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Water Demand Forecast

7.1 Introduction

For planning purposes, the development of projections of population growth in the study area and associated public water supply demand is essential. This Section presents an updated population forecast based on State Office of Financial Management (OFM) figures, and a water demand forecast based on updated water use assumptions. This information, together with the assessment of existing utilities ability to meet current and future water supply needs (Section 8), provides the framework for designing the coordination process required to assure future water supply requirements are met in an efficient manner.

7.2 Background and Approach

Planning for future water supply needs requires projection of demand for both near- and long-term periods. The near-term projections are generally necessary to define needed capital improvements anticipated within the next six years. Such improvements require lead time for financing, design, and construction. Long-term forecasts are necessary to quantify probable water resource requirements. Such forecasts guide the identification and sizing of long-range supply facilities, the water rights reservation process, and management of water resources necessary to meet future demands.

The long-term water use forecasting is combined with different growth rate scenarios to develop high, medium, and low population forecasts. Each of these forecasts serves as a valuable tool in the planning process. The "medium" forecast provides a "best estimate" of long-term growth based on historical and near-term events. A high forecast is used to project potential resource need while the low forecast is used to plan for revenues. Planning within the high-low range allows Skagit County (County) to develop resources accordingly without becoming financially overextended.

Population growth is the single most influencing factor in future water demand. Not only does the magnitude of future population have an impact, but the location of new population centers will greatly affect delivery of future water supplies. Therefore, population growth must be coordinated and based on approved land use plans and policies.

Water demand projections are based on existing studies, population projections, current water use data, land use patterns, and the estimated reduction in water use

resulting from water conservation. Demand forecasts are expressed as average day and peak day demand.

Data used in developing the demand forecast was obtained from OFM and Skagit County Planning and Community Development Department (SCPCD). Land use designations were provided by the County.

7.3 Reservation of Water

The Water Resources Act of 1971 (Chapter 90.54 RCW) provides that the Department of Ecology (Ecology) may reserve and set aside public water for utilization for specific purposes in the future. The priority of the reserved water right carries the date the reservation is established by Ecology. Regulations adopted by Ecology (Chapter 173-590 WAC) set forth the procedures to be followed and the requirements for petitioning for a reservation of water. A controlling condition is that a Coordinated Water System Plan (CWSP), approved by the Secretary of Health, must accompany a petition for regional water supply reservation unless an exemption is granted.

Ecology regulations require that petitions for reservation of water must be based on 50 year population and related water demand projections. For this reason, the projections developed herein extend to the year 2050.

7.4 Population Growth

The County population forecasts through the year 2020 reported herein are population forecasts reported by the OFM *1995 Washington State County Population Projections* (Table 7-1). These projections are developed using the "cohort-component" approach taking into consideration the age-sex specific rates for fertility, mortality, and migration. The reported "medium range" forecast are the figures that provided the framework for the 1995 County Growth Management Act (GMA) projections. The previous CWSP presented projection forecasts using a slightly modified "cohort-component" approach to forecast change for the County separate from the State as a whole. For this update, in light of the GMA, OFM figures have been used directly. The OFM forecast includes the years 1995 to 2020. An extended projection has been developed by extending OFM forecasts by 30 years to 2050. This was projected by consistently applying the annual growth rate estimated for 2020 over the additional 30-year period.

The population forecast is presented in three scenarios: high-, medium-, and low-series. This three-pronged approach to forecasting is provided to reflect the uncertainty associated with growth in population. A County-wide forecast is provided, as well as forecasts for selected cities (Table 7-2). The cities and figures reports are a compilation of data from OFM, 1993 CWSP, and Skagit County county-wide planning and policy.

