6.0 Water Rights and Water Use

This section provides a summary of water rights and water usage in WRIA 45.

6.1 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. Additional discussion regarding actual water uses (as distinct from water rights) is presented in Section 6.2.

6.1.1 Data Sources and Terminology Associated with Water Rights

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 over 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 (AF/yr). 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.

6.1.2 Surface Water Rights Summary

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

Surface Water Permits and Certificates

Table 6-1 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 subbasin (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 WRIA 45 is 73,099 AF/yr, while the total instantaneous quantity of appropriated surface water is 811 cfs. The instantaneous quantity includes supplemental water rights[2]; 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 category having the greatest watershed-wide instantaneous quantity is irrigation. Approximately 567 cfs (70%) is appropriated for the irrigation of more than 30,000 acres. Icicle Creek is the subbasin with the largest irrigation instantaneous quantity (261 cfs) and annual quantity (29,286 AF/yr). These totals include supplemental rights.

Other purpose of use categories 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 AF/yr) 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 subbasin. Another 40% is associated with rights in three subbasins: Chiwawa, Chumstick, and Lower Wenatchee. Together, the Icicle and Lower Wenatchee subbasins account for 75% of the total instantaneous quantity appropriated within the watershed.

Surface Water Claims

Similar to permits and certificates, surface water claims in WRIA 45 are organized in Table 6-1 according to subbasin. In the Wenatchee Watershed there are a total of 709 surface water claims. The total annual quantity associated with surface water claims for WRIA 45 is 22,204 AF/yr, while the total instantaneous quantity of

[2] See Section 6.1.4 for a discussion of primary versus supplemental water rights.

surface water claims is 307 cfs. Lower Wenatchee is the subbasin with the largest instantaneous quantity (134 cfs). The Peshastin subbasin has the largest annual quantity (7,319 AF/yr).

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 subbasin has the highest number of applications (30), while the Peshastin subbasin 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.

Reservoir (Storage) Rights

Table 6-1 excludes water rights associated with surface water bodies that are for storage purposes. Such rights are referred to as Reservoir Rights and typically have large values of annual quantities related to amounts of water appropriated for storage. These rights do not have instantaneous quantities. In the Wenatchee Watershed, there are four reservoir permits and certificates, having a combined total annual quantity of 19,000 AF/yr.

Unauthorized Uses of Surface Water

Outside the legal, appropriated use of surface water, there is a potential for unauthorized diversions to occur. Any use of surface water that is occurring and is not at least the subject of a claim could be considered to be an unauthorized use of surface water. Unlike the ground water code, there are no exemptions in the surface water code for even minimal uses of surface water. This means that every diversion of surface water must be substantiated by a water right (or claim) in order to be considered a legal use of surface water. Unfortunately, this is not always the case and history would reflect a certain amount of unauthorized diversions within any watershed. Moreover, it is nearly impossible to ascertain the exact amount of surface water that is actually being diverted and applied either beneficially or otherwise.

Consequently, there is no means for effectively tracking the potential unauthorized uses of surface water. Therefore, estimates for such quantities are not available for the Wenatchee Watershed. Moreover, getting such information in the future may be difficult and may or may not be associated with substantial quantities of water. Hence, in establishing a need for further refining such estimates, an examination may have to be made with regards to the benefits achieved in resolving these numbers versus the costs of obtaining the necessary information.

