# 2.0 WATER NEEDS

The purpose of this section is to summarize the current and potential future use of water in the Wenatchee River Watershed (also referred to as Water Resource Inventory Area [WRIA] 45) for municipal, residential, commercial, industrial and agricultural needs and environmental uses. Water use estimates are derived by reviewing water rights records and available water use records from municipal and irrigation water users. A comparison of the potential effect on streamflow in the Wenatchee River Watershed is made from the future increase in water demands. Instream flow needs, as defined by minimum flows set by Chapter 173-545 WAC, are described and compared to flows in the Wenatchee River.

## 2.1 CURRENT AND PROJECTED WATER USE

This section provides estimates of current and projected water use for various types of water users in the Wenatchee River Watershed. These estimates were made using existing and readily available information. This information is also summarized in the *Wenatchee River Basin Watershed Technical Assessment* (Montgomery Water Group, 2003).

### *2.1.1 Municipal and Domestic Water Use*

The section addresses water provided by public water systems, individual household wells and industry. The Department of Health (DOH) regulates public water systems under two main categories. Group A systems are those systems regulated under the federal Safe Drinking Water Act (SDWA). Group B systems are regulated under state law, but are not regulated under SDWA. Group A systems are further divided into two categories, as described below.

- Group A, Community Water Systems, provide water to 15 or more service connections used by year-round residents for 180 days or more in a year, or provide water to less than 15 connections that serve at least 25 year-round residents. These systems serve cities, subdivisions, mobile home parks, and other types of communities.
- Group A, Non-Community Water Systems, provide water to the public but not to residential communities. DOH regulates two sub-categories: transient and non-transient. Examples include campgrounds, restaurants, motels, day-care centers, and some businesses.
- Group B systems are those that meet the definition of a public water system under state law, but do not fall into one of the categories listed above. These include systems serving smaller communities and subdivisions ranging from 2 to 14 residential service connections.

For the portion of the population not receiving water from a public water system, it is assumed that water for domestic use is obtained via individual household wells. These wells are exempt from the requirement to obtain permits from Ecology. As such, there is limited information available on the number of these wells and their associated production.

Table 2.1-1 presents the estimate of population and the number of connections or equivalent residential units[1] (ERUs) served by the various categories of water supply and delivery for Year 2002. Estimated average day and maximum day demands are also provided. Average day demand is equal to the total annual demand allocated evenly to each day of the year. Maximum day demand is the day of the year having the highest water demand. The following subsections describe the methodology used to determine the populations served by the various types of municipal and domestic water supplies, and summarize the estimates of Year 2002 water production by these supplies.

#### 2.1.1.1 Estimate of Year 2002 Population

An estimate of population served by the various types of municipal and domestic water supplies is necessary in order to calculate the number of exempt household wells located within the Wenatchee River Watershed. The following approach was used in analyzing population data:

1. Estimates of population for 2000 and 2025 were obtained from Chelan County Department of Long Range Planning staff. The Year 2000 population estimates are based on results of Census 2000 and are organized by US Census Bureau Census County Divisions (CCDs). Three Chelan County CCDs comprise the Wenatchee River Watershed: the Wenatchee, Cashmere, and Leavenworth-Lake Wenatchee CCDs. Figure 2.1-1 depicts the boundaries of these CCDs. The Year 2025 population estimates are forecasts generated by County staff, based upon Office of Financial Management projections. Year 2002 population estimates were derived via interpolation between the 2000 population estimate and 2025 population forecast for each CCD. In total, the 2002 population for the Wenatchee River Watershed is estimated to be 53,181.

2. Estimates of the portion of Wenatchee River Watershed population served by the largest public water systems were obtained directly from water purveyors. This approach was followed with the Cities of Wenatchee, Cashmere, and Leavenworth, as well as Chelan County PUD No. 1, which serves portions of the City of Wenatchee as well as rural areas to the west. This information was organized by CCD.

3. Estimates of the population served by other public water systems were obtained from the Department of Health (DOH) Drinking Water Automated Information Network (DWAIN) database, as updated January 2003. This information was organized by CCD.

4. Estimates of the population served by exempt wells were calculated for each CCD by subtracting the population served by public water systems from the total CCD population.

Of the total watershed population of 53,181, approximately 67 percent (35,895) reside within the Wenatchee CCD. Twenty-one percent of the population (11,217) resides within the Cashmere CCD, and 11 percent (6,068) live in the Leavenworth CCD. Within the entire watershed, 80 percent of the population obtains water from public water systems, with the other 20 percent utilizing exempt wells.

[1] An equivalent residential unit (ERU) is a measure of water use equal to the amount consumed by an average single-family household, and is often used in water system planning. One single-family residential connection equals one ERU, while one multi-family residential connection or a commercial connection may equal more than one ERU.

## Table 2.1-1. Estimate of Current Population and Municipal/Domestic Water Use, by Water Use Category.

| | | | | 2002 Water Use | | | 2002 Water Use (AF/yr), by Type of Source [14] | |
|---|---|---|---|---|---|---|---|---|
| **Water Use Category** | **Notes** | **2002 Population [1]** | **Number of Connections or ERUs [2]** | **ADD (mgd)** | **MDD (mgd)** | **Annual (AF/yr) [3]** | **Ground Water** | **Surface Water** |
| ***Wenatchee CCD*** | | | | | | | | |
| PWS Serving > 100 People | | | | | | | | |
| City of Wenatchee | (4), (15) | 24,057 | 7,250 | NA | NA | NA | NA | NA |
| Chelan County PUD No. 1 - Wenatchee | (5), (15) | 8,542 | 3,726 | NA | NA | NA | NA | NA |
| Other Community & Group B PWS | (6) | 40 | 14 | 0.005 | 0.013 | 6 | 6 | 0 |
| Non-Community PWS | (7) | NA | 82 | 0.008 | 0.019 | 9 | 9 | 0 |
| Households with Exempt Well | (8) | 3,256 | 1,252 | 0.476 | 1.190 | 534 | 534 | 0 |
| Wenatchee CCD Sub-Total | (9) | 35,895 | 12,324 | 0.489 | 1.223 | 548 | 548 | 0 |
| ***Cashmere CCD*** | | | | | | | | |
| PWS Serving > 100 People | | | | | | | | |
| City of Cashmere | (10) | 3,045 | 1,860 | 0.697 | 1.255 | 781 | 195 | 586 |
| Peshastin Water District | (6) | 445 | 202 | 0.077 | 0.192 | 86 | 86 | 0 |
| Valley Hi Community Club | (6) | 219 | 98 | 0.037 | 0.093 | 42 | 42 | 0 |
| Chelan County PUD No. 1 - Dryden | (5) | 125 | 64 | 0.017 | 0.044 | 20 | 20 | 0 |
| Peshastin Domestic Water Assoc. | (6) | 117 | 52 | 0.020 | 0.049 | 22 | 22 | 0 |
| Other Community & Group B PWS | (6) | 1,353 | 512 | 0.195 | 0.486 | 218 | 218 | 0 |
| Non-Community PWS | (7) | NA | 285 | 0.027 | 0.068 | 30 | 30 | 0 |
| Households with Exempt Well | (8) | 5,913 | 2,274 | 0.864 | 2.161 | 969 | 969 | 0 |
| Cashmere CCD Sub-Total | (9) | 11,217 | 5,347 | 1.934 | 4.347 | 2,168 | 1,582 | 586 |
| ***Leavenworth CCD*** | | | | | | | | |
| PWS Serving > 100 People | | | | | | | | |
| City of Leavenworth | (11) | 3,269 | 2,170 | 1.011 | 2.629 | 1,133 | 397 | 737 |
| Ponderosa Community Club | (6) | 330 | 111 | 0.042 | 0.105 | 47 | 47 | 0 |
| Chiwawa Communities Association | (12) | 150 | 60 | 0.055 | 0.138 | 62 | 62 | 0 |
| Other Community & Group B PWS | (6) | 775 | 299 | 0.114 | 0.284 | 127 | 112 | 15 |
| Non-Community PWS | (7) | NA | 657 | 0.062 | 0.156 | 70 | 55 | 15 |
| Households with Exempt Well | (8) | 1,545 | 594 | 0.226 | 0.564 | 253 | 253 | 0 |
| Leavenworth CCD Sub-Total | (9) | 6,068 | 3,891 | 1.510 | 3.876 | 1,693 | 926 | 767 |
| ***WRIA 45 Total*** | | | | | | | | |
| Community & Group B PWS | (13) | 42,466 | 16,418 | 2.270 | 5.288 | 2,544 | 1,207 | 1,338 |
| Non-Community PWS | | NA | 1,024 | 0.097 | 0.243 | 109 | 94 | 15 |
| Households with Exempt Well | | 10,714 | 4,121 | 1.566 | 3.915 | 1,755 | 1,755 | 0 |
| WRIA 45 Total | | 53,181 | 21,563 | 3.933 | 9.446 | 4,409 | 3,056 | 1,353 |

Notes:
CCD = Census County Division; PWS = Public Water System; ADD = Average Day Demand; MDD = Maximum Day Demand
mgd = million gallons per day; AF/yr = acre-feet per year

(1) Estimated population served by each water supplier and water supply category in 2002. See further notes below for sources of estimates.
(2) Where public water systems use equivalent residential units (ERUs) for planning purposes, ERUs are listed. Otherwise, the number of connections served is listed.
(3) Average day demand converted to AF/yr by multiplying by 1,121.
(4) Population data obtained from City of Wenatchee planning staff. Connections data obtained from Department of Health (DOH) Drinking Water Automated Information Network (DWAIN) database, January 2003.
(5) Population data obtained from DWAIN. ERU and water demand data obtained from Chelan County PUD No. 1 Water and Wastewater Utility Plan, September 2001.
(6) Population and connections (residential) data obtained from DWAIN. ADD calculated as number of connections times 380 gpd/connection (averag water production factor for WRIA 45). MDD calculated as ADD times 2.5 (average peaking factor for WRIA 45).
(7) Assumed no population served year-round by Non-Community PWS. Connections (total) data obtained from DWAIN. ADD calculated as number c connections times 95 gpd/connection (i.e., 380/4, assuming use occurs only half of the year and at half the rate of average residential water product MDD calculated as ADD times 2.5 (average peaking factor for WRIA 45).
(8) Population calculated as total CCD population minus population served by PWS. Number of connections calculated as population served divided b (average number of persons per household in Chelan County, as obtained from Census 2000 data). ADD calculated as number of connections tim 380 gpd/connection (average water production factor for WRIA 45). MDD calculated as ADD times 2.5 (average peaking factor for WRIA 45).
(9) CCD total population for 2000 and 2025 obtained from Chelan County planning staff. Year 2002 population determined via interpolation.
(10) Information obtained from City of Cashmere Water System Plan Update, to be finalized May 2003.
(11) Information obtained from City of Leavenworth Water System Plan - Final Draft, November 2002.
(12) Population and connections (residential) data obtained from DWAIN. ADD obtained from water system operator, personal comm.; includes usage b owners in addition to those listed in DWAIN and who are not present full year. MDD calculated as ADD times 2.5 (average peaking factor for WRIA
(13) Total of all Community and Group B PWS.
(14) Based upon data obtained from PWS and DWAIN.
(15) Source of water supply located outside of WRIA 45; therefore, no estimate of demand is provided.

#### 2.1.1.2 Estimate of Year 2002 Municipal and Domestic Water Use

Table 2.1-1 summarizes the estimate of 2002 municipal and domestic water use throughout the Wenatchee River Watershed. Information for specific public water systems serving more than 100 people is shown in detail. Data pertaining to other public water systems and household wells are shown in totals for these categories. The following approach was used in developing the water use information in Table 2.1-1:

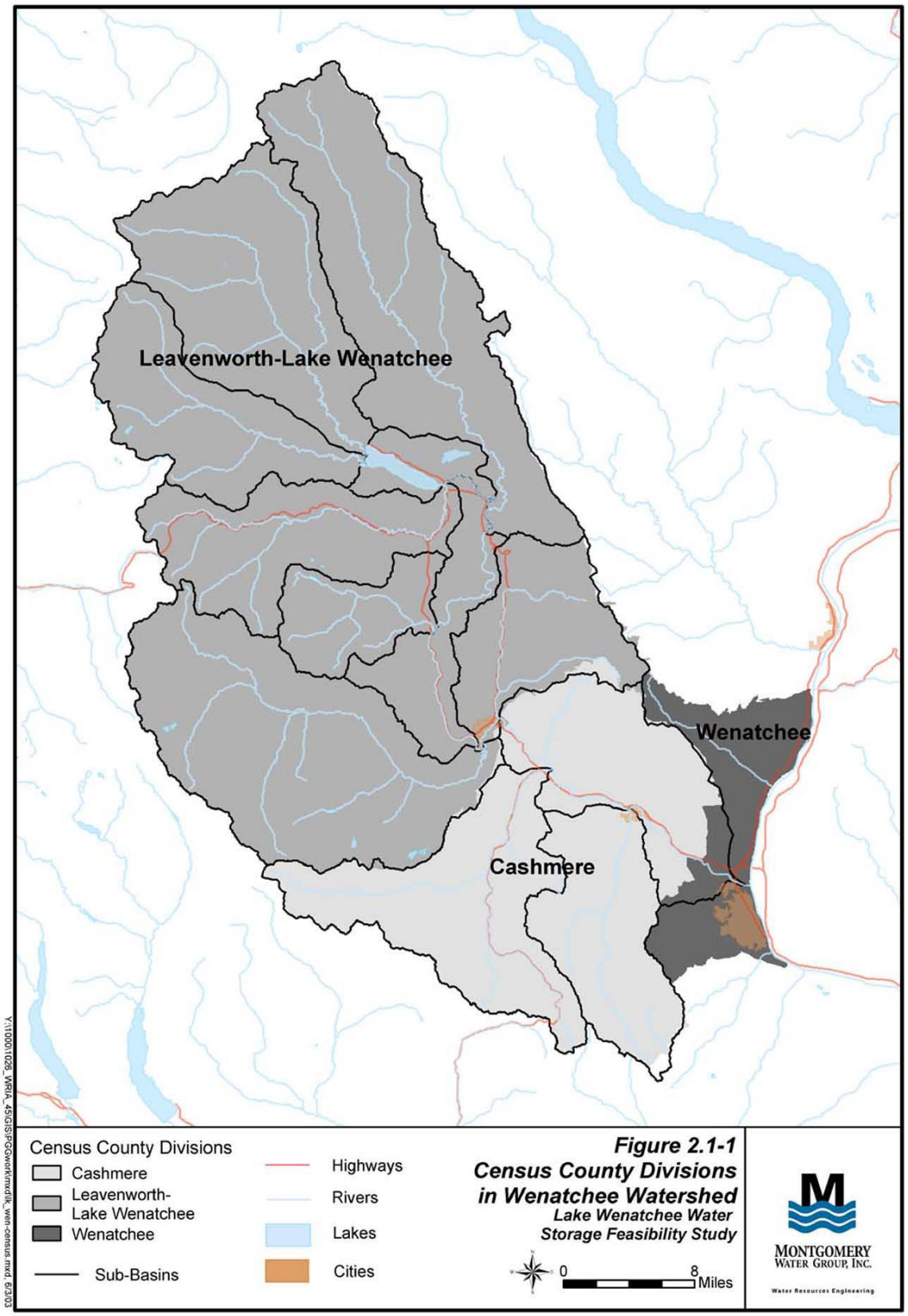
1. Analysis of current water use associated with public water systems was performed using data obtained from water system plans and DOH's DWAIN database. Large Group A public water systems are required to submit water system plans to DOH, which include water use estimates and projections. For large communities such as Cashmere and Leavenworth, these plans are the most reliable source of usage information. These cities were contacted and current water use information was obtained from city staff. Such information was also directly obtained from the Chelan County PUD No.1 for its Dryden Water System, and from the Chiwawa Communities Association. The other large systems (i.e., those serving more than 100 people) did not respond to requests for water use data. Average day and maximum day demands were tabulated, as well as the annual amount of water used, in acre-feet per year (afy). The average daily water use factor for these systems was calculated to be 380 gallons per day (gpd) per residential connection, based upon usage and connections data. The average peaking factor (i.e., ratio of maximum day to average day usage) was determined to be 2.5.

