1.75	2,115 / 2,041
2010[4]	0.969	2.33	2,693	0.775 / 0.711	1.87 / 1.71	2,174 / 2,003
2011	1.060	2.55	2,937	0.807	1.95	2,260
2012	1.161	2.80	3,209	0.850	2.05	2,374
2013	1.258	3.03	3,469	0.887	2.14	2,474
2014	1.356	3.27	3,730	0.925	2.23	2,576
2015	1.454	3.50	3,992	0.963	2.32	2,677
2016	1.560	3.76	4,276	1.012	2.44	2,810
2017	1.666	4.02	4,561	1.062	2.56	2,943
2018	1.774	4.27	4,848	1.112	2.68	3,076
2019	1.881	4.53	5,136	1.162	2.80	3,211
2020	1.989	4.79	5,426	1.212	2.92	3,345
2021	2.079	5.01	5,667	1.255	3.03	3,461
2022	2.170	5.23	5,909	1.299	3.13	3,576
2023	2.261	5.45	6,153	1.342	3.23	3,693
2024	2.352	5.67	6,397	1.386	3.34	3,810
2025	2.444	5.89	6,643	1.430	3.45	3,927
2026	2.549	6.14	6,924	1.487	3.58	4,082
2027	2.673	6.44	7,257	1.564	3.77	4,287
2028	2.779	6.70	7,539	1.622	3.91	4,441
2029	2.884	6.95	7,823	1.680	4.05	4,596
2030	2.991	7.21	8,108	1.738	4.19	4,752

[1] *After 2007, MDD is calculated based on ADD and a peaking factor of 2.41.*

[2] *PHD calculated from MDD and number of ERUs served, per Tables 2-20 and 2-21.*

[3] *Projected demand/actual demand. When actual ADD is used, MDD is calculated based on the actual ADD and a peaking factor of 2.41.*

[4] *Originally projected demand/demand projected after conservation savings. See Chapter 4 for a description of the conservation program.*