Table 6-1
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	Drainage to Col. R.	TOTAL
Permits and Certificates															
Purpose of Use [2]															
Domestic	# of Records	5	4	1	149	13	1	8	15	6	35	11	3	4	255
	Qa (AF/yr)	4	331	0	263	26	0	6	46	10	66	136	4	5	895
	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	0.1	12.7
Irrigation [6]	# of Records	2	5		15	11	1	10	49	23	92	6	18	7	239
	Qa (AF/yr)	11	4,775		139	587	0	150	1,291	29,286	2,314	129	219	246	39,145
	Qi (cfs)	0.6	34.2		1.0	2.4	0.3	2.9	12.4	260.9	243.5	4.6	3.0	1.3	567.0
Municipal	# of Records									3	7			1	11
	Qa (AF/yr)									636	3,584			7,393	11,613
	Qi (cfs)									6.2	5.4			17.7	29.3
Fish Propagation	# of Records		2						1	1	3				7
	Qa (AF/yr)		13,000						0	0	4,812				17,812
	Qi (cfs)		33.0						0.5	42.0	37.5				113.0
Comm./Ind.	# of Records										1		1	7	9
	Qa (AF/yr)										0		0	3,425	3,425
	Qi (cfs)										2.0		0.8	39.8	42.6
Other	# of Records	2	3	2	1	5	1		2	1	3	1		2	23
	Qa (AF/yr)	0	45	4	6	5	0		6	1	18	0		125	209
	Qi (cfs)	1.3	33.0	1.0	0.1	4.1	0.2		0.0	3.0	2.3	1.3		0.7	46.9
Subtotal, Permits & Certificates	# of Records	9	14	3	165	29	3	18	67	34	141	18	22	21	544
	Qa (AF/yr)	14	18,150	4	407	617	0	156	1,342	29,933	10,794	264	223	11,194	73,099
	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	59.6	811.4
	Acres Irrigated	32	1,432		50	241	14	145	440	14,926	13,568	22	117	72	31,058
Claims	# of Records	7	18		99	39	4	60	16	25	228	51	135	27	709
	Qa (AF/yr)	393	4,734		288	941	46	176	336	4	3,171	7,319	3,495	1,303	22,204
	Qi (cfs)	24.4	33.2		2.8	4.6	0.0	1.5	2.5	0.1	134.1	53.1	46.2	4.5	307.0
	Acres Irrigated	172	1,501		29	287	13	7	106	427	5,671	4,103	392	150	12,858
Applications [3]	# of Records	1	4		30	3		2	5	6	16	9	2	3	81
	Qi (cfs)	0.1	0.1		15.6	1.1		0.0	0.0	1.0	6.3	18.8	0.0	0.0	43.0

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 this analysis is August 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 draining to the Columbia 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 "Domestic-Single" are 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 known that this is the 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 shown as 243.5 cfs but Irrigation Qa is only listed as 2,314 AF/yr).

6.1.3 Ground Water Rights Summary

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

Ground Water Permits and Certificates

Table 6-2 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 subbasin (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 for WRIA 45 is 23,277 AF/yr, 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 subbasin with the largest irrigation instantaneous quantity (14.5 cfs) and the largest irrigation annual quantity (3,003 AF/yr).

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 AF/yr) 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 subbasins: Chumstick, Icicle, and Lower Wenatchee. These same three subbasins also account for 62% of the total ground water instantaneous quantity appropriated throughout the watershed.

Ground Water Claims

Similar to permits and certificates, ground water claims in WRIA 45 are organized in Table 6-2 according to subbasin. 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 23,729 AF/yr, while the total instantaneous quantity of ground water claims is 131 cfs. Lower Wenatchee is the subbasin with the largest instantaneous quantity (42.3 cfs), while the subbasin referred to as Drainage to the Columbia River has the greatest annual quantity (9,225 AF/yr). The Mission subbasin also has many claims (31.6 cfs on an instantaneous basis and 5,185 AF/yr on an annual basis).

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 subbasin has the highest number of applications (25), while the Lake Wenatchee subbasin has the largest total instantaneous quantity (2.8 cfs).

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 6.2.

Unauthorized Uses of Ground Water

Like surface water, there is a potential for unauthorized use of ground water. There are several ways that such withdrawals may be occurring, including:

- Simple use without a valid permit from the State (i.e., for uses that the law requires to have a permit);
- Use from a so-called exempt well that exceeds the conditions of that exemption (e.g., using more than 5,000 gallons per day for domestic purposes; watering a commercial garden; etc.)
- Use in violation of the conditions of a standing permit (e.g., use beyond what the original permit allows either with regards to point of diversion, place of use, or beneficial use).

In the Wenatchee Watershed, the quantity of ground water used without authorization is not known. Such an estimate may require substantial resources both in terms of time and potential fieldwork. Determination of this quantity may require either direct or indirect measurement of the quantities of water actually being used at specific locations, with comparisons being made with individual rights and/or the conditions associated with exempt wells.