2. Although the City of Wenatchee and Chelan County PUD No.1 – Wenatchee Area are listed in Table 2.1-1 for population estimation purposes, no water use information is provided, since these two purveyors share a regional source of supply located outside of the Wenatchee River Watershed (the Rocky Reach Dam Aquifer).

3. Estimates of water use for the other systems listed individually in Table 2.1-2, as well as all other Community and Group B public water systems, were developed using connections information in DWAIN, in conjunction with the average water use and peaking factors mentioned above. Average daily demand was calculated as the number of residential connections listed in DWAIN multiplied by the average daily water use factor (380 gpd). Maximum day demand was calculated as the average day demand multiplied by the average peaking factor (2.5).

4. There is little readily available data pertaining to water use by Non-Community public water systems. Therefore, an estimate was made, based upon the average water use and peaking factors described above. However, it is noted that there is a high degree of uncertainty associated with these estimates, as they are predicated on multiple assumptions. For the purposes of this analysis, water use by Non-Community public water systems is assumed to occur for only half of the year, and at half of the average daily rate of a typical residence, given that most such systems are campgrounds, parks, etc. Therefore, estimates of water use by Non-Community public water systems were calculated as the number of total connections listed in DWAIN multiplied by 95 gpd per connection (i.e., 380 gpd/4). A peaking factor of 2.5 was used to generate maximum day demands.

5. Water use estimates for households with exempt wells were developed using the same method used for the smaller Community and Group B public water systems, applying average daily water use and peaking factors.


Leavenworth-Lake Wenatchee
Wenatchee
Cashmere
Census County Divisions
Cashmere
Leavenworth-Lake Wenatchee
Wenatchee
Sub-Basins
Highways
Rivers
Lakes
Cities
0
8
Miles
Figure 2.1-1
Census County Divisions in Wenatchee Watershed
Lake Wenatchee Water Storage Feasibility Study
MONTGOMERY WATER GROUP, INC.
Water Resources Engineering

6. Also provided in Table 2.1-1 is an estimate of the amount of municipal and domestic water use obtained from groundwater versus surface water sources. This distinction is based upon information provided by water purveyors and type of source data available from DWAIN.

Based on this approach, total municipal and domestic water use for WRIA 45 is estimated to be approximately 3.9 million gallons per day (mgd) on an average daily basis and 9.4 mgd on a maximum daily basis. This equates to 6.0 cfs on an average day and 14.6 cfs on a maximum day. The total annual amount used is 4,400 afy. The Cashmere CCD contains the highest water use, at 2,170 afy annually. Of this amount, 45% is associated with exempt well use. In the Leavenworth CCD, the majority of water usage is accounted for by the City of Leavenworth, with less than 15 percent of total usage associated with individual household wells. As noted earlier, the majority of the population residing within the Wenatchee CCD receives water from outside the watershed. However, 548 afy is produced from within the watershed, the majority of which is associated with exempt wells.

Considering the entire watershed, public water systems comprise 58% of the total municipal and domestic water use, with 42% of usage accounted for by exempt wells.

#### 2.1.1.3 Estimate of 2025 Population

The Washington State Office of Financial Management (OFM) prepares forecasts of future population that are used for growth management planning by cities and counties in Washington State. The forecasts are provided at five-year intervals between 2000 and 2010 and single-year intervals between 2010 and 2025. The projections provide high, intermediate, and low growth expectations for each county. The high and low projected population forecasts generally reflect assumptions as to the uncertainty regarding growth over the next 25 years. These assumptions are based on the historical high and low decade migration patterns for each county and on current factors affecting the economic base and attractiveness of specific areas in the state. The alternative forecasts are a means of taking the fundamental unpredictability of long-range projections into account. The OFM population forecasts for Chelan County are summarized in Table 2.1-2 and illustrated in Figure 2.1-2.

**Table 2.1-2. Forecasted Population Growth in Chelan County.**

| | Year | | | |
|---|---|---|---|---|
| **Projection** | **2000** | **2010** | **2020** | **2025** |
| High | 66,616 | 81,009 | 94,966 | 101,859 |
| Medium | 66,616 | 75,993 | 85,864 | 90,461 |
| Low | 66,616 | 71,015 | 76,848 | 79,176 |

Counties may select a growth management planning target within the high and low projections. Chelan County Planning Department has adopted the high growth projection for use in growth management planning. For 2025, the population forecast for Chelan County is 101,859, an increase of 35,243 from the population found in the 2000 Census.

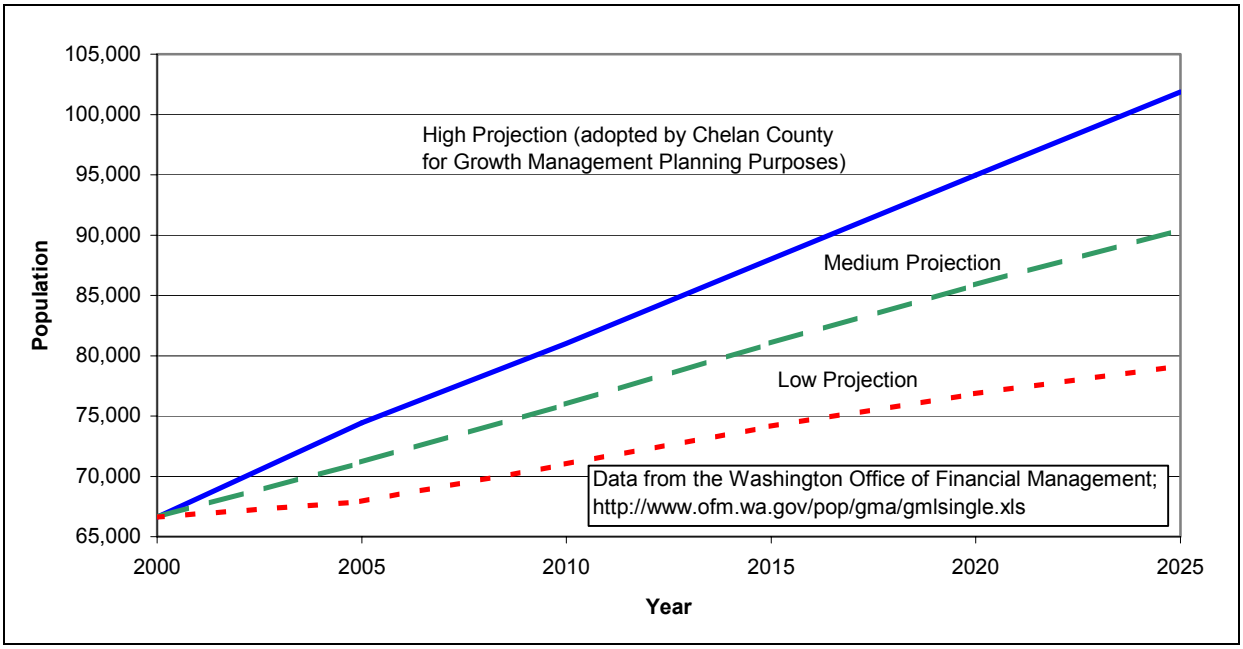



**Figure 2.1-2. Forecasted Population Growth in Chelan County.**

The projected 2025 population within each County Census Division was obtained from Chelan County Planning and is summarized in Table 2.1-3 along with 2000 Census results and 2002 estimates. The population within the Wenatchee River Watershed is projected to grow from 53,180 in 2002 to about 79,600 in 2025, an increase of about 26,500. Most of the growth will occur in the Wenatchee CCD, with a population increase of about 18,200. The population increase in the Cashmere CCD is projected at about 5,900 and the population increase in the Leavenworth-Lake Wenatchee CCD is projected at about 2,550.

**Table 2.1-3. Forecasted Population Growth in Wenatchee River Watershed.**

| Census County Divisions | 2000 Census | 2002 | 2025 |
|---|---|---|---|
| Cashmere | 10,824 | 11,217 | 17,092 |
| Leavenworth - Lake Wenatchee | 5,902 | 6,068 | 8,453 |
| Wenatchee | 34,678 | 35,895 | 54,061 |
| **Total Population of C.C.D.'s located in Wenatchee River Watershed** | **51,404** | **53,180** | **79,606** |

#### 2.1.1.4 Estimate of Year 2025 Municipal and Domestic Water Use

Future Municipal and Domestic Water Use was estimated using the population growth estimates contained in the previous sections as well as estimates contained in Water System Plans for the Cities of Leavenworth and Cashmere. Table 2.1-4 summarizes those estimates. The Average Daily Demand is forecast to increase 1.7 mgd (2.6 cfs) by 2025. The Maximum Daily Demand, which occurs in summertime, is forecast to increase 4.7 mgd (7.3 cfs) by 2025. The annual volume of water use is forecast to increase by about 1,900 acre-feet by 2025.

The future water demands include both surface water and groundwater. An estimate of the split of use between surface water and groundwater was not attempted however most of the additional demand will likely be obtained from groundwater sources. The exception may be the Cities of Leavenworth and Cashmere, who currently use surface water for a portion of their supply and may use additional surface water if they have adequate surface water rights.

**Table 2.1-4. Wenatchee River Watershed Projected Municipal and Domestic Water Use in 2025.**

| | | Estimated 2002 Population | Estimated 2025 Population | Est. No. of Connections or ERUs | ADD (mgd) | MDD (mgd) | Annual (afy) |
|---|---|---|---|---|---|---|---|
| Wenatchee CCD | City of Wenatchee, PUD and other community systems | 32,639 | 47,925 | n/a | n/a | n/a | n/a |
| | Households with exempt wells | 3,256 | 5,404 | 2,078 | 0.790 | 1.975 | 885 |
| | Wenatchee CCD sub-total supplied with water from WRIA 45 | 3,256 | 5,404 | 2,078 | 0.790 | 1.975 | 885 |
| Cashmere CCD | City of Cashmere | 3,045 | 10,225 | 6,391 | 1.592 | 3.980 | 1,785 |
| | Others including Community and Exempt wells | 8,172 | 6,867 | 2,641 | 1.004 | 2.509 | 1,125 |
| | Cashmere CCD sub-total | 11,217 | 17,092 | 9,032 | 2.596 | 6.489 | 2,910 |
| Leavenworth CCD | City of Leavenworth | 3,269 | 6,012 | 3,989 | 1.857 | 4.817 | 2,082 |
| | Others including Community and Exempt wells | 2,800 | 2,441 | 939 | 0.357 | 0.892 | 400 |
| | Leavenworth CCD sub-total | 6,068 | 8,453 | 4,928 | 2.214 | 5.709 | 2,482 |
| WRIA 45 Total (Does not include population served by Wenatchee) | | 20,541 | 30,949 | 16,038 | 5.599 | 14.173 | 6,277 |
| **Estimated 2002 Totals** | | | | | **3.933** | **9.446** | **4,409** |
| **Estimated Increase in Demand 2002-2025 in mgd and acre-feet** | | | | | **1.666** | **4.727** | **1,868** |
| **Estimated Increase in Demand 2002-2025 in cfs and acre-feet** | | | | | **2.6** | **7.3** | **1,868** |

### *2.1.2 Self-Supplied Commercial/ Industrial Water Use*

Some industries have their own water rights and sources of supply, which are considered here separately from municipal usage. For the purposes of this analysis, annual water usage for such users was assumed to equal the annual amount of their commercial/industrial water rights. This approach does not identify

the actual water use by such users; rather, it identifies the maximum authorized use by each user. In the case of commercial/industrial surface water rights, no annual quantity is provided in the State's water right database. The only information provided for these rights is instantaneous quantity. Therefore, annual water usage by commercial/industrial surface water right holders is considered unknown. Estimation of annual use based upon instantaneous water rights (i.e., assuming constant use of the instantaneous quantity) is not a viable approach, as most such users do not use water constantly throughout the year.

Table 2.1-5 summarizes the water usage associated with self-supplied commercial/industrial users. The points of withdrawal and diversion of all Wenatchee River Watershed commercial/industrial water right holders listed in Table 2.1-5 are located within the Cashmere CCD, near the Cities of Cashmere and Peshastin. These users are fruit grower associations or unions, with the exception of one lumber company. In most cases, fruit grower associations and packers use water for non-consumptive purposes such as fruit washing, process transport, and water-cooled refrigeration. In total, the amount of ground water used for self-supplied commercial/industrial purposes is estimated to be 933 afy.

Not included in Table 2.1-5 are industries around the City of Wenatchee, which obtain surface water from the Columbia River and ground water from outside of any of the sub-basins directly tributary to the Wenatchee River. These industries include Pacific Pulp Molding, Columbia Concrete Pipe Company, Spring Builders Inc., Keyes Fibre Company, Western Cold Storage Company, JM Smucker Company, Wenatchee Wenoka Growers, Glico Apple Corporation, and Stemilt Growers, Inc.

**Table 2.1-5. Estimate of Current Self-Supplied Commercial/Industrial Water Use.**

| | 2002 Water Use [1] | | | | |
|---|---|---|---|---|---|
| | Annual (afy), by Type of Source | | | | |
| Water Right Holder | ADD [3] (mgd/cfs) | MDD [4] (mgd/cfs) | Ground Water | Surface Water | Total |
| Wenatchee CCD - Subtotal | 0/0 | 0/0 | 0 | 0 | 0 |
| Cashmere CCD - Subtotal | 0.833/1.29 | 2.806/4.35 | 933 | Unknown [2] | 933 |
| Peshastin Fruit Growers Assoc. | 0.357/0.55 | 0.361/0.56 | 400 | 0 | 400 |
| Central Packers | 0.225/0.35 | 0.258/0.4 | 252 | 0 | 252 |
| Peshastin Cooperative Growers | 0.206/0.32 | 0.323/0.5 | 231 | 0 | 231 |
| Cashmere Fruit Growers Union | 0.045/0.07 | 0.574/0.89 | 50 | Unknown [2] | 50 |
| Schmitten Lumber Co. | Unknown [2] | 1.290/2.0 | 0 | Unknown [2] | Unknown |
| Leavenworth CCD - Subtotal | 0/0 | 0/0 | 0 | 0 | 0 |
| TOTAL-WRIA 45 | 0.833/1.29 | 2.806/4.35 | 933 | Unknown [2] | 933 |

Notes:

[1] Based on water right information presented in Section 2.4.