Table 7-1
1995 OFM Population Forecasts
High, Medium, and Low Population Projections for Skagit County

	Five-Year Intervals					Single-Year Intervals									
	1990	1995	2000	2005	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
High	79,555	93,101	106,454	121,320	136,644	140,063	143,547	147,074	150,631	154,240	158,555	162,890	167,258	171,676	176,067
Medium	79,555	93,101	103,478	114,635	125,508	127,847	130,228	132,684	135,169	137,714	140,735	143,738	146,769	149,810	152,812
Low	79,555	93,101	101,617	110,552	118,853	120,656	122,496	124,344	126,201	128,074	130,376	132,680	134,983	137,298	139,560

7.5   Forecast Results

Table 7-2 shows the breakdown of projected population by urban growth area (UGA) and unincorporated areas of the County for 1995, 2000, and 2015.   During this period, population in the cities is expected to grow faster than in the unincorporated areas listed.   Mount Vernon is also expected to gain an increasing share of the County population.

Table 7-2
Population Growth for Select Skagit County Cities and Reservations

Area Designation	Population Year		
Urban Growth Area	1995[a]	2000[a]	2015[b]
Anacortes	14,252	16,612	18,300
Burlington/County	--	--	3,420
Big Lake	--	--	2,400
Burlington	4,751	5,101	7,065
Concrete	826	903	1,110
Hamilton	682	697	315
La Conner	641	632	890
Lyman	245	221	370
Mount Vernon	23,251	27,948	41,725
Sedro-Woolley	5,543	5,168	11,030
Swinomish	--	--	2,722
UGA subtotal	50,191	57,283	89,345
County - Unincorporated subtotal	46,720	54,284	48,355
Total County	96,911	111,567	137,700

a.   As estimated in 1993 Skagit County CWSP approved population forecast (Exhibit 7-3).
b.   As listed in the 1996 Skagit County County-wide Planning Policies documents (Exhibit 7-2).

Urban growth boundaries have been defined for cities within the County as part of the GMA.   The goal is to direct new growth into the incorporated areas, rather than the unincorporated areas.   Skagit County Planning will continue its goal for future growth to be distributed as 80 percent in incorporated areas and remaining 20 percent in unincorporated areas of the County.

From 1995-2050, natural growth rates are expected to remain the essentially constant.   Growth will result from migration into the County.   Therefore, the changes in growth largely reflect and change in the migration into the County.

7.5.1   Medium Population Forecast

Table 7-3 shows County-wide low, medium, and high population projections. The OFM medium forecast population for Skagit County shows annual growth decreasing to 2.0 percent by 2000 and fluctuating between 1.7 and 2.1 percent through 2050.   Population is projected to be 103,478 by 2000 and 160,265 by the year 2050.

Table 7-3

Skagit County Low, Medium, and High Population Forecasts[a]

Year	Low Forecast		Medium Forecast		High Forecast	
	Population	% Growth	Population	% Growth	Population	% Growth
1990	79,555		79,555		79,555	
1995	93,101	14.5%	93,100	14.5%	93,101	14.5%
2000	101,617	8.4%	103,475	10.0%	106,454	12.5%
2005	110,552	8.1%	114,635	9.7%	121,320	12.3%
2010	118,853	7.0%	125,510	8.7%	136,644	11.2%
2011	120,656	1.5%	127,847	1.8%	140,063	2.4%
2012	122,496	1.5%	130,228	1.8%	143,547	2.4%
2013	124,344	1.5%	132,684	1.9%	147,074	2.4%
2014	126,201	1.5%	135,169	1.8%	150,631	2.4%
2015	128,074	1.5%	137,700	1.8%	154,240	2.3%
2016	130,376	1.8%	140,735	2.2%	158,555	2.7%
2017	132,680	1.7%	143,738	2.1%	162,890	2.7%
2018	134,983	1.7%	146,769	2.1%	167,258	2.6%
2019	137,298	1.7%	149,810	2.0%	171,676	2.6%
2020	139,560	1.6%	152,812	2.0%	176,067	2.5%
2030[b]	161,890	16.0%	183,374	20.0%	220,083	25.0%
2040[b]	187,792	16.0%	220,049	20.0%	275,104	25.0%
2050[b]	217,839	16.0%	264,059	20.0%	343,880	25.0%

