APPENDIX E

DOMESTIC AND EXEMPT WATER USE

Contents

Issue Paper:
The Ground Water (5000 GPD) Water Rights Exemption

1. Introduction And Background

1.1. Purpose and Scope

This issue paper examines the ground water (5,000 GPD) exemption to the Washington State water rights procedure. The goals of the paper include; provide background on exemptions to Washington State water rights permitting procedures; recognize the appropriate role of exempted domestic wells, as well as, the importance of protecting the water resources of the county and measures required to safeguard public health; provide appropriate recommendations if required.

1.2. Background

The small domestic well, which traditionally has served the water needs to a single household, is exempt from the water rights permit process as long as the amount of water extracted from the well is less than 5000 gallons per day (gpd) and less than 1/2 acre of lawn and/or non-commercial garden is irrigated. The right to the use of "domestic supplies of water" is well founded in the state laws of Washington and is common to numerous other western states.

Recently, a great deal of concern has been raised regarding a proliferation of exempt wells which are often perceived to be unregulated and a loophole in the Department of Ecology (Ecology) water rights process. Currently Ecology takes several years to approve a water right for a well withdrawing more than 5000 gpd. Conversely, wells which fall under the ground water exemption require no permit from Ecology and have been deemed sufficient by the Bremerton-Kitsap County Health Department(BKCHD) to serve up to 6 residences. Some concern also exists within both state and county health departments that small systems represent an inherent public health threat as well as an unnecessary administrative burden.

2. Current Laws, Policies And Procedures

As the history of water law for the State of Washington is fully discussed in the issue paper on water rights, this paper will not repeat the development of basic water law. This paper will focus on the specific aspects of the law as it regards the ground water exemption.

In **RCW 90.44.050**, the explicit exception of domestic wells from the water right permitting process is defined:

> "...Except, however, that any withdrawal of public ground water for stock-watering purposes, or for the watering of a lawn or of a non-commercial garden not exceeding one-half acre, or for single or group domestic uses in an amount not exceeding five thousand gallons a day, or for an industrial purpose in an amount not

exceeding five thousand gallons a day is and shall be exempt from the provisions of this section...."

Ecology can control the proliferation of new exempt wells under existing statutory authorities where it is warranted by resource conditions (see chapter 173-548 WAC, Water Resources Program in the Methow River Basin, WRIA 48).

The ground water exemption is well founded in state law. Any recommendations for administration or regulation of these wells should carefully consider the long standing basis for the exemption.

Exempt wells can be regulated within the existing law when it is shown that their use will adversely impact a senior right holder.

Under RCW 19.27.097 (the Growth Management Act of 1990), as amended, the counties and/or cities have increased authority to control development based on water availability. They can impose conditions on building permits, requiring connection to an existing public water system, where appropriate. They can deny building permits in areas where there is not an adequate water supply available.

3. Purpose Of The Ground Water Exemption

The following points are critical considerations for exempting small wells from the permit process. They serve as the basis for developing the subsequent recommendations.

Rights of Ownership It can be argued that the Ground Water exemption can be derived from the tenet that a basic subsistence amount of water is implicit in the ownership of the land surface.

Impact on the Hydrologic System The amount of water actually extracted by exempt wells in Kitsap County is a small portion of the ground water resource. Domestic wells are generally located in sparsely populated areas where public water supplies are presently not available. The extraction of small amounts of water over a broad area result in minimal impact upon the regional ground water system. The few exceptions can be handled on an individual basis without modifying or encumbering the basic language of the present law.

Although up to 5000 gpd can be put to beneficial use without a water right permit, far less water is actually used or needed by most exempt well owners. The following calculation is an estimate of the impact exempt wells have on ground water in Kitsap County. Water system purveyors in the county report 300 gpd is typical usage for single domestic services. There is no present evidence that typical domestic well owners either require or use, on an annual average, more than 300 gpd. Never the less, 400 gpd will be used for this estimate. Kitsap County has an estimated 10,000 exempt wells and approximately 1000 of these serve more than one unit (average 3). The corresponding 12,000 service connections require an

estimated 4.8 million gallons per day (mgd). Exempt wells are spread over approximately 75% of the County (300 square miles), an area that has a recoverable recharge of 110 mgd (GWMP Vol. 1, 1991). The use of approximately 4.8 mgd, which appears to be a large quantity, represents only about 4.4% of the resource available. This calculation ignores the contribution of on site recharge.

Permitting Exempt Wells The task of permitting exempt wells in Kitsap County would be a monumental administrative task, extremely costly, and would add little to regional ground water management. For a one year period ending November 15, 1992, Ecology received 75 applications from Kitsap County. The figure usually is 100 or less. State-wide, Ecology reports that ten wells are drilled for every one that requires a permit (J. Liszak, Ecology, phone conservation Feb. 17, 1993). In 1992, 359 wells were drilled in Kitsap County. Seventy-eight percent were exempt from the application process. Water Right application processing time currently exceeds three years. Adding exempt wells to the permitting process would devastate a system that is already in grave trouble. As an alternative, a sample group of exempt wells could be monitored to statistically estimate the impact of all domestic wells on the hydrologic system.