[2] No annual quantities are associated with the two surface water commercial/industrial water rights (Cashmere Fruit Growers Union and Schmitten Lumber Co.).

[3] Calculated as annual water right ($Q_a$) divided by 365 days/year.

[4] Instantaneous water right ($Q_i$).

#### 2.1.2.1 Estimate of Future Self-Supplied Commercial/Industrial Water Use

The growth in self-supplied commercial and industrial water use is limited because of difficulty in obtaining new water rights and the potential for interruptions in supply when instream flows are not met if water rights are obtained. These types of water users will locate where a reliable water supply is available. This sector may increase water use in the Wenatchee River Watershed but would likely need to purchase the water from another user, such as an irrigator or municipality. No change in total diversions or streamflow would likely result from that scenario.

### *2.1.3 Agricultural Water Use*

This section presents estimates of water diverted for irrigation use and water applied to crops in the study area.

#### 2.1.3.1 Records of Water Diverted for Irrigation Use

Section 2.4, Water Rights, summarizes the volume of Water Right Permits, Certificates and Claims for various purposes including irrigation. The volume of water rights stated in those tables may overstate the volume of water diverted and used for irrigation purposes because supplemental rights are included, limitations to use of the water rights are not described and the quantities associated with claims have not been reviewed or adjudicated. The totals should be considered to be an upper bound, or maximum potential irrigation use. To verify those totals and obtain a more accurate estimate of water diversions, water measurement data is used.

Most of the irrigation water users in the Wenatchee watershed are located within the Wenatchee Reclamation District and the Icicle and Peshastin Irrigation District. Approximately 12,000 acres are irrigated in the Wenatchee watershed with water delivered by those districts. Water diversion records for those irrigation water users were requested and obtained. The data from the Wenatchee Reclamation District is for 2002 (Smith, pers. comm) while the Icicle and Peshastin Irrigation Districts requested that data published in Water Conservation Plans for the Districts be used in this report. That data is from 1990 and 1991, however they stated the water diversion patterns have not changed significantly since that time (Teeley, pers. comm).

Table 2.1-6 lists the average weekly diversions by the Wenatchee Reclamation District for 2002. The diversions listed in the table should not be construed to be long-term averages as diversions change both annually and seasonally due to weather conditions, cropping patterns, acreage irrigated and other factors. Figure 2.1-3 illustrates the weekly diversions. The District starts diversions in early April and stops in mid-October. At the beginning and end of the irrigation season the District typically diverts about one-half of their water right of 200 cfs. Peak diversions occur during July and August in response to hot weather and peak crop irrigation requirements.

Water use records are not available for smaller water users, although their water use is limited to their water right. The diversion patterns that occur for the Wenatchee Reclamation District are probably typical for smaller irrigation water users in the Wenatchee River Watershed.

**Table 2.1-6. Pattern and Quantity of Diversions for Wenatchee Reclamation District, 2002.**

| Date | Flowrate (cfs) | Weekly Volume (ac-ft) |
|---|---|---|
| 4/8/02 | 91.6 | 1,272 |
| 4/15/02 | 94.3 | 1,309 |
| 4/22/02 | 92.9 | 1,290 |
| 4/29/02 | 98.3 | 1,364 |
| 5/6/02 | 96.9 | 1,346 |
| 5/13/02 | 91.6 | 1,272 |
| 5/20/02 | 118.3 | 1,643 |
| 5/27/02 | 119.6 | 1,661 |
| 6/3/02 | 119.6 | 1,661 |
| 6/10/02 | 143.7 | 1,995 |
| 6/17/02 | 151.7 | 2,106 |
| 6/24/02 | 149.0 | 2,069 |
| 7/1/02 | 155.7 | 2,162 |
| 7/8/02 | 181.1 | 2,514 |
| 7/15/02 | 167.7 | 2,329 |
| 7/22/02 | 169.1 | 2,347 |
| 7/29/02 | 167.7 | 2,329 |
| 8/5/02 | 165.1 | 2,292 |
| 8/12/02 | 157.0 | 2,180 |
| 8/19/02 | 163.7 | 2,273 |
| 8/26/02 | 155.7 | 2,162 |
| 9/2/02 | 146.4 | 2,032 |
| 9/9/02 | 129.0 | 1,791 |
| 9/16/02 | 114.3 | 1,587 |
| 9/23/02 | 114.3 | 1,587 |
| 9/30/02 | 113.0 | 1,568 |
| 10/7/02 | 113.0 | 1,568 |
| 10/14/02 | 92.9 | 1,290 |
| Total Diversions | | 51,000 |

Data from the Icicle and Peshastin Irrigation Districts is summarized in Table 2.1-7. Their records show the peak diversions occurring in the period of June through August with water use increasing to a peak in April and May and declining in September towards the end of the irrigation season.

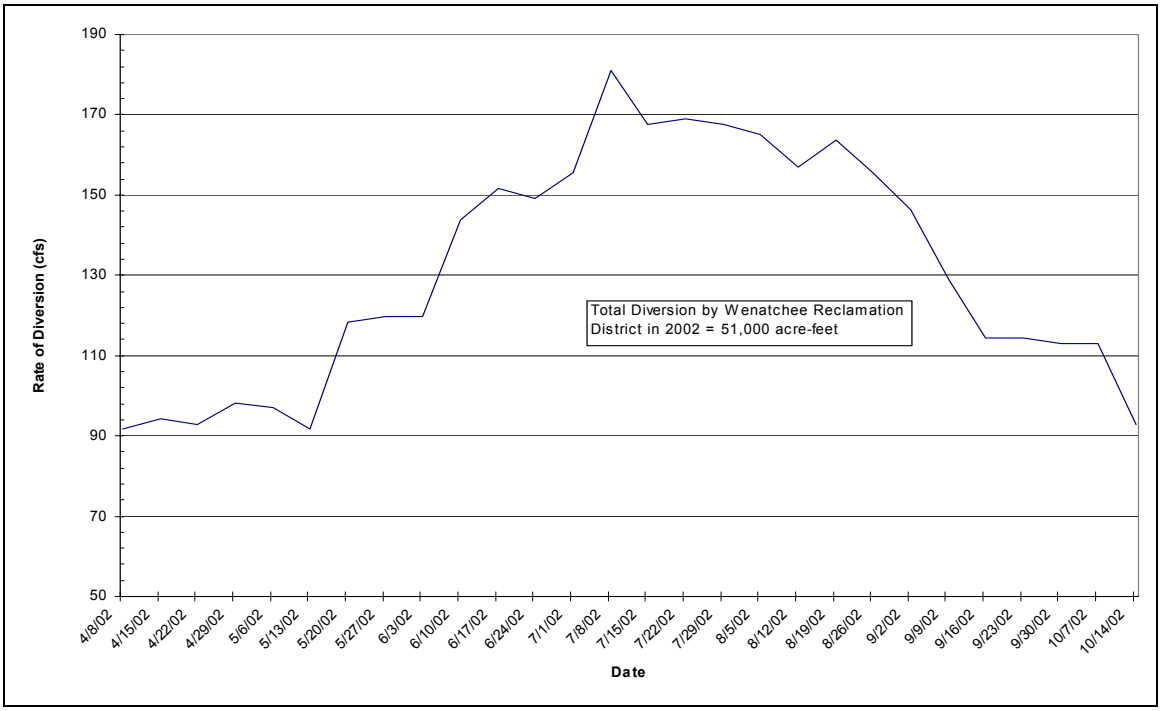



**Figure 2.1-3. Wenatchee Reclamation District Diversions – 2002**

**Table 2.1-7. Monthly Diversions Icicle and Peshastin Irrigation Districts - Average of 1990 and 1991**

| Month | Icicle Creek Diversion | | Peshastin Creek Diversion | |
|---|---|---|---|---|
| | Rate (cfs) | Volume (acre-feet) | Rate (cfs) | Volume (acre-feet) |
| April | 69 | 4,106 | 30.5 | 1,812 |
| May | 88.5 | 5,443 | 35.0 | 2,154 |
| June | 96.5 | 5,742 | 37.0 | 2,199 |
| July | 99.5 | 6,120 | 39.5 | 2,427 |
| August | 98.5 | 6,058 | 36.6 | 2,248 |
| Sept | 78.5 | 4,671 | 28.0 | 1,666 |
| **Totals** | | **32,139** | | **12,505** |

It is likely that additional data will be available in the future for analyzing irrigation diversions with the implementation in 2003 of WAC 173-173, *Requirements for Measuring and Reporting Water Use.* The WAC contains new requirements for the measurement and reporting of water diversions. In the future, water users will be required to record diversions using standard measuring devices and report annually the rate and volume of water diverted to the Department of Ecology.

#### *2.1.3.1.1 Volume of Water Needed to Meet Crop Irrigation Requirements*

An indirect method of estimating water use for irrigation is to count the acreage irrigated and estimate the amount of water needed to productively grow crops. This method will not provide an estimate of the

amount of water diverted or pumped but will provide an estimate of the volume of water consumptively used for irrigation in the watershed.

Crop Irrigation Requirements (CIRs) for representative crops grown in the Wenatchee River Basin are listed in Table 2.1-8. The CIRs were obtained from the Washington Irrigation Guide (WSU, SCS 1985) and represent average annual consumptive water use for different crops and locations in the basin. The actual crop water demands can vary substantially depending on weather conditions, soil type, location, and other factors. Two locations are documented in Table 2.1-8; Leavenworth and Wenatchee. The CIR for Leavenworth is a fair representation of the upper watershed while the CIR for Wenatchee represents the lower watershed. For each location, CIRs for different crop types representing the types of crops grown in the area. The CIRs are provided in inches per month and annually in inches per year and feet per year.

In addition to average CIRs from the Washington Irrigation Guide, data from the WSU Tree Fruit Research Extension Center is available for apple trees with cover. The Research Center is located in Wenatchee. The average CIR measured at the Research Center for the period of 1972-2000 was 35 inches. That corresponds to and confirms the CIR contained in the Washington Irrigation Guide.

The CIR is one component of the on-farm irrigation water requirement. The other component is the efficiency of irrigation, called the field application efficiency. The field application efficiency varies with the type of irrigation practiced (surface or pressurized), the field configuration, size, slope, soils, and other factors. The Washington Irrigation Guide published approximate field application efficiencies for various types of irrigation practiced, which are listed in Table 2.1-9.

The irrigation method most used in the Wenatchee River Watershed is solid set sprinklers with varying emitter sizes from Rainbird-type sprinklers to micro-spray nozzles. The average field application efficiency in the Wenatchee River Watershed is likely about 70 percent.

The volume of water required by a grower for a particular crop type, when considering their method of irrigation, is equal to the CIR for the crop type divided by the field application efficiency for their method of irrigation. For example, an apple grower in the lower Wenatchee Valley that uses solid set sprinklers may require 4.19 acre-feet of water per acre (2.93 ft CIR/0.70 field application efficiency) to meet the CIR during an average year.

**Table 2.1-8. Average Crop Irrigation Requirements.**

| Location / Crop Type | Typical Crop Irrigation Period | Monthly Water Demand (inches) | | | | | | | Seasonal Water Demand (inches) | Seasonal Water Demand (feet) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | April | May | Jun | July | Aug. | Sept. | Oct. | | |
| **Leavenworth** | | | | | | | | | | |
| Alfalfa | 6/3-10/7 | 0 | 0 | 3.37 | 6.42 | 4.77 | 2.56 | 0 | 17.12 | 1.43 |
| Pasture/Turf | 6/3-10/7 | 0 | 0 | 3.58 | 6.78 | 5.05 | 2.77 | 0 | 18.18 | 1.52 |
| Apples w/Cover | 6/3-10/7 | 0 | 0 | 4.52 | 8.54 | 6.44 | 3.6 | 0 | 23.10 | 1.93 |
| Pears & Plums w/Cover | 5/24-10/7 | 0 | 0.47 | 4.53 | 7.83 | 5.89 | 3.19 | 0 | 21.91 | 1.83 |
| Winter Wheat | 4/22-10/7 | 0.11 | 3.44 | 5.01 | 7.78 | 2.78 | 0 | 0 | 19.12 | 1.59 |
| **Wenatchee** | | | | | | | | | | |
| Alfalfa | 5/7-10/10 | | 3.82 | 6.71 | 7.98 | 5.59 | 3.91 | 0.47 | 28.48 | 2.37 |
| Pasture/Turf | 5/7-10/10 | | 4.04 | 7.09 | 8.41 | 5.91 | 4.12 | 0.51 | 30.08 | 2.51 |
| Apples w/Cover | 5/7-10/10 | | 3.37 | 8.23 | 10.55 | 7.52 | 5.00 | 0.47 | 35.14 | 2.93 |
| Pears & Plums w/Cover | 5/7-10/10 | | 3.97 | 7.47 | 9.69 | 6.88 | 4.56 | 0.4 | 32.97 | 2.75 |
| Winter Wheat | 4/2-10/10 | 2.21 | 6.33 | 8.23 | 7.53 | 0.57 | 0.31 | 0.7 | 25.88 | 2.16 |

**Table 2.1-9. Expected Field Application Efficiencies in Washington.**

| Irrigation Method | Efficiency (percent) |
|---|---|
| Level Border | 75 |
| Graded Border | 70 |
| Flood Irrigation | 50 |
| Contour Ditch | 50 |
| Level furrow | 65 |
| Graded Straight furrow | 60 |
| Graded Contour Furrow | 60 |
| Trickle - Point Source Emitter | 90 |
| Trickle - Spray Emitter | 85 |
| Trickle - Continuous Tape | 90 |
| Handline/Wheel Line | 65 |
| Big Gun (Fixed Place) | 60 |
| Traveling Gun | 65 |
| Solid Set (Above Canopy) | 65 |
| Solid Set (Below Canopy) | 70 |
| Center Pivot | 70 |
| Linear Move | 70 |

Growers may also require additional water to make up for conveyance losses in irrigation canals or ditches used to convey water to farms. The magnitude of conveyance loss depends on the type of canal or ditch (lined or unlined), their length, the degree of maintenance and other factors. In our experience in North Central Washington, we have found conveyance losses to range from zero (for piped systems) to more than 50 percent. The only data on efficiency found in the Wenatchee River Watershed was from the Icicle Irrigation District Comprehensive Water Conservation Plan and Peshastin Irrigation District Comprehensive Water Conservation Plan (Klohn Leonoff, 1993). Those reports indicate conveyance losses averaging 10-15%.