[a] Source: Washington State Office of Financial Management
[b] Consultant projection based on OFM projected growth rate in 2020.
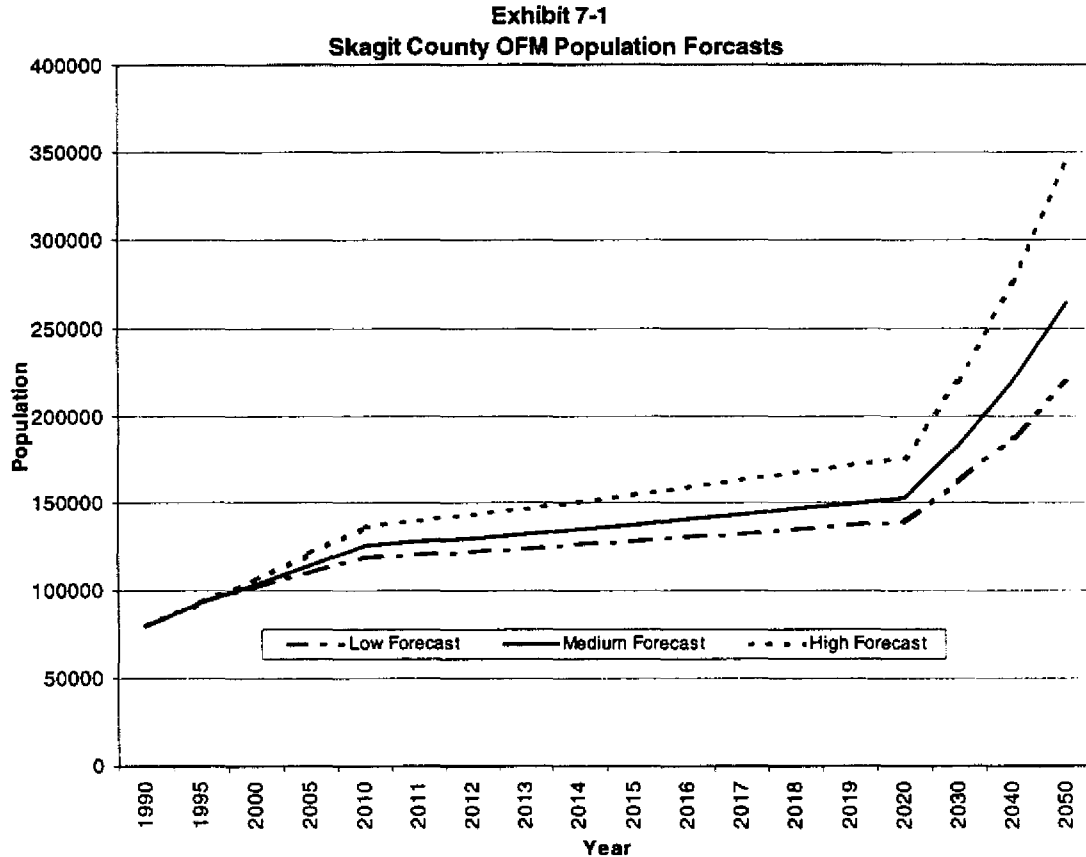
7.5.2 Low Population Forecast

A low forecast of population assumes that the County growth rate will drop to 1.7 by 2000 and fluctuate between 1.4 and 1.8 through 2020. This estimate lowers the population forecast significantly, with a population of 101,617 forecast for 2000 and *146,367* by the year 2050.

7.5.3 High Population Forecast

The high population forecast assumes continued high levels of migration into the County. This estimate assumes a growth rate of 2.2-2.6 percent through

2020. Under these assumptions, the County population forecast is 106,454 for 2000 and **184,654** for the year 2050.

Exhibit 7-1 graphically illustrates the high, medium, and low population forecast for Skagit County.

Exhibit 7-1
Skagit County OFM Population Forcasts

7.6 Adopted Forecast

In accordance with the GMA stipulating the use of OFM population forecasts for planning purposes, the Water Utility Coordinating Committee (WUCC) adopted the medium population forecast. Therefore, on a County-wide basis, Table 7-4 shows the population data used for CWSP study purposes.