4. Conclusions

The time, expense and effort required to administer ground water withdrawal from currently exempted wells could be excessive and could detract from more worthwhile endeavors. It is also apparent that current water rights policy will cause the number of exempt wells to continue to accelerate. The ground water exemption has a basic, useful purpose. Elimination of the exemption would be detrimental to some individuals of the County and would adversely impact the ground water management process. The exemption from the Water Rights permitting process for domestic wells which produce less than 5000 gpd should be retained.

4.1. Recommendations And Strategies

5K 1. Kitsap Public Utility District (KPUD) has set up an exempt well monitoring program. This program should be designed to collect the hydrogeologic and usage data necessary to provide the information required to generate statistically valid conclusions concerning the nature of and production from exempt wells in Kitsap County and to assess the effects they might have on the hydrologic system.

5K 2. Should a problem area be identified, through either the domestic or public well monitoring networks, a program to evaluate the total hydrogeology of the impacted aquifer must be undertaken. If it becomes apparent that exempted wells are a significant component of the problem, then within the problem area, the program must identify the seniority of water rights for the large wells and the dates of drilling for the domestic wells which are involved and evaluate the water balance for the aquifer. Under such circumstances, it is appropriate to bring the exempt withdrawals into the management process. Where feasible, appropriate local officials should initiate the above action.

5K 3. Should an aquifer be determined to be in an overdraft condition, water use should be regulated in accordance with state law. An aquifer management plan which controls withdrawals must be developed for the affected ground water system. In the most severe conditions, the county should consider petitioning Ecology to close the area to additional withdrawal.

5K 4. For over-drafted aquifers, an education program must be initiated to inform the public as to the rationale for water withdrawal reductions. Voluntary agreements for limited use could be solicited from individual domestic well owners. The drilling community must be informed by Ecology when an aquifer has been closed and completion of wells will no longer be allowed.

Boulder Area Sustainability Information Network

Current Theme: Personal Action

NATURE OF RESIDENTIAL WATER USE AND EFFECTIVENESS OF CONSERVATION PROGRAMS

by
James P. Heaney, William DeOreo, Peter Mayer, Paul Lander, Jeff Harpring, Laurel Stadjuhar, Beorn Courtney, and Lynn Buhlig

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An overview of research during the past four years on evaluating the nature of residential water use and the expected effectiveness of water conservation programs is presented. This research has been done jointly by faculty and students at the University of Colorado and staff members of Aquacraft, Inc. of Boulder, Colorado.The initial exploratory phase of this research was supported by the Colorado Water Resources Research Institute and the City of Boulder. Subsequent major funding for the national study was provided by the American Water Works Association Research Foundation and twelve participating cities including Boulder and Denver.

In the August 1998 issue of *Colorado Water*, Michelsen, McGuckin, and Stumpf summarized the results of their effort to evaluate the effectiveness of residential price and nonprice programs. They used a "macro" approach and developed three estimating models. The Regional model compares water use patterns across cities. The Season Specific model is a variation of the Regional model that looks at water use behavior during specific seasons of the year. Finally, the City Specific model evaluates water use patterns in individual cities. In all cases, historical monthly water use data were utilized to do this analysis. Their results indicate that water price has a significant and negative impact on water use but that water demand is very price-inelastic. Thus, increasing water rates as a conservation measure will not cause a major decline in water use. Their results indicate that nonprice conservation programs can be effective but the results were mixed. Based on their monthly database, they concluded that outdoor water use does vary with monthly temperature, but not with monthly precipitation. A general conclusion of these authors is that:

> *A significant finding of this study is the overall lack of information available regarding the implementation of nonprice conservation programs and the lack of detail and consistency of water use information necessary to evaluate changes in demand. With improved information, combinations of programs, proven to be successful in reducing water-use levels in one city, could be applied to cities with similar characteristics in different regions of the United States.*

♦ ♦ *Overview of Our Urban Water Demand Studies* -- Beginning in 1993, Professor Heaney and a graduate student, Lynn Buhlig, began exploring the nature of urban water use and the possible effectiveness of water conservation. Using the City of Boulder as the case study and relying on aggregate monthly water use data for the entire city, we attempted to estimate the effectiveness of a variety of conservation practices that had been installed beginning in 1988. Data from 1971 through 1987 were used to describe the pre-conservation water use patterns. These data were compared to

the post-conservation period of 1988 through 1994. A wide variety of conservation practices were installed by the City of Boulder including public education, a demonstration xeriscaping garden, increasing water rates, automation of the City's irrigation systems, and rebate programs for buffalo grass and soil moisture sensors. The results of this aggregate analysis using monthly data were disappointing. No statistically significant difference in the pre and post-conservation water use patterns could be discerned. This does not mean that the conservation practices were ineffective; rather, it means that the use of monthly data for the entire city probably disguises the impact of a small change in one component of water use. Based on this finding, we decided to move from doing statistical analysis of city-wide monthly water use data to evaluating individual houses. The problem was how to do detailed, non-intrusive measurements of household water use. The largest micro study that had been done was work by Brown and Caldwell (1984). This study sampled only a small number of houses and some of the metering was intrusive which may have affected the usage patterns.