Table 6-2
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	Drainage to Col. R.	TOTAL
Permits and Certificates															
Purpose of Use [2]															
Domestic	# of Records		2		5	7	1	8	74	1	36	2	11	2	149
	Qa (AF/yr)		40		124	116	1	80	196	1	758	156	172	1,417	3,061
	Qi (cfs)		0.2		0.4	0.8	0.1	0.5	2.0	0.0	2.5	0.5	0.7	4.5	12.0
Irrigation	# of Records	2	1		2	5	1	4	54	7	75		49	7	207
	Qa (AF/yr)	139	45		23	306	9	68	1,132	106	3,003		1,368	374	6,572
	Qi (cfs)	1.0	0.2		0.1	1.1	0.1	0.3	5.0	0.4	14.5		5.8	1.8	30.3
Municipal	# of Records								2		3	1	4		10
	Qa (AF/yr)								2,000		553	75	1,227		3,855
	Qi (cfs)								6.7		1.5	0.2	3.1		11.5
Fish Propagation	# of Records									2					2
	Qa (AF/yr)									6,377					6,377
	Qi (cfs)									11.4					11.4
Comm./Ind.	# of Records										4		1	5	10
	Qa (AF/yr)										883		70	1,936	2,889
	Qi (cfs)										1.5		0.1	6.0	7.6
Other	# of Records					1		2							3
	Qa (AF/yr)					8		516							524
	Qi (cfs)					0.2		0.7							0.9
Subtotal, Permits & Certificates	# of Records	2	3	0	7	13	2	14	130	10	118	3	65	14	381
	Qa (AF/yr)	139	85	0	147	430	10	664	3,328	6,484	5,197	231	2,837	3,726	23,277
	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	12.3	73.6
	Acres Irrigated	40	10		9	245	4	17	453	35	758		380	99	2,049
Claims	# of Records	1	14		48	23	2	58	15	19	391	59	312	44	986
	Qa (AF/yr)	1	150		140	209	4	234	116	1,836	6,235	394	5,185	9,226	23,729
	Qi (cfs)	0.0	0.9		0.9	3.0	0.0	4.3	1.4	11.7	42.3	10.6	31.6	24.2	131.0
	Acres Irrigated	0	30		2	23	11	54	18	69	1,064	30	956	249	2,505
Applications [3]	# of Records	1			6			2	9		25		3	7	53
	Qi (cfs)	0.0			2.8			0.0	6.7		0.9		0.1	0.4	10.9

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 this analysis is August 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 draining to the 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" and "Domestic-Single" are 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.

6.1.4 Summary of All Water Rights in WRIA 45

Table 6-3 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 subbasin 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 6-1 through 6-3 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.

Map 8 illustrates the distribution of water right permits and certificates in WRIA 45. Map 9 illustrates the distribution when water right claims are added to those totals.

Table 6-3
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	Drainage to Col. R.	TOTAL
Permits and Certificates															
Purpose of Use															
Domestic	# of Records	5	6	1	154	20	2	16	89	7	71	13	14	6	404
	Qa (AF/yr)	4	371	0	387	142	1	86	241	11	824	292	176	1,422	3,956
	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	4.6	24.8
Irrigation	# of Records	4	6		17	16	2	14	103	30	167	6	67	14	446
	Qa (AF/yr)	150	4,819		161	893	9	218	2,423	29,391	5,317	129	1,587	619	45,717
	Qi (cfs)	1.6	34.3		1.1	3.6	0.4	3.1	17.4	261.4	258.1	4.6	8.8	3.0	597.2
Municipal	# of Records								2	3	10		4	1	20
	Qa (AF/yr)								2,000	636	4,137		1,227	7,393	15,393
	Qi (cfs)								6.7	6.2	6.9		3.1	17.7	40.6
Fish Propagation	# of Records		2						1	3	3			0	9
	Qa (AF/yr)		13,000						0	6,377	4,812			0	24,189
	Qi (cfs)		33.0						0.5	53.4	37.5			0.0	124.3
Comm./Ind.	# of Records										5		2	12	19
	Qa (AF/yr)										883		70	5,361	6,314
	Qi (cfs)										3.5		0.9	45.8	50.2
Other	# of Records	2	3	2	1	6	1	2	2	1	3	1		2	26
	Qa (AF/yr)	0	45	4	6	13	0	516	6	1	18	0		125	733
	Qi (cfs)	1.3	33.0	1.0	0.1	4.3	0.2	0.7	0.0	3.0	2.3	1.3		0.7	47.8
Subtotal, Permits & Certificates	# of Records	11	17	3	172	42	5	32	197	44	259	20	87	35	924
	Qa (AF/yr)	153	18,235	4	554	1,047	10	820	4,670	36,417	15,991	420	3,061	14,920	96,301
	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	71.8	884.9
	Acres Irrigated	72	1,442	0	59	486	18	162	892	14,961	14,326	22	497	171	33,107
Claims	# of Records	8	32		147	62	6	118	31	44	619	110	447	71	1,695
	Qa (AF/yr)	394	4,884		427	1,149	50	409	452	1,840	9,406	7,712	8,680	10,529	45,933
	Qi (cfs)	24.4	34.1		3.7	7.6	0.1	5.9	3.9	11.7	176.4	63.7	77.8	28.7	438.0
	Acres Irrigated	172	1,531		31	309	24	61	124	496	6,735	4,133	1,348	400	15,363
Applications	# of Records	2	4		36	3		4	14	6	41	9	5	10	134
	Qi (cfs)	0.1	0.1		18.4	1.1		0.0	6.7	1.0	7.2	18.8	0.1	0.4	53.9