#### *2.1.3.1.2 Estimated Consumptive Use of Water for Irrigation*

To estimate the total consumptive water use for irrigation in the Wenatchee River Basin, irrigated land cover area and types were determined and average CIRs applied to those crop types. Irrigation areas and land cover types were estimated from the National Land Cover Dataset (NLCD) for 1992. The analysis was performed for each sub-basin delineated in the *Wenatchee River Basin Watershed Technical Assessment*. Those sub-basins are shown in Figure 2.1-4. Table 2.1-10 shows the area of potentially irrigated land types in each sub-basin and the entire Wenatchee River Basin. Five sub-basins, White, Little Wenatchee, Nason, Chiwaukum, and Lake Wenatchee showed no irrigated land use types in the NLCD. The total irrigated area estimated using the 1992 NLCD data is 12,836 acres; of that 11,573 acres were classified as orchards. A shortcoming of the NLCD data is that irrigated area (lawns, landscaping) is also contained within urbanized or developed area. Because the predominant land cover within an area classified as urban may be housing or streets the irrigated area within those areas is not accounted for. If the urban area water supply is solely from a municipal supplier, such as the City of Cashmere, that water use is accounted for in Section 2.1.1 Municipal and Domestic Use. If they are served by an irrigation district or company, that consumptive use of water is not accounted for in this analysis.

The number and type of irrigated acreage was then multiplied by the corresponding CIR value for the land use type. The area of orchards was multiplied by the CIR for apples, because it is a more conservative number than the CIR for pears. The area of pasture and hay was multiplied by the CIR for alfalfa. The area of small grains was multiplied by the CIR of winter wheat. The remaining irrigated areas were multiplied by the CIR for pasture/turf. Table 2.1-11 shows the estimated irrigation water demand for each sub-basin and the Wenatchee River Watershed. The total estimated consumptive use of water for irrigation purposes is 35,000 acre-feet per year. The on-farm demand, including field application efficiency, would likely be 30-40% greater. Most of the additional water used will seep into shallow groundwater aquifers and may be a source of water supply for groundwater users or may return to surface water via a stream or wetland.

The 1992 data set is the most recent land coverage data set from the NLCD although additional color infrared photos were taken in 2002. The 2002 photos have not yet been analyzed by the USGS.

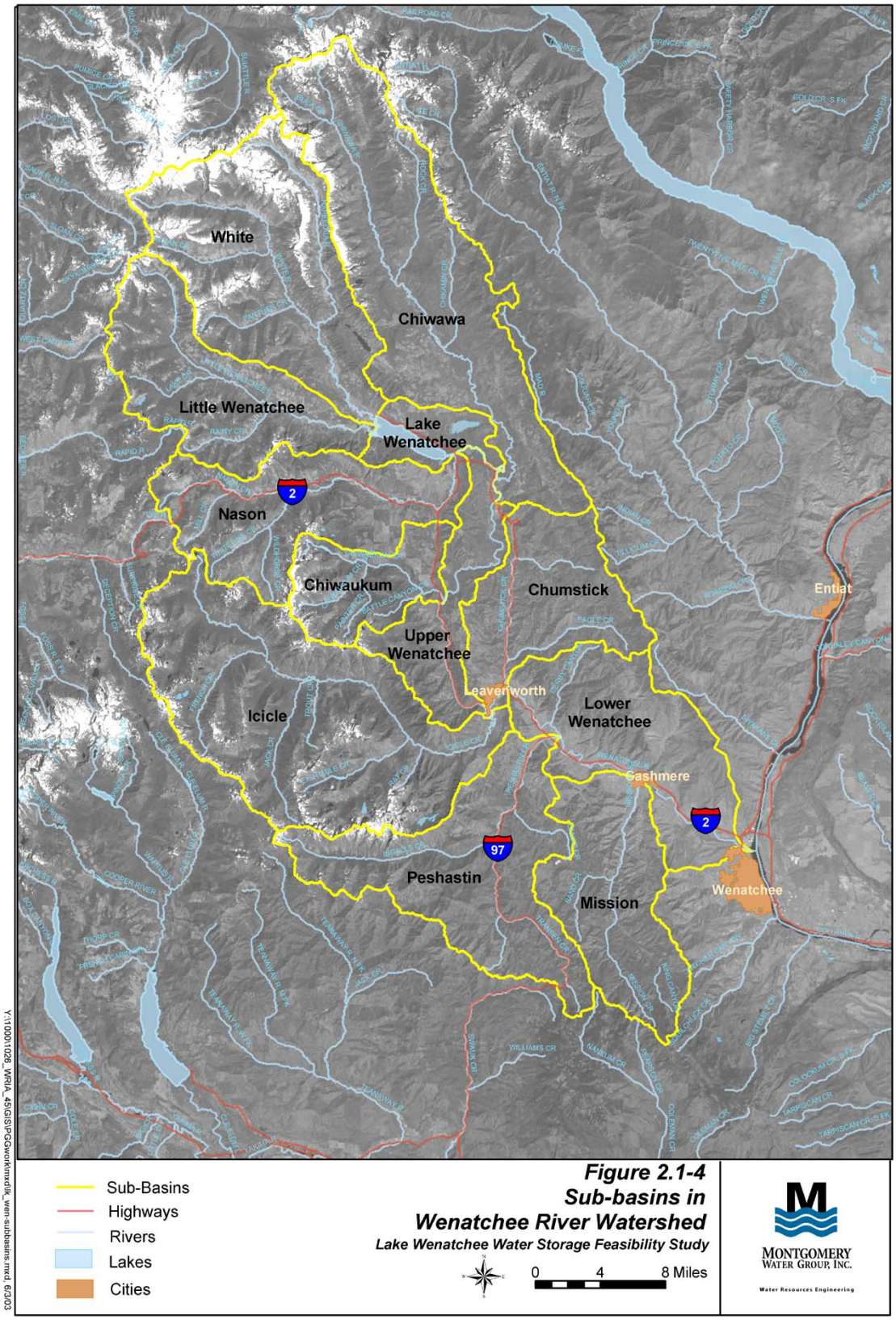



***Figure 2.1-4***
***Sub-basins in***
***Wenatchee River Watershed***
***Lake Wenatchee Water Storage Feasibility Study***

**Table 2.1-10. Summary of Potentially Irrigated Lands Based Upon 1992 Land Cover Database (acres).**

| Land Cover Type | Chiwawa | Upper Wenatchee | Chumstick | Icicle | Peshastin | Mission | Lower Wenatchee | Wenatchee River Watershed |
|---|---|---|---|---|---|---|---|---|
| Orchards, Vineyards, Other | 49 | 278 | 652 | 216 | 645 | 1,807 | 7,926 | 11,573 |
| Pasture, Hay | 93 | 320 | 118 | 86 | 17 | 0 | 299 | 933 |
| Row Crops | 0 | 0 | 0 | 0 | 1 | 0 | 27 | 28 |
| Small Grains | 0 | 0 | 3 | 0 | 1 | 0 | 253 | 257 |
| Fallow | 0 | 0 | 0 | 0 | 0 | 0 | 8 | 8 |
| Urban, Recreational Grasses | 0 | 0 | 37 | 0 | 0 | 0 | 1 | 37 |
| **Potentially Irrigated Land** | **142** | **598** | **810** | **302** | **664** | **1,807** | **8,513** | **12,836** |

**Table 2.1-11. Estimated Irrigation Water Demand for Consumptive Use Based Upon 1992 Land Cover Data (acre-feet).**

| Land Cover Type | Chiwawa | Upper Wenatchee | Chumstick | Icicle | Peshastin | Mission | Lower Wenatchee | Wenatchee River Watershed |
|---|---|---|---|---|---|---|---|---|
| Orchards, Vineyards, Other | 94 | 536 | 1,255 | 416 | 1,889 | 5,290 | 23,210 | 32,690 |
| Pasture, Hay | 133 | 457 | 168 | 122 | 42 | 0 | 709 | 1,631 |
| Row Crops | 0 | 0 | 0 | 0 | 2 | 0 | 69 | 71 |
| Small Grains | 0 | 0 | 5 | 0 | 2 | 0 | 545 | 552 |
| Fallow | 0 | 0 | 0 | 0 | 0 | 0 | 20 | 20 |
| Urban, Recreational Grasses | 0 | 0 | 56 | 0 | 0 | 0 | 1 | 57 |
| **Total Consumptive Use** | **227** | **992** | **1,485** | **538** | **1,934** | **5,290** | **24,554** | **35,020** |

#### *2.1.3.1.3 Summary of Agricultural Census of Irrigated Acreage*

Although the 1992 land cover data set is the most recent comprehensive data found agricultural census data is available to review changes in irrigated acreage that have occurred since that time. The *2001 Washington Fruit Survey* (Washington Agricultural Statistics Service, 2001) was consulted to estimate the trend in tree fruit acreage in recent years. The Washington Agricultural Statistics Service is part of the Washington State Department of Agriculture and conducts periodic statewide fruit acreage surveys. The most recent survey completed was in 2001. Data is also available from the National Agricultural Statistics Service (NASS) for previous years, such as 1982, 1987, 1992 and 1997. The results of the tree

fruit survey are compiled and reported by Fruit Reporting District (FRD). The Wenatchee FRD, which comprises Chelan, Douglas and Okanogan Counties, contains the Wenatchee River Watershed. Table 2.1-12 presents a comparison of fruit acreage in the Wenatchee FRD since 1982.

**Table 2.1-12. Tree Fruit Acreage in Wenatchee Fruit Reporting District.**

| Year | Apple Acreage | Pear Acreage | Cherry Acreage |
|---|---|---|---|
| 1982 | 58,865 | 8,733 | 3,716 |
| 1987 | 59,022 | 10,694 | 3,991 |
| 1992 | 57,346 | 11,684 | 4,923 |
| 1997 | 55,643 | 12,682 | 6,533 |
| 2001 | 54,000 | 14,650 | 9,500 |

Source: 2001 Washington Fruit Survey (Washington Agricultural Statistics Service, 2001)

The total acreage of apples, pears and cherries planted in the Wenatchee FRD increased by 4,197 acres in the period of 1992 to 2001. A decline in the acreage planted in apples has been offset by increases in pear and cherry acreage. Additional data on the acreage with different varieties of fruit is also available but is not presented in this report.

The tree fruit acreage by County or Watershed within the Wenatchee FRD was not available from the *2001 Washington Fruit Survey*. However estimates of irrigated orchards and irrigated farmland located in Chelan County were published in the 1997 *Census of Agriculture* (NASS, 1999). Those estimates are summarized in Table 2.1-13.

**Table 2.1-13. Irrigated Farmland in Chelan County.**

| Year | Irrigated Orchard Acreage | Other Irrigated Acreage | Total Irrigated Acreage |
|---|---|---|---|
| 1987 | 28,923 | 2,356 | 31,279 |
| 1992 | 28,775 | 1,233 | 30,008 |
| 1997 | 28,603 | 1,959 | 30,562 |

Source: 1997 Census of Agriculture (NASS, 1999)

An overall decrease of about 700 irrigated acres has occurred since 1987 but an increase of about 550 acres occurred from 1992 to 1997. The agricultural statistics for both the Wenatchee FRD and Chelan County indicate that tree fruit acreage has increased since 1992. The change within the Wenatchee River Watershed is not available from those publications. The Washington State Department of Agriculture (WSDA) was consulted and it was found they performed mapping of crops in Chelan County in 2002 (pers. communication with Perry Beale). The data was obtained from the WSDA and analyzed for the Wenatchee River Watershed. Table 2.1-14 presents that data. That data estimates the area of orchard in the Wenatchee Watershed at 16,169 acres. The WSDA mapping did not include irrigated area beyond crops, such as parks and landscaping. Although there are differences between the 1992 NLCD and the 2002 WSDA mapping, a comparison of these data sources and the agricultural census indicates irrigated orchard acreage has not decreased in the Wenatchee River watershed. The consumptive use estimate presented in the previous section is likely representative of current conditions also.

**Table 2.1-14. Estimates of Land Area and Zoning within Wenatchee River Watershed.**

| | Area within each Subbasin (acres) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Land Use Classification** | **Chiwaukum** | **Chiwawa** | **Chumstick** | **Icicle** | **Lake Wenatchee** | **Little Wenatchee** | **Lower Wenatchee** | **Mission** | **Nason** | **Peshastin** | **Upper Wenatchee** | **White** | **Totals** |
| Commercial Agricultural | 0 | 0 | 0 | 0 | 0 | 0 | 6,161 | 1,412 | 0 | 622 | 0 | 0 | 8,195 |
| Commercial Forest | 30,243 | 123,758 | 39,454 | 131,586 | 10,322 | 64,146 | 16,079 | 46,288 | 63,407 | 81,923 | 30,104 | 94,899 | 732,209 |
| Public | 0 | 0 | 4 | 171 | 801 | 0 | 179 | 0 | 71 | 0 | 0 | 0 | 1,226 |
| Rural Residential / Resource 2.5 | 42 | 324 | 199 | 371 | 112 | 0 | 1,578 | 372 | 220 | 397 | 774 | 22 | 4,411 |
| Rural Residential / Resource 5 | 706 | 732 | 4,749 | 854 | 149 | 0 | 5,039 | 2,122 | 1,417 | 1,627 | 1,717 | 115 | 19,227 |
| Rural Residential / Resource 10 | 433 | 534 | 1,666 | 447 | 294 | 0 | 6,480 | 1,928 | 1,137 | 873 | 400 | 426 | 14,619 |
| Rural Residential / Resource 20 | 474 | 1,527 | 5,309 | 3,763 | 982 | 816 | 29,705 | 6,935 | 2,565 | 604 | 2,458 | 4,438 | 59,576 |
| Total Rural Residential / Resource | 1,655 | 3,118 | 11,924 | 5,436 | 1,536 | 816 | 42,802 | 11,356 | 5,339 | 3,501 | 5,349 | 5,001 | 97,833 |
| Rural Village | 0 | 0 | 100 | 1 | 59 | 0 | 1,628 | 71 | 0 | 0 | 0 | 0 | 1,860 |
| Rural Commercial | 0 | 0 | 0 | 0 | 3 | 0 | 83 | 0 | 105 | 34 | 10 | 0 | 236 |
| Rural Industrial | 155 | 0 | 0 | 0 | 0 | 0 | 221 | 0 | 0 | 0 | 0 | 0 | 376 |
| Rural Recreational / Resource | 0 | 183 | 20 | 0 | 212 | 0 | 0 | 0 | 322 | 108 | 8 | 0 | 853 |
| Rural Waterfront | 0 | 387 | 57 | 11 | 402 | 0 | 32 | 0 | 0 | 0 | 581 | 15 | 1,484 |
| Urban Residential 1 | 0 | 0 | 0 | 0 | 0 | 0 | 8 | 0 | 0 | 0 | 0 | 0 | 8 |
| Urban Residential 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

#### *2.1.3.1.4 Future Agricultural Water Use*

The potential for change in irrigated agriculture exists due to market conditions for fruit and the proximity of farmland to desirable areas to live. A review of the long-term potential change in land use was performed by analyzing zoning data and comparing the area zoned agriculture to that currently used for farming. Table 2.1-14 presents estimates of land area zoned for agriculture and residential uses in the Wenatchee River Watershed.