Table 7-4
WUCC Approved County-wide Population Forecast

Year	1995	2000	2010	2020	2030	2040	2050
County Population	93,101	103,478	125,508	152,812	155,257	157,741	160,265

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7.7 Urban Growth Areas

In accordance with requirements of RCW 36.70A, Skagit County and cities have developed urban growth management area (UGMA) boundaries; within which growth shall be encouraged and outside of which growth can occur only if it is not urban in nature. These areas are shown on Exhibit 7-2.

The Skagit County City/County Planning Policies Committee has set the criterion that 80 percent of future population growth in the County will occur in the UGAs. The balance, 20 percent, will take place in the remaining County area, which is assumed to be rural. To establish an estimate of future population distribution, this criteria was applied to the OFM medium population projection. Table 7-5 shows the population distribution resulting from application of the 80/20 criteria. In the 1993 CWSP, the Cities of Concrete, Hamilton, and Lyman were assumed to be rural until after 1995. All of these Cities have been designated as UGAs and are included in the UGA population counts.

Table 7-5
Distribution of Skagit County Future Growth—Urban vs. Rural

Area Designation	1995 Population[a]	1995 Population Distribution	New Growth Through 2050 Distributed Per 80/20 Criteria	2050 Population[b]	2050 Population[b] Distribution
County Total	96,911	100%	63,354	160,265	100%
UGAs	50,191	52%	50,683	100,874	63%
Unincorporated Skagit County	46,720	48%	12,670	59,391	37%

[a] 1993 CWSP approved estimate
[b] OFM Medium series population estimate

7.8 Current Water Use

The 1993 CWSP process compiled and reviewed information on per capita water consumption from a cross-section of public water systems in Skagit County and the adjoining counties of Snohomish and Whatcom. Data of particular interest was average daily use per capita and the ratio of peak day to average daily per capita use. Upon review, the WUCC approved the continued application of the water use data for this 1999 CWSP.

The representative usages adopted in this CWSP to calculate water use were:

Urban Average Day Gallons per Capita	150
Urban Peak Day Factor	2.0
Rural Average Day Gallons per Capita	100
Rural Peak Day Factor	2.6

7.9 Water Conservation

Mandatory requirements for improving efficiency in water use have been established at the State level in the Conservation Planning Requirements (CPR) administered by DOH (Appendix A). It may be expected that Ecology approval of any application for water rights permit filed by a utility in the future will be conditioned on implementation of at least a basic water conservation program.

The CPR outlines required elements for three conservation programs identified as Basic, Moderate, and Full designed to address conservation within different size utilities.

7.9.1 Program Concepts

Water demand management includes the implementation of comprehensive long-term conservation programs, short-term emergency response plans, water reuse projects, and peak flow management. The recommended concept outlines the framework for a comprehensive conservation program with recognition of the other demand management elements.

The conservation program elements should be effective and reasonable for utility implementation. Short-term regulatory or mandatory measures, more associated with drought or other emergency conditions of water shortage, are not considered an element of conservation, but rather an emergency response plan. Peak flow management, such as every other day lawn watering, can also be an integral element of an emergency response plan or system design strategy. Peak withdrawal rate can also be reduced by increasing storage capacities. Careful consideration of hourly, daily, weekly, and average annual water use characteristics is required to properly assess the impact of

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conservation plans versus peak flow management. Conservation should reduce average annual use and some peak period usage. Peak flow management may reduce the withdrawal rate but may not reduce the overall average annual use rate.

Since water conservation is to be considered a supply option, the policies and program to be implemented must be defined. Reduction in water use and the period over which it occurs must be estimated. The targeted reduction must be factored into the demand forecast, and regional water supply need projections should be reduced commensurate with the anticipated water savings. The program projections should be monitored against assumptions to assess their effectiveness. The final step in the process is to include the water conservation program as a base element in the program for future water supply planning.

Drawing upon existing literature and experience, specific measures have been identified as having some potential for conserving water. The measures which were selected display a history of effectiveness, address areas of known concern, and are capable of being implemented.