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 6-1) and Ground Water Rights (see Table 6-2).

6.2 Water Use Estimates

This section provides an estimate of actual current water usage for various types of water use in WRIA 45. Having been performed on an assessment level, this summary is limited to compilation and review of readily available, existing information.

6.2.1 Municipal and Domestic Uses

This section addresses water provided by public water systems and individual household wells. 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 primarily obtained via individual household wells, although a small subset of the population may obtain water via individual surface water diversions (e.g., some property owners in the Lake Wenatchee area). For the purposes of estimating water usage in this analysis, however, all such surface water users are assumed to be utilizing groundwater wells. This approach is taken because the number of individual surface water users is unknown and the amount of usage is likely similar to that of individual well users. Therefore, the entire population not served by public water systems is categorized as individual household well users.

As noted in Section 5.1.3, 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 6-4 presents the estimate of population and the number of connections or equivalent residential units[3] (ERUs) served by the various categories of water supply and delivery for Year 2002. Also provided are estimates of average day and maximum day demands. 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.

[3] 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 6-4
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 (average 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 of 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 production). 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 by 2.6 (average number of persons per household in Chelan County, as obtained from Census 2000 data). ADD calculated as number of connections times 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 by lot 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 45).
(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.

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 WRIA 45. 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 WRIA 45: the Wenatchee, Cashmere, and Leavenworth-Lake Wenatchee CCDs. Map 7 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 WRIA 45 is estimated to be 53,181.

2. Estimates of the portion of WRIA 45 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.

Estimate of Year 2002 Municipal and Domestic Water Use

Table 6-4 summarizes the estimate of 2002 municipal and domestic water use throughout WRIA 45. 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 6-4:

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 (AF/yr). 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 6-4 for population estimation purposes, no water use information is provided, since these two purveyors share a regional source of supply located outside of WRIA 45 (the Rocky Reach Dam Aquifer).

3. Estimates of water use for the other systems listed individually in Table 6-4, 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.

6. Also provided in Table 6-4 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 AF/yr.

The Cashmere CCD contains the highest water use, at 2,170 AF/yr 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 Leavenwoth, 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 AF/yr is produced from within the watershed, the majority of which is associated with exempt wells.

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

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 6-5.

Table 6-5
Forecasted Population Growth in Chelan County

Projection	Year			
	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.

The projected 2025 population within each County Census Division was obtained from Chelan County Planning and is summarized in Table ~~6~~6 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 6-6
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 CCDs located in Wenatchee River Watershed	51,404	53,180	79,606

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 6-7 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 6-7
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)
Wenat-chee 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
Leaven-worth 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**

6.2.2 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, as summarized in Section 6.1. This approach, therefore, does not identify the actual water usage 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 GWIS data. 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 6-8 summarizes the water usage associated with self-supplied commercial/industrial users. The points of withdrawal and diversion of all WRIA 45 commercial/industrial water right holders listed in Table 6-8 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, water is used by fruit grower associations and packers for non-consumptive purposes such as fruit washing, process transport, and water-cooled refrigeration. In total, the amount of ground water estimated to be used for self-supplied commercial/industrial purposes is 933 AF/yr.