A large difference in land area exists between the current agricultural land use and the area zoned for agriculture. The area zoned for agriculture is in the range of 4-6000 acres less than current irrigated area. However the availability of the land for residential use does not mean that it will be converted from agricultural use; the conversion will depend on the value of the land for residential property and the economics of continuing to farm. The previous section reviewed the changes in irrigated acreage that has occurred since 1982 and found the agricultural land base in Chelan County to be fairly stable and not declining. Most of the growth in the watersheds will occur in or near urban growth areas such as Cashmere and Leavenworth. Farms in the vicinity of those towns are most susceptible to development pressure.

When farms are converted to residential uses, the water rights associated with their properties are still owned by the property owner and can be used to irrigate lawns and landscaping as those water uses are defined as a beneficial use in the State Water Code. If the property is within an irrigation district, the district is obligated to deliver the same quantity of water as previously delivered to the property. The rate of delivery is fixed by the water rights appurtenant to the property and usually varies from 5 to about 10 gallons per minute per acre. Since irrigation districts are obligated to deliver that rate of flow even to a residential water user, the peak rate of diversion by the irrigation district from a stream will often not change. The total volume of water may be reduced because of less land area to irrigate or less interest in maintaining fields properly irrigated. An example is the Greater Wenatchee Irrigation District, which has units in East Wenatchee, Brays Landing and at Howard Flat near Chelan. The East Wenatchee unit has experienced the conversion of agricultural land to residential purposes. The Brays Landing and Howard Flat units are almost entirely agricultural. The district estimated the percentage of residential land to be 7% as of 2000 (Montgomery Water Group, 2000). The water demand in the Brays Landing unit is approximately 4% higher per acre than in the East Wenatchee unit. The water demand in the Howard Flat unit is approximately 8% higher per acre than in the Brays Landing unit and 13% higher per acre than in the East Wenatchee unit. However the demands at peak periods have not declined and therefore reductions in peak diversions have not occurred.

It is our opinion the peak rate of water use for agricultural use may not change significantly for the reasons described above. However the overall volume of water used for irrigation may be slightly reduced.

Although there is agricultural land that is converting to residential land, there are still some areas where additional water supply could be used to irrigate acreage that may be contiguous with an existing orchard but does not currently have water rights. That occurs in the Wenatchee River valley as most irrigation water supplies were developed a century ago using gravity delivery systems. Lands lying above the canals or lands with poor drainage could not be irrigated. With pumping systems and more advanced sprinkler systems, more land can be irrigated. In the Water Rights section (2.4) the review of Water Right Applications shows that a number of applications have been

made for additional irrigation. It is not known how much of the water applied for would be used for agricultural use or for landscaping purposes. A number of applicants in the Lower Wenatchee sub-basin are fruit growers, which indicates the desire to plant additional acreage. The information available in the water rights database does not indicate the acreage applied for. The Water Right Applications would need to be reviewed individually to glean that information. A limitation to the use of water from new Water Rights is the interruptibility of those rights when stream flow is less than regulatory minimum flow. Most agricultural enterprises such as orchards cannot economically operate unless an alternate source is available (through a lease or temporary transfer of water). Landscape irrigation can withstand interruption without significant economic losses.

## 2.2 INSTREAM FLOW NEEDS

Instream flows were established by rule in 1983 for three reaches on the Wenatchee River, one reach on Icicle Creek and one reach on Mission Creek. The instream flows are set in Chapter 173-545 WAC Instream Resource Protection Program (IRPP) for the Wenatchee River Basin. Future consumptive water rights for diversion of surface water from the main stem of the Wenatchee River and perennial tributaries are subject to these instream flows as measured at the appropriate stream gauge, preferably the nearest one downstream. Chapter 173-545 WAC also stipulates that Peshastin Creek is subject to a June 15 to October 15 closure for protection of instream values. These instream flows do not affect water rights that were in existence prior to 1983. Single domestic and stockwater use are exempt, and nonconsumptive uses that are compatible with the purposes of the instream flows may be approved.

Table 2.2-1 lists the five stream reaches (called stream management units) affected by the instream flow criteria set in Chapter 173-545 WAC. Control stations are USGS streamflow gauging stations. Instream flow rates for each reach are tabulated in Table 2.1-17.

**Table 2.2-1. WAC Stream Management Units in Wenatchee River Watershed.**

| Control Station | Stream Gauge | River Mile | Stream Management Reach |
|---|---|---|---|
| Wenatchee River at Plain | 12-457000 | 46.2 | From Plain Road Bridge RM 46.2, to headwaters |
| Icicle Creek near Leavenworth | 12-458500 | 1.5 | From headwaters to Icicle Creek to its mouth |
| Wenatchee River at Peshastin | 12-459000 | 21.5 | From confluence of Derby Creek to Plain Road Bridge, RM 46.2 excluding Derby Creek and Icicle Creek |
| Wenatchee River at Monitor | 12-462500 | 7.0 | From mouth to confluence of Derby Creek, including Derby Creek and excluding Mission Creek |
| Mission Creek near Cashmere | 12-462000 | 1.5 | From Mission Creek headwaters to its mouth |

The Wenatchee Watershed Planning Unit has started a process to recommend new instream flows as part of the watershed planning process. That process will take several years to complete and is contingent on receipt of adequate funding to complete the instream flow setting process.

**Table 2.2-1. WAC Instream Flow Requirements in Wenatchee River Watershed.**

| Month | Day | Instream Flow from WAC (cfs) | | | | |
|---|---|---|---|---|---|---|
| | | 12-457000 Wenatchee River at Plain | 12-458000 Icicle Creek near Leavenworth | 12-459000 Wenatchee River at Peshastin | 12-462000 Mission Creek near Cashmere | 12-462500 Wenatchee River at Monitor |
| Jan | 1 | 550 | 120 | 700 | 6 | 820 |
| | 15 | 550 | 120 | 700 | 6 | 820 |
| Feb | 1 | 550 | 120 | 700 | 6 | 820 |
| | 15 | 550 | 120 | 700 | 6 | 800 |
| Mar | 1 | 550 | 150 | 750 | 6 | 800 |
| | 15 | 700 | 170 | 940 | 11 | 1040 |
| Apr | 1 | 910 | 200 | 1300 | 22 | 1350 |
| | 15 | 1150 | 300 | 1750 | 40 | 1750 |
| May | 1 | 1500 | 450 | 2200 | 40 | 2200 |
| | 15 | 2000 | 660 | 2800 | 40 | 2800 |
| Jun | 1 | 2500 | 1000 | 3500 | 28 | 3500 |
| | 15 | 2000 | 660 | 2600 | 20 | 2400 |
| Jul | 1 | 1500 | 450 | 1900 | 14 | 1700 |
| | 15 | 1200 | 300 | 1400 | 10 | 1200 |
| Aug | 1 | 880 | 200 | 1000 | 7 | 800 |
| | 15 | 700 | 170 | 840 | 5 | 700 |
| Sep | 1 | 660 | 130 | 820 | 4 | 700 |
| | 15 | 620 | 130 | 780 | 4 | 700 |
| Oct | 1 | 580 | 130 | 750 | 4 | 700 |
| | 15 | 520 | 130 | 700 | 5 | 700 |
| Nov | 1 | 550 | 150 | 750 | 6 | 800 |
| | 15 | 550 | 150 | 750 | 6 | 800 |
| Dec | 1 | 550 | 150 | 750 | 6 | 800 |
| | 15 | 550 | 150 | 750 | 6 | 800 |

Figures 2.2-1 and 2.2-2 present a statistical analysis of streamflow compared to the IRPP flows for two Wenatchee River gauging stations; at Plain and at Monitor. The IRPP flows generally fall between the 50% and 90% exceedance values for streamflow on the affected streams except in September when the IRPP flows exceed the 50% exceedance flow values.

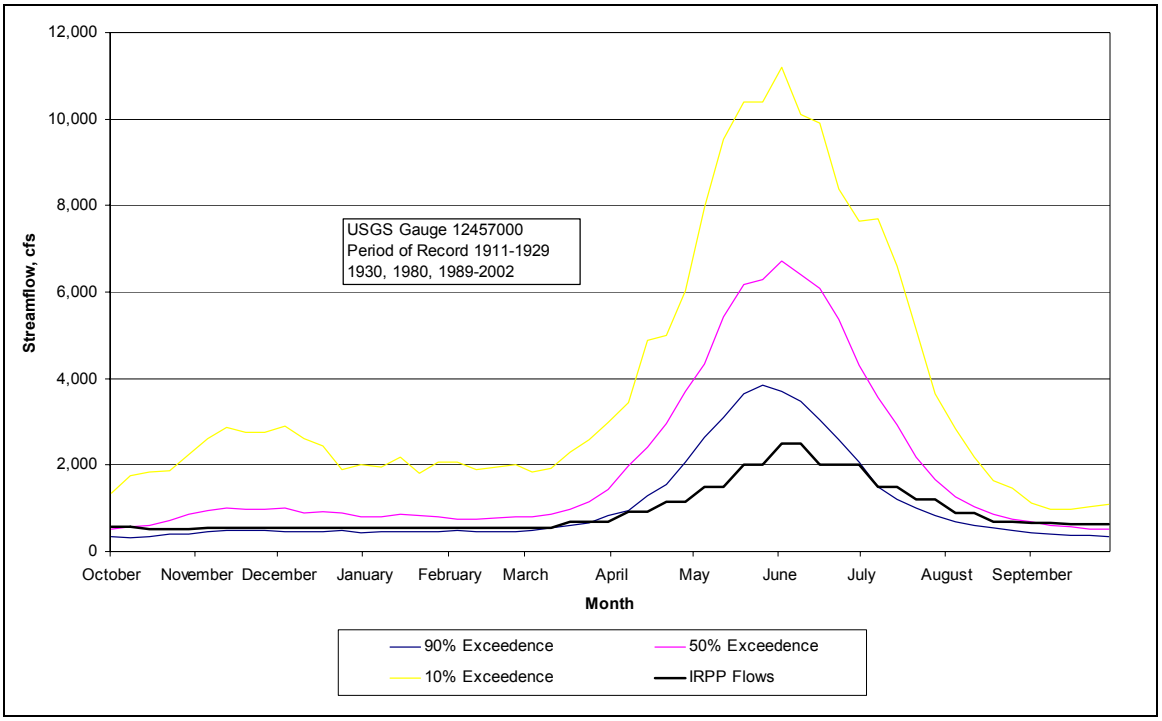



**Figure 2.2-1. Comparison of Wenatchee River at Plain Flow to IRPP Flows.**

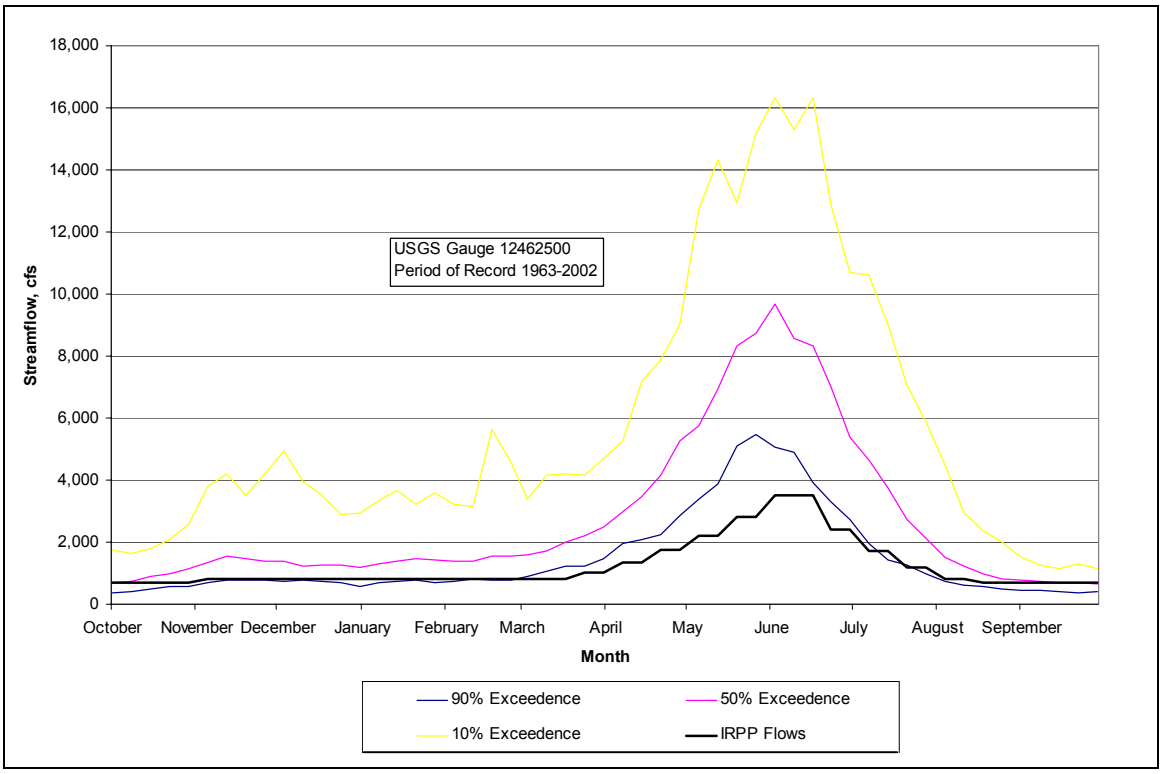



**Figure 2.2-2. Comparison of Wenatchee River at Monitor Flow to IRPP Flows.**

Figures 2.2-3 and 2.2-4 show a comparison of Wenatchee River flow at Plain and Monitor to IRPP flows for the last two July-October time periods. The flow volume which Wenatchee River flows are less than IRPP flows are listed in the figures. In 2002, the Wenatchee River flows were 15,700 – 24,700 ac-ft below IRPP flows. In 2001, the Wenatchee River flows were 46,100 – 50,400 ac-ft below the IRPP flows. 2001 was a drought year with an extended period of low streamflow. In 2002, the annual runoff was average but a late summer dry period caused streamflow to decline to 2001 levels.