The conservation measures are grouped into the three categories: (1) public education, (2) technical assistance, and (3) system measures. A fourth category of "incentives" is also identified. Elements within this fourth category are recommended for inclusion in a program of further study. These measures are listed and defined in Appendix A.

7.9.2 Recommended Program

The recommended program has been developed with activities for accomplishment assigned to the utilities and/or a regional organization such as a group of public water systems, a regional water association or Public Utility District. The program provides a recommended framework with the understanding that the level of effort or activity is dependent on the conditions specific to the utility. Where a dual role is shown for a particular activity, the utility is lead with the regional activity being one of support.

The scope of programs vary from:

❑ A Base Program which is a minimum program based on specific regional needs as well as expected cost benefit. This base program will be required of all public water utilities with less than 1,000 services. Since this size utility generally does not have staff that can devote time to a conservation program, the emphasis is on the regional program. Public education and technical and administrative services

could be provided in support of the smaller utilities in the base program by appropriate State and regional programs.

❑ A Moderate Program would be implemented by a majority of the municipal corporations (cities and districts). This program would apply to utilities with 1,000 to 25,000 services. The emphasis in this program shifts to greater utility implementation with regional support.

❑ A Full Program would apply to utilities having 25,000 or more services. This program is limited to the larger cities or regions in critical water areas. The program requires a considerable staff effort and possible changes in land use or building code controls for implementation of some of the program measures.

Conservation elements recommended for each level of program, and assignment of responsibility for implementation, are shown in matrix form on Appendix A.

7.9.3 Program Implementation

The CPR assigns the level of conservation program requirement based upon water supply conditions in an area and the public water system size. Water supply conditions are placed in three categories as follows:

❑ A Critical Area - defined as a region of the State in which Ecology's water needs assessment indicates that current water supplies are not adequate to meet all future needs.

❑ A Growth Area - defined as an area in which population growth is expected to be 2 percent per year or more averaged over a 5-year period.

❑ A Non-Critical Area - defined as a public water systems service area or region in which existing supplies are adequate to meet projected water needs.

In the near-term, Skagit County falls within the growth area category. The related requirements for program implementation are:

Number of Service Connections	Utility Program	Regional Program
>25,000	Moderate	Moderate
10-25,000	Moderate	Moderate
1,000 - 10,000	Moderate	Moderate
<1,000	Base	Moderate

It should be noted that if a public water system's residential water use data indicates either: (1) per capita demand is greater than 150 percent of the regional average; or (2) unaccounted for water exceeds 20 percent of annual use, the public water system will be required to upgrade or expand its conservation program to include the next higher level program.

Implementation of the recommended conservation program will require new program development, regional coordination, and incorporation of the program within the utility's water system plan (WSP). Full implementation and a projected reduction in demand should occur in the year 2000. Conservation effectiveness should be evaluated to ensure targets are on schedule.

In general terms, conservation measures should be pursued to the level where the cost of the measure is equal to the value of the water conserved. However, for purposes of this CWSP, measurement of the benefits of a conservation program will be based on two benchmarks:

(1)   Reduction in per capita average day residential demand, with 1990 being the benchmark year.

(2)   Distribution of educational materials or implementation of the various conservation program sub-elements. The program objectives will be defined by the utility in their water system/conservation plan.

An organization with public water supply management responsibilities for the entire CWSP planning area does not exist at the present time. The Public Utility District No. 1 of Skagit County (PUD) is participating in Water Conservation Coalition of Puget Sound. This is a cooperative effort by cities, water districts, regional water associations, and others in the Puget Sound Basin to develop common or complementary water conservation programs. Efforts at this time focus on public education. As a starting point for the CWSP regional program, it is recommended that the City of Anacortes and other larger utilities join in the Coalition activities either directly or through a common program coordinated by the WUCC.

7.9.4 Water Use Reduction

Based upon experience in the City of Seattle and other areas, it is estimated that implementation of the above described program within the County will result in a 10 percent reduction by 2000, and maintained in the years thereafter. This would reduce the year 2000 average day requirement for the urban area from 150 gpcd to 135 gpcd and for the rural area from 100 gpcd to 90 gpcd.