Not included in Table 6-8 are industries around the City of Wenatchee, which obtain surface water from the Columbia River and ground water from outside of any of the subbasins described in Section 6.4.1. 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 6-8
Estimate of Current Self-Supplied Commercial/Industrial Water Use

	2002 Water Use (1)				
	Annual Water Use (AF/yr), 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:
CCD = Census County Division; ADD = Average Day Demand; MDD = Maximum Day Demand
mgd = million gallons per day; cfs = cubic feet per second; AF/yr = acre-feet per year

(1) Based on water right information presented in Section 6.1.
(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).

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.

6.2.3 Irrigation Water Use

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

Records of Water Diverted for Irrigation Use

Tables 6-1 through 6-3 summarize 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 study area 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 districts 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 6-9 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 6-1 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 small irrigation water users in the Wenatchee River Watershed.

Table 6-9
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 Diversion		**51,000**

Data from the Icicle and Peshastin Irrigation Districts is summarized in Table 6-10. 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.

Table 6-10
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**

The total diversion by the Wenatchee Reclamation District and the Icicle and Peshastin Irrigation District is estimated to be approximately 96,000 acre-feet per year, based upon the limited data available. 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.

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 6-11. 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 6-11; Leavenworth and Wenatchee. The CIR for Leavenworth is a fair representation of the upper subbasins while the CIR for Wenatchee represents the three lower subbasins; Lower Wenatchee, Mission and Peshastin. 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.

Table 6-11
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	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**

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 6-12.

Table 6-12
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
Corrugations	60
Subirrigation - Water Table Control	65
Subirrigation - Trickle	70
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

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%.

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.

Irrigation water users may also require additional water to make up for conveyance losses in irrigation canals or ditches that are used to convey water from the point of diversion to the farm. 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%. The only data on efficiency found in the Wenatchee Watershed was from the *Icicle Irrigation District Comprehensive Water Conservation Plan* (Klohn Leonoff, 1993a) and the *Peshastin Irrigation District Comprehensive Water Conservation Plan* (Klohn Leonoff, 1993b). Those reports indicate conveyance losses averaging 10-15%.

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 for 1992 (NLCD) (USGS, http://landcover.usgs.gov/natllandcover). The analysis was performed for each subbasin. Table 6-13 shows the estimated area of irrigated land types in each subbasin and the entire Wenatchee River Basin. Five subbasins, 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 6.2.1 Municipal and Domestic Use. If an irrigation district or company serves them, that consumptive use of water is not accounted for in this analysis. Other uncertainties and discrepancies in the data exist such as the classification of orchard land in the Chiwawa and Upper Wenatchee subbasins. It was reported by water users (pers. comm. with Dennis Pobst) that the area of orchard shown does not reflect actual conditions. The difference is likely due to the resolution of the data and uncertainties in typing land cover. 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.

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 6-14 shows the estimated irrigation water demand for each subbasin 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

Table 6-13

Estimate of 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	38
Potentially Irrigated Land	**142**	**598**	**810**	**302**	**664**	**1,807**	**8,513**	**12,836**

Note: Data obtained from National Land Cover Data set. Potential limitations of the dataset include not distinguishing between urban land covers with irrigated area and urban land covers without irrigated area. Limitation underestimates irrigated area. Other uncertainties and discrepancies in the data exist such as the classification of orchard land in the Chiwawa and Upper Wenatchee subbasins. The data likely overestimates those areas.

Table 6-14
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**

Note: Estimated demands based upon land cover data set from Table 6-13. Limitations and uncertainties described in Table6-13 also apply to the estimated irrigation demands.

aquifers and may be a source of water supply for groundwater users or may return to surface water via a stream or wetland.