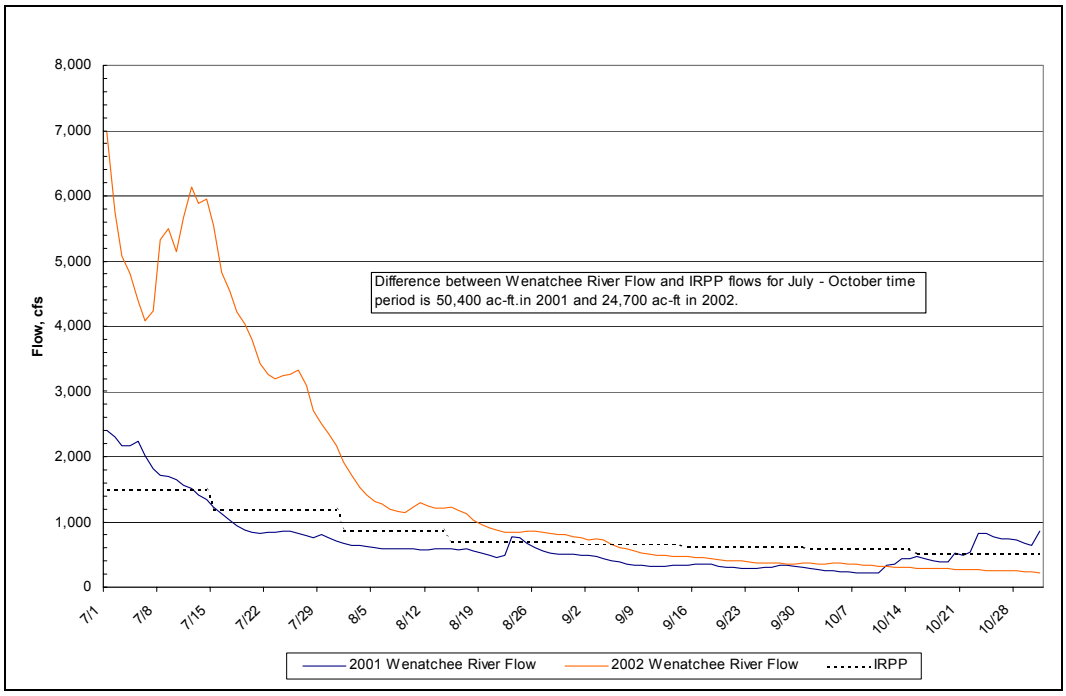



**Figure 2.2-3. Comparison of Wenatchee River at Plain Flow to IRPP Flows for 2001 and 2002.**

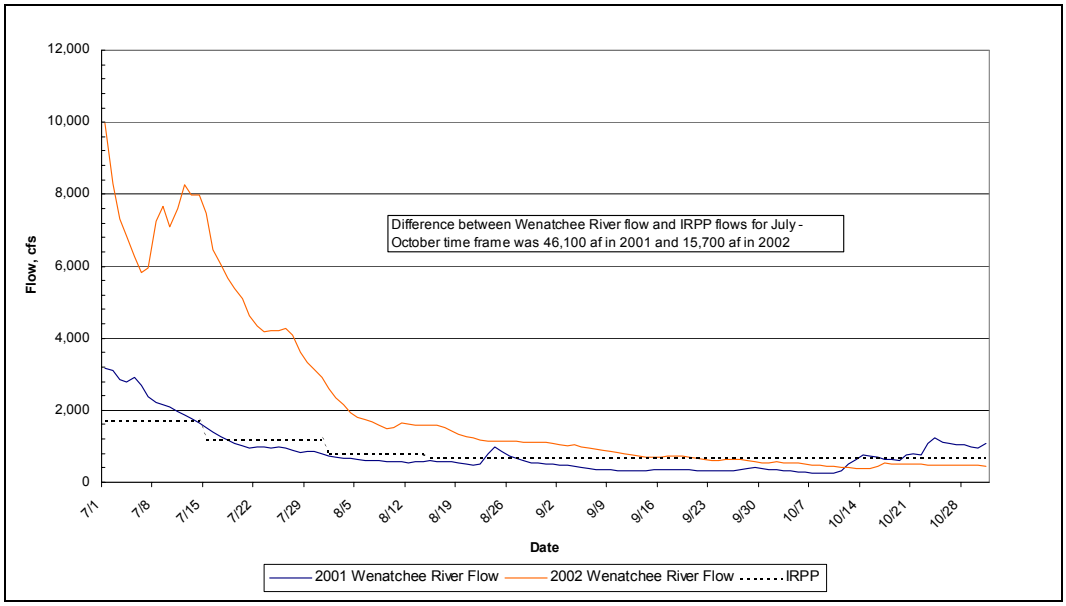



**Figure 2.2-4. Comparison of Wenatchee River at Monitor Flow to IRPP Flows for 2001 and 2002.**

Additional discussion of the quantity of water needed to meet IRPP targets is contained in Section 3. Analyses provided in that section show that, on average, there are 87 days per year that the IRPP flows are not met at the Wenatchee River at Plain gauging station. The average annual quantity of water needed to meet IRPP flows at Plain for the June – October time period is 17,500 acre-feet. These analyses show that a large volume of flow would be required to increase Wenatchee River flow to meet IRPP levels.

## 2.3 WATER CONSERVATION OPPORTUNITIES

### *2.3.1 Municipal and Domestic*

Water conservation planning is a required element of Water System Plans prepared for the Washington Department of Health (DOH). Water System Plans are required for Group A systems and smaller systems that are expanding. There are minimum requirements for water conservation depending on the size of the water system. The minimum requirements are easy to meet as they contain requirements such as metering at the well source, metering at deliveries and public education. From those basic requirements water systems can implement a number of different strategies to conserve water. Those strategies include leak detection, meter installation or replacement, indoor plumbing retrofits, peak demand management, progressive rate structures, outdoor landscaping water demand management and many other strategies. The information obtained in our review of public water systems with written water conservation plan elements of their Water System Plans showed an estimated reduction of 5-10% of the peak and annual demand with implementation of water conservation programs. The water savings would accrue over a long time period as water conservation projects are implemented. If those types of water savings could be achieved for all municipal and domestic water users, the peak demand (current and future) could be reduced by about 3.5 cfs and the average annual demand reduced by approximately 600 afy by 2025.

### *2.3.2 Agricultural Water Conservation*

The only water conservation plans found for irrigation entities in the Wenatchee River Watershed are the Icicle Irrigation District Comprehensive Water Conservation Plan and the Peshastin Irrigation District Comprehensive Water Conservation Plan (Klohn Leonoff, 1993). Those plans were prepared to meet the requirements of The Washington State Department of Ecology's Referendum 38 Program. The plans allowed the Districts to obtain grants and low-interest loans from Ecology for projects that conserve water and improve the operations of their canal systems. Although they may be the only water Conservation Plans written, water conservation activities have been on-going for other water users such as the Wenatchee Reclamation District, who have been constructing canal linings to reduce seepage and replacing water delivery boxes to better measure and control deliveries.

The types of projects reviewed in those plans include canal lining and piping, upgrading turnouts, reconstructing flumes and other hydraulic structures, increasing maintenance on open canals, constructing reregulating reservoirs and on-farm water conservation measures. Costs and potential water savings were presented for each.

The projects reviewed would reduce seepage losses and spills from irrigation canals and seepage losses that occur on-farm. They would not reduce the consumptive use of water needed for crops. The seepage from canals and farms contributes to groundwater aquifers and either flows back to surface water bodies or wetlands or is pumped from aquifers by groundwater users such as domestic exempt well owners.

There is typically a delay in the time seepage occurs to when the flow reenters a surface water body. That delay depends on subsurface geological conditions and the distance from the point of seepage to a surface water body. In work performed in the upper Yakima River basin, it has been found the overall delay from when seepage occurs in canals and farms in the Kittitas Valley to when it reenters the Yakima River is 1-2 months (U.S. Bureau of Reclamation 1998). With about one-half of the total return flow from a diversion returning in the same month it is diverted.

The plans concluded that with implementation of priority projects (upgrading turnouts, canal lining, increasing maintenance, and upgrading structures) the water savings would be 7-10% of diversions. Those types of projects can be implemented by irrigation entities without substantially changing the mode of operation of the irrigation delivery systems, which are primarily open canals. The cost in 1993 for those measures was estimated to be $1.8M, or about $230/acre.

An estimate of the total effect on streamflow in Icicle Creek, Peshastin Creek or the Wenatchee River was not made that accounts for seepage and return flow back to those streams. Because of return flow, the full water savings would not likely be realized as improvements in instream flow. For this review, we are assuming that one-half of the water savings from water conservation would result in instream flow improvements. Table 2.1-7 presented the diversions from the districts throughout the irrigation season. In September, the time of lowest flow, the total diversions from the districts average 106.5 cfs. The potential water savings from implementing water conservation measures would then be about 7.5 cfs to 10.6 cfs and the improvement in instream flow likely in the range of 4-5 cfs during September.

An estimate of the improvement in instream flow if all irrigation entities implemented water conservation measures can be made by scaling the effect of the Icicle and Peshastin Irrigation District improvements. The plans estimated the total amount of irrigated acreage in both districts to be 7,636 acres in 1991. Of that total acreage, 7,097 acres were in orchards. The total orchard acreage in the watershed was estimated to be 11,573 acres in 1992 (Section 2.1). A scaling factor of 1.6 (11,573/7,097) can be applied to the water savings estimated in the Icicle and Peshastin Irrigation District plans. The estimate of water savings in terms of improvements in instream flow would be on the order of 6-8 cfs. Additional water savings may result from water conservation measures implemented on the portions of the WRD that convey water diverted from the Wenatchee River to area within the Cities of Wenatchee and East Wenatchee. Since those areas are not tributary to the Wenatchee River, their irrigated farmland was not counted in Section 2.1.3. Approximately 8,115 acres of the 12,500-acre WRD is located in the Cities of Wenatchee and East Wenatchee. Applying the same water conservation factors to that area, the water savings are estimated to be 8-12 cfs. Since seepage that occurs in those areas does not return to the Wenatchee River a return flow factor is not applied to the water savings. The improvement in instream flow in the Wenatchee River would be equal to those water savings. The estimated total water conservation savings, measured in terms of improvements in instream flow, is 14-20 cfs for improvements to irrigation delivery systems.

Additional water savings could be accomplished through improvements in on-farm irrigation efficiencies. Irrigation districts and companies don't control the application of water on-farm (their responsibility is to deliver a set quantity of water to a farm headgate) and therefore are not active in on-farm water conservation activities. The promotion of on-farm water conservation occurs through the Conservation Districts, the WSU Cooperative Extension and National Resources Conservation Service (NRCS). Section 2.1.3 contained a discussion of typical irrigation methods in the Wenatchee River Watershed. Most all orchards use solid set sprinklers. The average field application efficiency is not known but

estimated to be about 70%. Some improvement in field application efficiency is possible through irrigation audits, conversion to micro sprinklers and through irrigation scheduling. Assuming an efficiency improvement of 10%, the water savings would be roughly equal to those calculated above for improvements to irrigation systems, or 14-20 cfs. The costs would be higher though, in the range of $500-$1000 per acre depending on the improvements required to implement the conservation activities.

The total water savings, measured in terms of improvements to instream flow from water conservation in the agricultural sector could be in the range of 30-40 cfs. This estimate is based upon simplified assumptions of irrigation system conveyance and on-farm efficiencies. Many of the irrigation entities and farmers are continuously upgrading their systems to conserve water and improve their operations. A more detailed review of the current operations of irrigation districts and companies would be required to obtain better estimates of potential water savings. In addition, analysis of the location where seepage occurs would be required to better estimate the timing of return flow and the overall effect on instream flows. The costs of upgrading canals and on-farm irrigation systems would be high, approximately $750 to $1,250 per acre. The total cost would be applied to at least the 11,573 acres of orchard irrigated in the Wenatchee River Watershed and additional 8,115 acres irrigated with water diverted by WRD from the Wenatchee River.

## 2.4 WATER RIGHTS

This section addresses water rights in WRIA 45. It identifies the sources of information available for estimating the quantity of surface and ground water represented by water rights under the State Surface Water Code (RCW 90.03) and the State Groundwater Code (RCW 90.44). Water claims and applications are also summarized.

Water rights in the State of Washington fall into two major categories. One category consists of "claims" for water based on the filing of water right claims during the time periods specified in State law for filing such claims. The other category is water rights obtained through the application process specified in the State Water Code.

The Washington State Department of Ecology (Ecology) has the responsibility for administering water rights in the State, via the application and review process set forth in the State Water Code. Ecology maintains paper files for each water right application submitted. These paper files serve as the complete record for each water right. Information from these files has also been entered into a digital database, the Water Rights Application Tracking System (WRATS). Ecology's Central Regional Office, within which jurisdiction WRIA 45 lies, has combined the WRATS data with information from other sources in developing a Geographic Information System (GIS) – based database containing water right information for the entire Central Region. Information from this product, the Geographic Water Information System (GWIS), was used in developing the WRIA 45 water rights summary for permits, certificates, and claims presented herein. Data extracted from this product were updated in August, 2002. The GWIS database has been provided to Chelan County for use in watershed planning activities.

Additional data pertaining to water right applications were obtained from Ecology's website. These data were updated in September, 2002. An application indicates an applicant has requested water, but a decision approving, modifying, or denying the application for a water right has not been made by Ecology. The date an application is filed with Ecology is the priority date for the application and any

water right issued under the application. Water rights are based on "first in time is first in right," which means that earlier water rights have priority over later ones, if regulation between uses is necessary.

The GWIS information includes approximately 925 records for permits and certificates for WRIA 45. The database also includes approximately 1,700 claims for surface and ground water in the watershed. As of September 2002, there were 134 water right applications for the watershed awaiting an Ecology decision.

Information from GWIS that was used in this summary includes the following:

- **Type of Record** - A "record" is simply one entry in the database. A record may represent a permit to develop a water right, a certificate indicating that the water right has been perfected (i.e., put to use); or a claim documenting water uses that existed prior to adoption of the State Water Code. In general terms, a record for an "active permit" or "active certificate" indicates the holder has the right to put the water to use. Therefore, these records offer a convenient tool for estimating the total amount of water that has been authorized for appropriation in WRIA 45.

  The validity and extent of each claim registered in accordance with the Claims Registration Act (RCW 90.14) lies with the Superior Court through the adjudication process. Since only a portion of the claims within the Wenatchee Watershed have undergone adjudication, the accuracy of the claims data is unknown. However, the information in GWIS does document this information.

- **Instantaneous and Annual Quantities** - The GWIS database indicates both the instantaneous quantity ($Q_i$) and the maximum annual quantity of water ($Q_a$). $Q_i$ is expressed in cubic feet per second (cfs) for surface water and gallons per minute (gpm) for ground water. $Q_a$ is expressed in acre-feet per year (afy). In order to facilitate comparison between surface and ground water quantities, ground water instantaneous quantities have been converted to cfs. For purposes of analyzing total amounts of water rights in the watershed, the annual quantity is the most useful measure.

- **Location** - The "point of withdrawal" or "point of diversion" associated with a water right is a specifically-defined location from where the water is obtained. This is different than the "place of use", which is a specifically-defined land area where the water can be used. GWIS includes the Township, Range, and Section of the well location, point of withdrawal, or point of diversion. The Township, Range and Section identifies a single, one-square-mile area within WRIA 45. Water rights have been organized geographically in this summary, based upon points of withdrawal and diversion.