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7.10 Other Related Water Requirements

In developing the water demand projections for Skagit County utilities, three special areas require consideration. These are future industrial water requirements, expansion of service to North Whidbey Island, and potential service to North Snohomish County.

7.10.1 Industrial Requirements

The most significant industrial water users continue to be Shell Oil Company (5.06 MGD) and Texaco Oil Refinery (5.35 MGD). Both are served by the City of Anacortes. Other industrial users of the Anacortes supply system range in current use from 0.02 MGD (Norpetro) to 0.36 MGD (plywood plant).

Based upon the identified needs, the potential for a shift in industrial development away from the south Puget Sound region due to water supply shortages, the water supply resources of Skagit County, and recognizing that the CWSP forecast extends to the year 2050, the WUCC determined that an additional demand of 15.0 MGD be factored into the demand forecast. This demand was assumed to occur incrementally at the rate of 5.0 MGD each in the year 2000, 2020, and 2040.

7.10.2 North Whidbey Island/Oak Harbor

The City of Oak Harbor and the Whidbey Island Naval Air Station are currently supplied by the City of Anacortes. Water delivery averaged 2.35 MGD in 1990. The City of Anacortes, accounting for the demand in its Water Plan, assumed that Island County demands on the Anacortes system would increase in the future. It is estimated that additional demands of Island County will be 1.0 MGD (3.35 MGD total demand) in the year 2000, with an additional 1.4 MGD (4.75 MGD total demand) in 2010 through 2050.

For planning purposes herein, the WUCC recommended that the City of Anacortes' projections for Island County water service is utilized.

7.10.3 North Snohomish County/City of Stanwood

The City of Stanwood currently obtains its public water supply (including commercial and industrial) from three wells and a spring. In the 1993 CWSP, future water requirements were determined and described in the North Snohomish County CWSP adopted in 1991. A regional supply plan was developed which relied on interties with the City of Everett system. However, regional transmission was identified only for that portion of North Snohomish County generally located south of the Stillaguamish River. The

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City of Stanwood was expected to continue to rely on groundwater development.

Problems have been identified with Stanwood's wells, which raise questions as to the ability of local groundwater sources to provide water of adequate quality and quantity to meet Stanwood's future needs. A regional solution is being considered through intertie with the PUD system.

For planning purposes, the future water requirements for the City of Stanwood service area were considered the same as those reported in the 1993 CWSP. These requirements are reported in Table 7-6.

Table 7-6
City of Stanwood Average and Peak Day Water Demand

Year	Avg. Day MGD	Peak Day MGD
2000	0.50	1.00
2010	0.59	1.18
2020	0.74	1.48
2030	0.90	1.80
2040	1.03	2.06
2050	1.33	2.66

These requirements are based upon a water conservation plan similar to the recommended Skagit County plan being in place in the year 2000. Therefore, the demands are comparable only to the Skagit County projections that include water conservation.

7.10.4 Agricultural Water Use

In developing this water demand forecast, the WUCC recognized that the water requirement for present and future agricultural use was a significant factor in allocating and managing the County water resources. This demand is over and above the water supply requirements identified above. However, the statute under which the CWSP is developed limits the scope of study to public water supply and directly related needs. Agricultural use is not included except as might be served (e.g., greenhouse use) through a municipal or industrial supply.

It is intended, however, that all water users in Skagit County will be documented during the development of the Skagit River Watershed Plan.

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7.11 Water Demand Projections

The population and water use data described above were applied to two scenarios to provide a range of water demand forecast for Skagit County through the year 2050. The scenarios and assumptions contained therein are as follows:

Scenario 1

❏ Per capita water consumption will remain constant at the current representative rates of 150 gpd for urban areas and 100 gpd for rural areas.

❏ Peak day to average day use ratios will remain constant at 2.0 to 1 for urban areas and 2.6 to 1 for rural areas.

❏ Population growth will be distributed 80 percent to urban areas and twenty percent to rural areas. Assumes approximately a 0.5% annual shift in population distribution to account for 80/20 planning criteria distribution for new growth.