Additional quantities of water are diverted from the Wenatchee River for use outside of the watershed. The Wenatchee Reclamation District delivers water to 12,500 acres; approximately 8,114 acres are located outside of the Wenatchee Watershed and water delivered to them would not return to the Wenatchee River. It is assumed that the diversion of flow for those water users represents a consumptive use to the Wenatchee River. The estimated consumptive use for those users is estimated by pro-rating that acreage to the quantity of flow diverted (51,000 acre-feet in 2002). The estimated consumptive use is 33,000 acre-feet (8,114/12,500 * 51,000). The consumptive use for remainder of the District that lies within the Wenatchee Watershed is covered by the estimate contained in Table 6-14.

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 6-15 presents a comparison of fruit acreage in the Wenatchee FRD since 1982.

Table 6-15
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)
Wenatchee Fruit Reporting District includes Chelan, Douglas and Okanogan Counties

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 6-16.

Table 6-16
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. Map 10 presents that analysis. The WSDA data estimates the area of orchard in the Wenatchee Watershed at 16,169 acres. The WSDA mapping did not include irrigated areas beyond crops, such as parks and landscaping. Although there are differences between the 1992 NLCD and the 2002 WSDA mapping, a comparison of those 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 6-17
Crop Acreage within Wenatchee River Watershed (2002)

Crop Type	Chumstick (ac)	Lower Wenatchee (ac)	Mission (ac)	Peshastin (ac)	Totals (ac)
Alfalfa	---	24	16	---	40
Apples	358	740	---	---	1,098
Cherries	---	575	---	---	575
Christmas Trees	---		22	---	22
Peaches	---	147	---	---	147
Pears	37	10,437	2,655	1,220	14,349

Source: WSDA, 2003

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 6-18 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 – 6,000 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 (6.1) 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 subbasin 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 streamflow is less than regulatory minimum flow. Most agricultural enterprises such as orchards cannot economically operate with interruptible supplies unless an alternate source is available (through a lease or temporary transfer of water). Landscape irrigation can withstand interruption without significant economic losses.

Table 6-18
Estimates of Land Area and Zoning within Wenatchee River Watershed
Area within each Subbasin (acres)

Land Use Classfication	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 and 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
Urban Residential 3	0	0	0	0	0	0	2	0	0	0	0	0	2
Total Urban Residential	0	0	0	0	0	0	10	0	0	0	0	0	10
Pedestrian Oriented Commercial	0	0	0	0	0	0	0	0	0	0	0	0	0
Peshastin Village Commercial	0	0	0	0	0	0	2	0	0	0	0	0	2
General Commercial	0	0	0	0	0	0	5	0	0	0	0	0	5
Tourist Commercial	0	0	0	0	0	0	0	0	0	0	0	0	0
Industrial	0	0	0	0	0	0	4	0	0	0	0	0	4
Commercial Mineral	31	0	0	0	0	0	0	0	0	181	0	30	241
Urban Waterfront Residential	0	0	0	0	0	0	0	0	0	0	0	0	0
Indian Allotment Land	0	0	0	0	0	0	0	0	0	0	0	0	0
City Urban Growth Area	0	0	1,315	0	0	0	667	668	0	0	19	0	2,669
Open Water	8	73	95	120	2,984	1	438	0	7	0	438	159	4,325
Totals	32,092	127,518	52,969	137,325	16,321	64,963	68,311	59,794	69,252	86,369	36,509	100,104	851,527

6.2.4 Other Water Use

Aside from municipal, domestic, self-supplied commercial/industrial, and irrigation uses, water is used for other purposes throughout WRIA 45. Such other uses of surface water include fish propagation, recreation, power generation, frost protection, and fire suppression. The majority of water rights associated with these uses are for fish propagation, recreation, and power generation, all of which are non-consumptive, meaning that water is returned to the surface water body within a short distance of where it is diverted. The quantity of water rights associated with frost protection and fire suppression is minimal. Other uses of ground water in the watershed include highway maintenance and fire protection. The quantities associated with the water rights for these uses are small and are likely not fully utilized.

6.2.5 Total Water Use in WRIA 45

Total Municipal/Domestic and Self-Supplied Commercial/Industrial Water Use

Table 6-19 presents a summary of all municipal/domestic and self-supplied commercial/industrial water use in WRIA 45. Also presented is an estimate of consumptive water use.