- **Purpose of Use** - Each water right is granted for a specific purpose, such as irrigation, stock watering, domestic use, municipal use, industrial use, etc. In many cases, a single water right is granted for multiple uses. For example a water right may permit use of the water for irrigation, stock watering, and domestic use.

### *2.4.1 Surface Water Rights Summary*

This section provides a summary of the surface water data found in GWIS for WRIA 45.

#### 2.4.1.1 Surface Water Permits and Certificates

Table 2.4-1 provides a summary of the surface water rights information contained in the GWIS database for WRIA 45. Certificate and permit data is sorted by purpose of use and by sub-basin (according to location of point of diversion). Pertinent information regarding the number of records, and instantaneous and annual quantities, is provided. In the Wenatchee Watershed there are a total of 544 surface water right permits and certificates. The total annual quantity associated with surface water rights for the watershed is 73,099 afy, while the total instantaneous quantity of appropriated surface water is 811 cfs. The instantaneous quantity includes supplemental water rights; therefore, the maximum amount of water allowed to be diverted at any given time may be much less than 811 cfs.

The purpose of use categories having the greatest watershed-wide instantaneous quantity are irrigation. Approximately 567 cfs (70%) is appropriated for the irrigation of more than 30,000 acres. Icicle Creek is the sub-basin with the largest irrigation instantaneous quantity (261 cfs) and annual quantity (29,286 afy). These totals include supplemental rights.

Other purpose of use category having substantial watershed-wide annual quantities is fish propagation and municipal. However, it should be noted that the fish propagation water rights (totaling 17,800 afy) apply to a non-consumptive use of water (i.e., water is diverted from a stream for use in fish hatcheries, with the majority of water returned downstream after its use).

It is also noted that the two largest municipal water purveyors in the watershed (City of Wenatchee and Chelan County PUD No. 1) obtain their water from a source located outside of the watershed (Rocky Reach Dam Aquifer) and thus do not have significant water rights within the watershed that are exercised.

In total, 40% of the annual quantity associated with surface water rights in the watershed is diverted within the Icicle sub-basin. Another 40% is associated with rights in three sub-basins: Chiwawa, Chumstick, and Lower Wenatchee. Together, the Icicle and Lower Wenatchee sub-basins account for 75% of the total instantaneous quantity appropriated within the watershed.

#### 2.4.1.2 Surface Water Claims

Similar to permits and certificates, surface water claims in the watershed are organized in Table 2-18 according to sub-basin. In the Wenatchee Watershed there are a total of 709 surface water claims. The total annual quantity associated with surface water claims is 22,204 afy, while the total instantaneous quantity of surface water claims is 307 cfs. Lower Wenatchee is the sub-basin with the largest instantaneous quantity (134 cfs). The Peshastin sub-basin has the largest annual quantity (7,319 afy).

#### 2.4.1.3 Surface Water Applications

There are a total of 81 surface water right applications currently pending in the Wenatchee Watershed. The total instantaneous quantity associated with these applications is 43 cfs. No annual quantities are provided with the application data. The Lake Wenatchee sub-basin has the highest number of applications (30), while the Peshastin sub-basin has the largest total instantaneous quantity (18.8 cfs). Purpose of use information is not provided in the applications data used for this analysis; however, the majority of applications having this information are for irrigation and domestic use.

See Section 2.4.3 for a discussion of primary versus supplemental water rights.

**Table 2.4-1**
**Surface Water Rights, By Subbasin [1]**
**Wenatchee River Watershed (WRIA 45)**

| | | White | Chiwawa | Little Wenatchee | Lake Wenatchee | Nason | Chiwaukum | Upper Wenatchee | Chumstick [4] | Icicle [5] | Lower Wenatchee | Peshastin | Mission |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Permits and Certificates*** | | | | | | | | | | | | | |
| Purpose of Use [2] | | | | | | | | | | | | | |
| Domestic | # of Records | 5 | 4 | 1 | 149 | 13 | 1 | 8 | 15 | 6 | 35 | 11 | 3 |
| | Qa (AF/yr) | 4 | 331 | 0 | 263 | 26 | 0 | 6 | 46 | 10 | 66 | 136 | 4 |
| | Qi (cfs) | 0.1 | 3.6 | 0.1 | 6.4 | 0.3 | 0.0 | 0.3 | 0.6 | 0.1 | 0.7 | 0.5 | 0.1 |
| Irrigation [6] | # of Records | 2 | 5 | | 15 | 11 | 1 | 10 | 49 | 23 | 92 | 6 | 18 |
| | Qa (AF/yr) | 11 | 4,775 | | 139 | 587 | 0 | 150 | 1,291 | 29,286 | 2,314 | 129 | 219 |
| | Qi (cfs) | 0.6 | 34.2 | | 1.0 | 2.4 | 0.3 | 2.9 | 12.4 | 260.9 | 243.5 | 4.6 | 3.0 |
| Municipal | # of Records | | | | | | | | | 3 | 7 | | |
| | Qa (AF/yr) | | | | | | | | | 636 | 3,584 | | |
| | Qi (cfs) | | | | | | | | | 6.2 | 5.4 | | |
| Fish Propagation | # of Records | | 2 | | | | | | 1 | 1 | 3 | | |
| | Qa (AF/yr) | | 13,000 | | | | | | 0 | 0 | 4,812 | | |
| | Qi (cfs) | | 33.0 | | | | | | 0.5 | 42.0 | 37.5 | | |
| Comm./Ind. | # of Records | | | | | | | | | | 1 | | 1 |
| | Qa (AF/yr) | | | | | | | | | | 0 | | 0 |
| | Qi (cfs) | | | | | | | | | | 2.0 | | 0.8 |
| Other | # of Records | 2 | 3 | 2 | 1 | 5 | 1 | | 2 | 1 | 3 | 1 | |
| | Qa (AF/yr) | 0 | 45 | 4 | 6 | 5 | 0 | | 6 | 1 | 18 | 0 | |
| | Qi (cfs) | 1.3 | 33.0 | 1.0 | 0.1 | 4.1 | 0.2 | | 0.0 | 3.0 | 2.3 | 1.3 | |
| Subtotal, Permits & Certificates | # of Records | 9 | 14 | 3 | 165 | 29 | 3 | 18 | 67 | 34 | 141 | 18 | 22 |
| | Qa (AF/yr) | 14 | 18,150 | 4 | 407 | 617 | 0 | 156 | 1,342 | 29,933 | 10,794 | 264 | 223 |
| | Qi (cfs) | 1.9 | 103.7 | 1.1 | 7.5 | 6.8 | 0.5 | 3.2 | 13.6 | 312.3 | 291.4 | 6.4 | 3.9 |
| | Acres Irrigated | 32 | 1,432 | | 50 | 241 | 14 | 145 | 440 | 14,926 | 13,568 | 22 | 117 |
| ***Claims*** | # of Records | 7 | 18 | | 99 | 39 | 4 | 60 | 16 | 25 | 228 | 51 | 135 |
| | Qa (AF/yr) | 393 | 4,734 | | 288 | 941 | 46 | 176 | 336 | 4 | 3,171 | 7,319 | 3,495 |
| | Qi (cfs) | 24.4 | 33.2 | | 2.8 | 4.6 | 0.0 | 1.5 | 2.5 | 0.1 | 134.1 | 53.1 | 46.2 |
| | Acres Irrigated | 172 | 1,501 | | 29 | 287 | 13 | 7 | 106 | 427 | 5,671 | 4,103 | 392 |
| ***Applications*** [3] | # of Records | 1 | 4 | | 30 | 3 | | 2 | 5 | 6 | 16 | 9 | 2 |
| | Qi (cfs) | 0.1 | 0.1 | | 15.6 | 1.1 | | 0.0 | 0.0 | 1.0 | 6.3 | 18.8 | 0.0 |

Notes:
Qa = Annual Quantity; Qi = Instantaneous Quantity; AF/yr = acre-feet per year; cfs = cubic feet per second
(1) Summary of water rights data obtained from Department of Ecology's Geographic Water Information System (GWIS), except for Applications data (see Note 3). Revision date of information used in t
2002. Data are organized geographically by point of diversion (POD) according to twelve defined subbasins. Those rights having a POD in the southeastern-most portion of WRIA 45 (i.e., the area drain
River) are categorized as "Drainage to Columbia River." This summary does not include Reservoir water rights, of which there are four in WRIA 45 with a total Qa of 19,000 AF/yr.
(2) Some water rights have multiple purposes of use. For such rights in this analysis, the purpose listed first in the GWIS database was assumed to be the primary use. For example, if "Irrigation" and "I
listed in this order as purposes of use for a given right, then that right is classified as an Irrigation water right in this table.
(3) Obtained from Ecology's website. Data current as of September 5, 2002.
(4) Includes the following revision of GWIS data: Irrigation Qi for document S4-29191C was changed from 30 (appears to be an entry error) to 3 cfs.
(5) Includes the following revision of GWIS data: Acres Irrigated for documents SWC01227, SWC01228, SWC01229, and SWC01591 are shown as 7,000 for each right in the database; however, it is k
total irrigated area for all rights combined. Therefore, only 7,000 acres is included to account for these rights in the total for the sub-basin.
(6) Some water right records in the GWIS database do not provide annual quantities for irrigation rights. This is reflected most prominently in the Lower Wenatchee sub-basin, where Irrigation Qi is shov

### *2.4.2 Ground Water Rights Summary*

This section provides a summary of the ground water data found in GWIS for the Wenatchee River Watershed.

#### 2.4.2.1 Ground Water Permits and Certificates

Table 2.4-2 provides a summary of the ground water rights information contained in the GWIS database for WRIA 45. Certificate and permit data is sorted by purpose of use and by sub-basin (according to location of point of withdrawal). Pertinent information regarding the number of records, and instantaneous and annual quantities, is provided. In the Wenatchee Watershed there are a total of 381 ground water right permits and certificates. The total annual quantity associated with ground water rights is 23,277 afy, while the total instantaneous quantity of appropriated ground water is 73.6 cfs (33,046 gpm). These totals include supplemental water rights.

The purpose of use category having the greatest watershed-wide instantaneous quantity is irrigation. Approximately 30.3 cfs (13,605 gpm) is appropriated for the irrigation of more than 2,000 acres. Lower Wenatchee is the sub-basin with the largest irrigation instantaneous quantity (14.5 cfs) and the largest irrigation annual quantity (3,003 afy).

The purpose of use categories having the greatest watershed-wide annual quantities are fish propagation and irrigation. However, it should be noted that the fish propagation water rights (totaling 6,377 afy) apply to a non-consumptive use of water (i.e., water is diverted from wells for use in fish hatcheries, with the majority of water returned to a receiving body after its use).

In total, 64% of the annual quantity associated with ground water rights in the watershed is withdrawn in three sub-basins: Chumstick, Icicle, and Lower Wenatchee. These same three sub-basins also account for 62% of the total ground water instantaneous quantity appropriated throughout the watershed.

#### 2.4.2.2 Ground Water Claims

Similar to permits and certificates, ground water claims in WRIA 45 are organized in Table 2.4-2 according to sub-basin. In the Wenatchee Watershed there are a total of 986 ground water claims. The total annual quantity associated with ground water claims for WRIA 45 is 23,573 afy, while the total instantaneous quantity of ground water claims is 131 cfs. Lower Wenatchee is the sub-basin with the largest instantaneous quantity (42.3 cfs). The Mission sub-basin also has many claims (31.6 cfs on an instantaneous basis and 5,185 afy on an annual basis).

#### 2.4.2.3 Ground Water Applications

There are a total of 53 ground water right applications currently pending in the Wenatchee Watershed. The total instantaneous quantity associated with these applications is 10.9 cfs. No annual quantities are provided with the application data. The Lower Wenatchee sub-basin has the highest number of applications (25), while the Lake Wenatchee sub-basin has the largest total instantaneous quantity (2.8 cfs).

#### 2.4.2.4 Exempt Wells

Under the State Ground Water Code, ground water cannot be withdrawn unless the user files an application and obtains a permit from Ecology. However, certain types of use are exempted from this requirement, and a valid right to use water can be established without applying for a permit under certain conditions (RCW 90.44.050). Uses exempted from the requirement to apply for a permit are:

- Stock-watering;
- Watering a lawn or non-commercial garden up to one-half-acre in size;
- Domestic uses (single or group domestic) up to 5,000 gallons per day; and
- Industrial purposes up to 5,000 gallons per day.

The law indicates that Ecology may, from time to time, require the water user to provide information regarding the means for withdrawal and the quantity of the withdrawal.

Wells installed under this provision of the law are known as "exempt wells," because they are exempt from the requirement to obtain a permit. Because no permit is issued, Ecology does not have comprehensive data on the number and size of such wells. Therefore, different methods must be applied to estimate the number of wells and the quantity of ground water withdrawals associated with those wells. This topic is discussed in greater detail in Section 2.1.1.