Scenario 2

❏ Peak day to average day use factors and population growth distribution will be the same as Scenario 1.

❏ Per capita water consumption will be reduced to 135 gpd for urban areas and 90 gpd for rural areas through water conservation measures in year 2000 and beyond.

Results of this analysis are presented in Tables 7-7 through 7-10.

7.12 Recommended Forecast

It is recommended that the WUCC adopt the Scenario 2 forecast for CWSP study purposes. Assuming that current (1995) demands are being met by County utilities, a future additional source requirement of about 23.5 MGD (average day) and 37 MGD (peak day) exists to meet demand in 2050.

Table 7-7
Scenario 1 - Average Day Water Demand (MGD)

	1995	2000	2010	2020	2030	2040	2050
County Population	93,100	106,454	136,644	176,067	220,083	275,104	343,880
Residential - Urban	7.26	8.62	11.27	16.37	21.46	28.47	37.65
Residential - Rural	4.47	4.90	6.15	6.69	7.70	8.53	9.28
Industrial	11.00	16.00	16.00	21.00	21.00	21.00	21.00
Island County	2.35	3.35	4.75	4.75	4.75	4.75	4.75
City of Stanwood	0.5	0.5	0.59	0.74	0.9	1.03	1.33
Whatcom County Intertie*			0.79	0.79	0.79	0.79	0.79
Total	**25.58**	**33.37**	**39.55**	**50.34**	**56.60**	**64.57**	**74.81**

Table 7-8
Scenario 1 - Peak Day Demand (MGD)

	1995	2000	2010	2020	2030	2040	2050
County Population	93,100	106,454	136,644	176,067	220,083	275,104	343,880
Residential - Urban	14.52	17.25	22.55	32.75	42.92	56.95	75.31
Residential - Rural	11.62	12.73	15.99	17.40	20.03	22.17	24.14
Industrial	11.00	16.00	16.00	21.00	21.00	21.00	21.00
Island County	4.7	6.7	9.5	9.5	9.5	9.5	9.5
City of Stanwood	1.00	1.00	1.18	1.48	1.80	2.06	2.66
Whatcom County Intertie			2.05	2.05	2.05	2.05	2.05
Total MGD	**42.84**	**53.68**	**67.27**	**84.18**	**97.30**	**113.73**	**134.66**

Table 7-9
Scenario 2 - Average Day Demand (MGD)

	1995	2000	2010	2020	2030	2040	2050
County Population	93,100	106,454	136,644	176,067	220,083	275,104	343,880
Residential - Urban	6.54	7.76	10.15	14.74	19.31	25.63	33.89
Residential - Rural	4.02	4.41	5.53	6.02	6.93	7.68	8.36
Industrial	11.00	16.00	16.00	21.00	21.00	21.00	21.00
Island County	2.35	3.35	4.75	4.75	4.75	4.75	4.75
City of Stanwood	0.5	0.5	0.59	0.74	0.74	1.03	1.33
Whatcom County Intertie			0.79	0.79	0.79	0.79	0.79
Total MGD	**24.41**	**32.02**	**37.81**	**48.04**	**53.52**	**60.87**	**70.12**

Table 7-10
Scenario 2 - Peak Day Demand (MGD)

	1995	2000	2010	2020	2030	2040	2050
County Population	93,100	106,454	136,644	176,067	220,083	275,104	343,880
Residential - Urban	13.07	15.52	20.29	29.47	38.62	51.25	67.78
Residential - Rural	10.46	11.46	14.39	15.66	18.02	19.96	21.73
Industrial	11.00	16.00	16.00	21.00	21.00	21.00	21.00
Island County	4.70	6.70	9.50	9.50	9.50	9.50	9.50
City of Stanwood	1.00	1.00	1.18	1.48	1.48	2.06	2.66
Whatcom County Intertie			2.05	2.05	2.05	2.05	2.05
Total MGD	**40.23**	**50.68**	**63.41**	**79.16**	**90.68**	**105.82**	**124.72**