Consumptive water use is that portion of total water usage that is actually consumed, and not returned to a receiving body. Little data is available to determine the consumptive percentage of total water use. For the purposes of this analysis, the following assumptions are used:

- A range of 25-45% is used to characterize the consumptive portion of municipal, domestic, and self-supplied commercial/industrial use. In other watersheds throughout the state, typical consumption percentages are on the order of 25%. This is based on evaluation of wastewater flow data in comparison with water production data for municipalities. In most cases, approximately 75% of all water withdrawn or diverted is returned to a receiving body (via a wastewater treatment plant or septic drain fields). However, data from the Cities of Cashmere and Leavenworth indicate that consumptive use is approximately 45-60%. Therefore, for the purposes of estimating consumptive use, a range of percentages is used to approximate upper and lower bounds of consumptive use, based upon a combination of the local and statewide data.

- All other water use is assumed to be non-consumptive, as it is composed primarily of fish propagation, recreation, and power generation, all of which involve the return of water to a receiving body.

In total, annual municipal/domestic and self-supplied commercial/industrial water use throughout WRIA 45 is on the order of 5,300 AF/yr, with 25-45 percent (1,340 - 2,400 AF/yr) being consumptively used. Total average day and maximum day usage is approximately 4.77 mgd (7.39 cfs) and 12.25 mgd (18.99 cfs), respectively.

Table 6-19
Estimate of Current Municipal/Domestic and Self-Supplied Commercial/Industrial Water Use – WRIA 45

	2002 Water Use				
	Annual Water Use (AF/yr), by Type of Source				
Census County Division	**ADD (mgd/cfs)**	**MDD (mgd/cfs)**	**Ground Water**	**Surface Water**	**Total**
Wenatchee CCD					
Municipal/Domestic	0.489/0.76	1.223/1.90	548	0	548
Commercial/Industrial	0/0	0/0	0	0	0
Wenatchee CCD Sub-Total	0.489/0.76	1.223/1.90	548	0	548
Wenatchee CCD Consumptive Use (1)	0.122-0.220/0.19-0.34	0.306-0.550/0.48-0.86	137-247	0	137-247
Cashmere CCD					
Municipal/Domestic	1.934/3.00	4.347/6.74	1,582	586	2,168
Commercial/Industrial	0.833/1.29	2.806/4.35	933	Unknown (2)	933
Cashmere CCD Sub-Total	2.767/4.29	7.153/11.09	2,515	586	3,101
Cashmere CCD Consumptive Use (1)	0.692-1.245/1.07-1.93	1.788-3.219/2.77-4.99	629-1,132	147-264	776-1,396
Leavenworth CCD					
Municipal/Domestic	1.510/2.34	3.876/6.01	926	767	1,693
Commercial/Industrial	0/0	0/0	0	0	0
Cashmere CCD Sub-Total	1.510/2.34	3.876/6.01	926	767	1,693
Cashmere CCD Consumptive Use (1)	0.378-0.680/0.59-1.05	0.969-1.744/1.50-2.70	232-417	192-345	424-762
WRIA 45 Total					
Municipal/Domestic	3.933/6.10	9.446/14.64	3,056	1,353	4,409
Commercial/Industrial	0.833/1.29	2.806/4.35	933	Unknown	933
WRIA 45 Total	4.766/7.39	12.252/18.99	3,989	1,353	5,342
WRIA 45 Total Consumptive Use (1)	1.192-2.145/1.85-3.33	3.063-5.513/4.75-8.55	997-1,795	339-609	1,336-2,404

Notes:
CCD = Census County Division; ADD = Average Day Demand; MDD = Maximum Day Demand
mgd = million gallons per day; cfs = cubic feet per second; AF/yr = acre-feet per year