**Table 2.4-2**
**Ground Water Rights, By Subbasin [1]**
**Wenatchee River Watershed (WRIA 45)**

| | | White | Chiwawa | Little Wenatchee | Lake Wenatchee | Nason | Chiwaukum | Upper Wenatchee | Chumstick | Icicle | Lower Wenatchee | Peshastin | Mission |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Permits and Certificates*** | | | | | | | | | | | | | |
| Purpose of Use [2] | | | | | | | | | | | | | |
| Domestic | # of Records | | 2 | | 5 | 7 | 1 | 8 | 74 | 1 | 36 | 2 | 11 |
| | Qa (AF/yr) | | 40 | | 124 | 116 | 1 | 80 | 196 | 1 | 758 | 156 | 172 |
| | Qi (cfs) | | 0.2 | | 0.4 | 0.8 | 0.1 | 0.5 | 2.0 | 0.0 | 2.5 | 0.5 | 0.7 |
| Irrigation | # of Records | 2 | 1 | | 2 | 5 | 1 | 4 | 54 | 7 | 75 | | 49 |
| | Qa (AF/yr) | 139 | 45 | | 23 | 306 | 9 | 68 | 1,132 | 106 | 3,003 | | 1,368 |
| | Qi (cfs) | 1.0 | 0.2 | | 0.1 | 1.1 | 0.1 | 0.3 | 5.0 | 0.4 | 14.5 | | 5.8 |
| Municipal | # of Records | | | | | | | | 2 | | 3 | 1 | 4 |
| | Qa (AF/yr) | | | | | | | | 2,000 | | 553 | 75 | 1,227 |
| | Qi (cfs) | | | | | | | | 6.7 | | 1.5 | 0.2 | 3.1 |
| Fish Propagation | # of Records | | | | | | | | | 2 | | | |
| | Qa (AF/yr) | | | | | | | | | 6,377 | | | |
| | Qi (cfs) | | | | | | | | | 11.4 | | | |
| Comm./Ind. | # of Records | | | | | | | | | | 4 | | 1 |
| | Qa (AF/yr) | | | | | | | | | | 883 | | 70 |
| | Qi (cfs) | | | | | | | | | | 1.5 | | 0.1 |
| Other | # of Records | | | | | 1 | | 2 | | | | | |
| | Qa (AF/yr) | | | | | 8 | | 516 | | | | | |
| | Qi (cfs) | | | | | 0.2 | | 0.7 | | | | | |
| Subtotal, Permits & Certificates | # of Records | 2 | 3 | 0 | 7 | 13 | 2 | 14 | 130 | 10 | 118 | 3 | 65 |
| | Qa (AF/yr) | 139 | 85 | 0 | 147 | 430 | 10 | 664 | 3,328 | 6,484 | 5,197 | 231 | 2,837 |
| | Qi (cfs) | 1.0 | 0.4 | 0.0 | 0.6 | 2.1 | 0.2 | 1.4 | 13.6 | 11.8 | 19.9 | 0.7 | 9.7 |
| | Acres Irrigated | 40 | 10 | | 9 | 245 | 4 | 17 | 453 | 35 | 758 | | 380 |
| ***Claims*** | # of Records | 1 | 14 | | 48 | 23 | 2 | 58 | 15 | 19 | 391 | 59 | 312 |
| | Qa (AF/yr) | 1 | 150 | | 140 | 209 | 4 | 234 | 116 | 1,836 | 6,235 | 394 | 5,185 |
| | Qi (cfs) | 0.0 | 0.9 | | 0.9 | 3.0 | 0.0 | 4.3 | 1.4 | 11.7 | 42.3 | 10.6 | 31.6 |
| | Acres Irrigated | 0 | 30 | | 2 | 23 | 11 | 54 | 18 | 69 | 1,064 | 30 | 956 |
| ***Applications*** [3] | # of Records | 1 | | | 6 | | | 2 | 9 | | 25 | | 3 |
| | Qi (cfs) | 0.0 | | | 2.8 | | | 0.0 | 6.7 | | 0.9 | | 0.1 |

Notes:
Qa = Annual Quantity; Qi = Instantaneous Quantity; AF/yr = acre-feet per year; cfs = cubic feet per second
(1) Summary of water rights data obtained from Department of Ecology's Geographic Water Information System (GWIS), except for Applications data (see Note 3). Revision date of information used 2002. Data are organized geographically by point of withdrawal (POW) according to twelve defined subbasins. Those rights having a POW in the southeastern-most portion of WRIA 45 (i.e., the area Columbia River) are categorized as "Drainage to Columbia River." Qi converted from gallons per minute (gpm) to cubic feet per second (cfs) for ease of comparison with surface water rights.
(2) Some water rights have multiple purposes of use. For such rights in this analysis, the purpose listed first in the GWIS database was assumed to be the primary use. For example, if "Irrigation" an listed in this order as purposes of use for a given right, then that right is classified as an Irrigation water right in this table.
(3) Obtained from Ecology's website. Data current as of September 5, 2002.

### *2.4.3 Summary of All Water Rights in WRIA 45*

Table 2.4-3 provides a summary of all surface and ground water rights in WRIA 45. In total, there are 924 permits and certificates, 1,695 claims, and 134 applications for new water rights. The Lower Wenatchee sub-basin has the highest number of water right records (259 permits/certificates, 619 claims, and 41 applications).

This analysis does not distinguish between "primary" and "supplemental" water rights, as such information is not provided in GWIS. A primary right can stand alone; but a supplemental right is always associated with a primary right. The supplemental right can only be used to the extent that the primary right cannot be exercised. As an example, in a dry year, a stream, which is a primary right, may not be available, but the right-holder can pump a well with a supplemental right to replace that water. Because of this relationship, supplemental rights are not additive to primary rights. Therefore, the totals provided in Tables 2-18 through 2-19 may overstate the amount of water appropriated for use under "normal" conditions. Some rights may only be exercised under certain conditions. These totals should be considered as an upper bound, or maximum, to the amount of water appropriated throughout the watershed.

## 2.5 ALLOCATION OF NEW WATER RIGHTS

The previous section described the applications for surface and ground water withdrawal permits. There are 81 surface water applications requesting a total of 43 cfs. The Peshastin sub-basin (18.8 cfs) has the largest quantity of surface water applied for. Ten cfs of that quantity is for a non-consumptive use while the other uses are for domestic use and highway use. That sub-basin is closed by Chapter 173-545 for further withdrawals from June 15 to October 15 so most of those applications would not likely be approved. The Lake Wenatchee sub-basin has the second highest quantity applied for (15.6 cfs). Most all of those applications are for domestic use. The Lower Wenatchee sub-basin has applications for 6.3 cfs; 5.4 cfs is for the City of Cashmere and the remainder mostly for domestic use. All of the surface water applications, if approved, would be subject to interruption when instream flows set forth in Chapter 173-545 are not met unless exempted by Ecology because of an overriding public interest. In some cases Ecology will write permits for domestic use with conditions that only indoor uses and limited outdoor uses are allowed during periods when instream flows are not being met. In the case of municipal uses, permits are usually written accounting for return flow from a wastewater treatment plant along with some mitigation for reduced streamflow.

There are 53 ground water applications requesting 10.9 cfs. The largest requested uses are in the Chumstick sub-basin (6.7 cfs) and the Lake Wenatchee sub-basin (2.8 cfs). The Chumstick applications are primarily for irrigation while the largest requested use in the Lake Wenatchee sub-basin is for fisheries, which is a non-consumptive use. The Lower Wenatchee sub-basin has the greatest number of applications (25) but many of them did not have quantities listed in the database. Therefore the requested quantity (0.9 cfs) is likely low. Most of the applications in that sub-basin are for domestic use. The total estimated quantity of ground water applications for domestic use is about 1 cfs while the estimated quantity of ground water applications for irrigation use is about 8 cfs.

**Table 2.4-3**
**Surface and Ground Water Rights, By Subbasin [1]**
**Wenatchee River Watershed (WRIA 45)**

| | | White | Chiwawa | Little Wenatchee | Lake Wenatchee | Nason | Chiwaukum | Upper Wenatchee | Chumstick | Icicle | Lower Wenatchee | Peshastin | Mission |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Permits and Certificates*** | | | | | | | | | | | | | |
| Purpose of Use | | | | | | | | | | | | | |
| Domestic | # of Records | 5 | 6 | 1 | 154 | 20 | 2 | 16 | 89 | 7 | 71 | 13 | 14 |
| | Qa (AF/yr) | 4 | 371 | 0 | 387 | 142 | 1 | 86 | 241 | 11 | 824 | 292 | 176 |
| | Qi (cfs) | 0.1 | 3.7 | 0.1 | 6.8 | 1.0 | 0.1 | 0.8 | 2.6 | 0.1 | 3.2 | 1.0 | 0.8 |
| Irrigation | # of Records | 4 | 6 | | 17 | 16 | 2 | 14 | 103 | 30 | 167 | 6 | 67 |
| | Qa (AF/yr) | 150 | 4,819 | | 161 | 893 | 9 | 218 | 2,423 | 29,391 | 5,317 | 129 | 1,587 |
| | Qi (cfs) | 1.6 | 34.3 | | 1.1 | 3.6 | 0.4 | 3.1 | 17.4 | 261.4 | 258.1 | 4.6 | 8.8 |
| Municipal | # of Records | | | | | | | | 2 | 3 | 10 | | 4 |
| | Qa (AF/yr) | | | | | | | | 2,000 | 636 | 4,137 | | 1,227 |
| | Qi (cfs) | | | | | | | | 6.7 | 6.2 | 6.9 | | 3.1 |
| Fish Propagation | # of Records | | 2 | | | | | | 1 | 3 | 3 | | |
| | Qa (AF/yr) | | 13,000 | | | | | | 0 | 6,377 | 4,812 | | |
| | Qi (cfs) | | 33.0 | | | | | | 0.5 | 53.4 | 37.5 | | |
| Comm./Ind. | # of Records | | | | | | | | | | 5 | | 2 |
| | Qa (AF/yr) | | | | | | | | | | 883 | | 70 |
| | Qi (cfs) | | | | | | | | | | 3.5 | | 0.9 |
| Other | # of Records | 2 | 3 | 2 | 1 | 6 | 1 | 2 | 2 | 1 | 3 | 1 | |
| | Qa (AF/yr) | 0 | 45 | 4 | 6 | 13 | 0 | 516 | 6 | 1 | 18 | 0 | |
| | Qi (cfs) | 1.3 | 33.0 | 1.0 | 0.1 | 4.3 | 0.2 | 0.7 | 0.0 | 3.0 | 2.3 | 1.3 | |
| Subtotal, Permits & Certificates | # of Records | 11 | 17 | 3 | 172 | 42 | 5 | 32 | 197 | 44 | 259 | 20 | 87 |
| | Qa (AF/yr) | 153 | 18,235 | 4 | 554 | 1,047 | 10 | 820 | 4,670 | 36,417 | 15,991 | 420 | 3,061 |
| | Qi (cfs) | 2.9 | 104.0 | 1.1 | 8.0 | 8.9 | 0.7 | 4.6 | 27.2 | 324.1 | 311.3 | 6.8 | 13.6 |
| | Acres Irrigated | 72 | 1,442 | 0 | 59 | 486 | 18 | 162 | 892 | 14,961 | 14,326 | 22 | 497 |
| ***Claims*** | # of Records | 8 | 32 | | 147 | 62 | 6 | 118 | 31 | 44 | 619 | 110 | 447 |
| | Qa (AF/yr) | 394 | 4,884 | | 427 | 1,149 | 50 | 409 | 452 | 1,840 | 9,406 | 7,712 | 8,680 |
| | Qi (cfs) | 24.4 | 34.1 | | 3.7 | 7.6 | 0.1 | 5.9 | 3.9 | 11.7 | 176.4 | 63.7 | 77.8 |
| | Acres Irrigated | 172 | 1,531 | | 31 | 309 | 24 | 61 | 124 | 496 | 6,735 | 4,133 | 1,348 |
| ***Applications*** | # of Records | 2 | 4 | | 36 | 3 | | 4 | 14 | 6 | 41 | 9 | 5 |
| | Qi (cfs) | 0.1 | 0.1 | | 18.4 | 1.1 | | 0.0 | 6.7 | 1.0 | 7.2 | 18.8 | 0.1 |

Notes:
Qa = Annual Quantity; Qi = Instantaneous Quantity; AF/yr = acre-feet per year; cfs = cubic feet per second
(1) Total of Surface Water Rights (see Table 5-1) and Ground Water Rights (see Table 5-2).

Section 2.1.1 presented an estimate of future municipal and domestic water needs. The estimated peak daily needs are forecast to increase by 7.3 cfs. Those demands are based upon population forecasts and are less than the total of surface and ground water applications pending. The forecast peak daily demands are also averaged over a peak day. The quantity of water requested on applications is typically higher than the peak daily demand as pumping equipment is sized larger to provide a factor of safety during operation and to ensure the pumping equipment does not have to operate all day to meet demands.

The effect on streamflow for surface water applications with consumptive uses and no immediate return flow will be a direct reduction in flow. Those types of uses with no immediate return flow are domestic multiple which typically have septic tank drainfields to dispose of indoor water used. A typical return flow factor (for water use discharged through drainfields from indoor water use) is 50%. The peaking factor (maximum/average daily demands) for domestic use is estimated to be 2.5 (Section 2.1.1) during the summertime. During summer, only about one-third of the water diverted may return to groundwater (counting both drainfields and return flow from outdoor irrigation). As described in Section 2.3 there is a delay between seepage into ground water and its return to surface water. That delay depends on the subsurface geology and the proximity of the seepage to a surface water body.

The effect on surface water from greater ground water extraction will vary depending on the aquifer properties and proximity to surface water. The effect cannot be stated with certainty because each well location will have a different effect on surface water. However it appears that most of the larger ground water applications are located in alluvial aquifers that are in continuity with surface water bodies such as the Wenatchee River. Those applications, if approved, would likely be subject to interruption when instream flows are not met. The return flow factor described in the previous paragraph would also apply for ground water use.

Of the total future municipal and domestic water use, approximately one-third may return to a surface water body, leaving two-thirds as a direct reduction in streamflow. That reduction is estimated to be about 5 cfs. That effect may be reduced if restrictions on water use are applied to the surface and ground water permits to minimize effects on streamflow during the periods instream flows are not met.

If the applications for irrigation use are approved, an increase in use of about 8 cfs would occur. Most of those permits, if approved, would likely be subject to interruption when instream flows are not met. The maximum effect on streamflow would be the consumptive use, which would be about 5.6 cfs for those applications.

## 2.6 SUMMARY OF WATER NEEDS

A review of potential population growth and growth in municipal, domestic, industrial and agricultural water use was made. From the perspective of population growth and growth in forecasted municipal demands, the estimated increase in water demands over the next 20 years is 7.3 cfs on a peak basis and 1,868 acre-feet annually. No growth in self-supplied industrial and commercial water use is forecast unless additional water is made available that would not be subject to interruption from low streamflow levels and minimum instream flows set by Chapter 173-545 WAC. A review of agricultural water use was made and an estimate of 68,000 acre-feet of consumptive use (either water consumptively used by crops or exported outside the Wenatchee River Watershed) made. The area of irrigated agriculture appears to be stable and not declining. There is a substantial area of land that is currently zoned for

residential use that can be converted from agricultural use. However our experience with conversion from agricultural to urban use is that although annual water use may decline, peak water use may not change. The peak water demands are important as they have the most immediate effect on streamflow.

A review of water right applications was made to compare to the predicted future water demands. The current applications are requesting 43 cfs from surface water and 10.9 cfs from ground water. The type of use requested on the applications are primarily municipal and domestic for surface water and irrigation for ground water. Most of the applications, if approved, would be subject to minimum instream flows and therefore interruptible during low streamflow periods. Some of the applications, such as those contained in the Peshastin Creek basin, would not likely be approved as the basin is closed from June 15 to October 15. The difference between the forecast future water needs and the quantity applied for is large and mostly due to applications for irrigation. It appears those applications are primarily for landscape or lawn irrigation and not commercial agriculture. It was estimated the increase in irrigation demand from approval of those applications to be 8 cfs; the estimated effect on streamflow is a reduction of 5.6 cfs. The estimated increase in municipal and domestic demand is 7.3 cfs and the estimated effect on streamflow is a reduction of about 5 cfs.

The estimated effect on streamflow from future municipal and domestic demand and from approval of pending water right applications for irrigation is a reduction of about 10.6 cfs.

## 2.7 USE OF STORED WATER

The water stored in Lake Wenatchee could be used for several purposes; those being instream flow augmentation, supply to future surface water users in the Wenatchee River Basin Watershed or as mitigation for future groundwater use either in the aquifers supplying the Wenatchee River or in tributaries to the Wenatchee River. Section 3 describes the volume of water that is potentially available from implementation of this project and the time frame during which the water could be discharged from the project to meet future water needs.