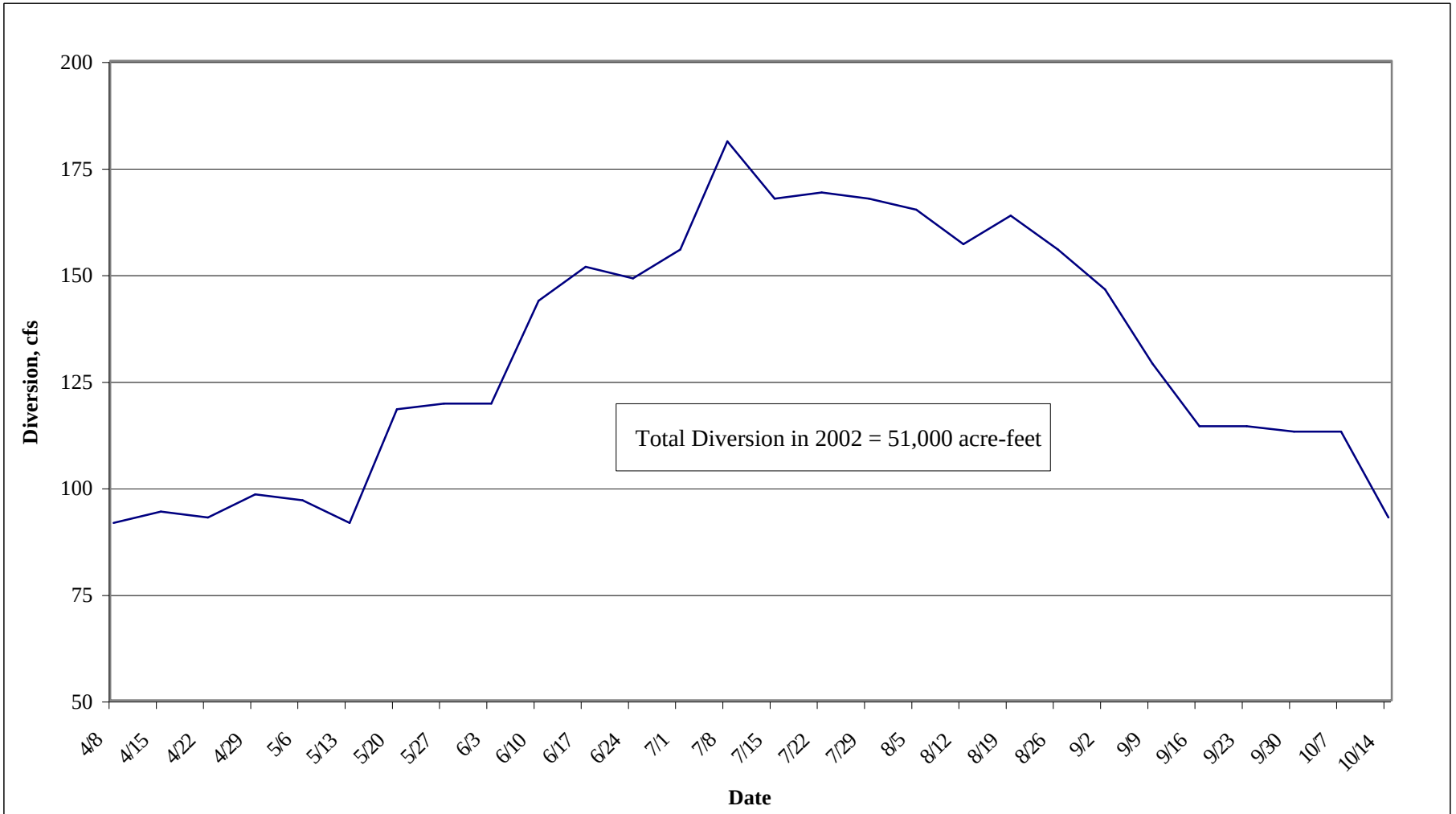
(1) Consumptive use is calculated as a range of 25-45% of total use.

(2) No annual quantities are associated with the two surface water commercial/industrial water rights.

Total Agricultural Use

The total estimated on-farm 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. That return is typically delayed by a month or so depending on its proximity to surface water and geological conditions and use by other water users.

Additional water is diverted out of the watershed for irrigation in the Cities of Wenatchee and East Wenatchee. That quantity is estimated to be about 33,000 acre-feet per year. The total out-of-stream consumptive use of water from the Wenatchee River Watershed is then estimated to be 68,000 acre-feet per year.



Data Provided by Wenatchee Reclamation District

Figure 6.1
Wenatchee Reclamation District
Diversions for 2002

Wenatchee River Basin Watershed Assessment

MONTGOMERY WATER GROUP, INC.