Bill DeOreo, a consulting engineer in Boulder, solved the measurement problem by developing a computerized sensing device that is attached to the water meter. It measures flow into the house at ten-second intervals. Signal processing software was developed to convert the ten-second flow signals to individual water using events. The initial evaluation of this technique was done in cooperation with the Water Conservation Office of the City of Boulder as part of Peter Mayer's 1995 MS thesis. The Heatherwood neighborhood near Boulder was the selected study area. The results were very encouraging.

After graduation, Peter Mayer joined Bill DeOreo at Aquacraft and they promoted the idea to cities across North America and to the American Water Works Association Research Foundation. As a result, a $900,000 monitoring study was initiated. For each of 12 cities across North America, a sample of 1,000 houses was selected based on evaluation of local demographics and historical water use. A questionnaire was sent to each of these 1,000 houses. The average response rate was 46%. Based on the returned questionnaires, a sample of 100 houses was selected. Then, detailed monitoring was done on each of these houses during two 14-day periods, one warmer and one cooler. Data was successfully obtained from all but 12 of the 1,200 homes. About 28,000 complete days of water use data were collected including more than 1.9 million water-use events (toilet flushes, showers, clothes washer cycles, faucet usage, irrigation, etc.). Graduate students from the University of Colorado were employed to work on this project as part of their MS thesis research. This research project ended earlier this year and the results are now becoming available. A brief summary of findings to date is presented below. More detailed information about this entire effort can be found in a series of reports, papers, and theses, i.e., Buhlig (1995), Mayer (1995), DeOreo et al. (1996), DeOreo and Mayer (1996), Mayer et al. (1997), Courtney (1997), Harpring (1997), Stadjuhar (1997), or by contacting http://www.aquacraft.com.

- *Demographics of Study Participants* -- The study group consists of a wide variety of single family homes. Study homes included mansions in gated communities and dilapidated one bedroom cabins. The landscapes ranged from lush turf grass and elegant xeriscape to horse pastures, hardscape to untamed weeds. The average household size in the study was 2.8 people and the median annual household income was between $50,000 and $60,000. Seventy-seven percent of survey respondents had completed at least some college and nearly 20 percent reported having either a Master's or higher degree. Nearly 92 percent of the surveyed homes were owner occupied and 8 percent were rental units. Of the study homes, 67.8 percent were built before 1980, 23.5 percent were built between 1980 and 1992, and 4.2 percent were built since 1993 when new plumbing codes went into effect.

General Results -- The 12 study sites represent a diverse collection of single-family water use patterns. In each of the 12 cities, a sample of 1,000 houses was selected. One year of historical metered water use was obtained from billing records for each of the 12,000 houses. Annual water use and estimated indoor and outdoor water use for each city is shown in Table 1. Indoor water use is estimated by averaging water use during the non-irrigation season. The majority of residential water use in Boulder (57%) and Denver (60%) is for outdoor purposes, primarily lawn watering. While the variability in indoor water use for cities across North America is low, it is much higher for outdoor water use. The results of the detailed measurements of water use in 100 houses in each of the 12 cities are presented below.

Indoor Water Use -- Indoor water use patterns for Boulder and Denver are compared to indoor use in the other 10 cities in Table 2. These results are based on the four weeks of continuous measurements of household water use for 1,200 houses across North America. Toilets are the major use of water indoors comprising 26.7% of the total. Clothes washers (21.6%), showers (16.7%), faucets (15.7%), and leaks (13.7%) are the other major components of indoor water use. The distribution of indoor water use is quite stable across the major water use components. The main sources of variability are in minor uses and leaks. The average indoor water use rates per capita for Boulder and Denver are 64.9 and 69.2 gallons per capita per day, respectively. The 12 city average indoor water use is 69.7 gallons per capita per day. These results for indoor water use are somewhat higher than previous studies that estimated indoor water use at about 60 gpcd (Maddaus 1987). The major source of the difference is probably in how leaks are evaluated. It is difficult to separate leaks into indoor or outdoor. The value for leaks shown in Table 2 assumes that leaks are chargeable to indoor water use. If they were assigned to outdoor water use, then the average per capita indoor water use rate would decrease to about 60 gpcd. Indoor residential water use per capita is quite stable in the United States reflecting the fact that indoor water use is for relatively essential purposes.

Table 1. Annual indoor and outdoor water use for 1,000 houses in each of 12 cities.

	1,000 gallons per house per year			%	%
Study Site	Total	Indoor	Outdoor	Indoor	Outdoor
Boulder, CO	134.1	57.4	76.7	42.8%	57.2%
Denver, CO	159.9	64.4	95.5	40.3%	59.7%
Eugene, OR	107.9	63.9	44	59.2%	40.8%
Las Virgenes, CA	301.1	71.6	229.5	23.8%	76.2%
Lompoc, CA	103	62.9	40.1	61.1%	38.9%
Phoenix, AZ	172.4	71.2	101.2	41.3%	58.7%
San Diego, CA	150.1	55.8	94.3	37.2%	62.8%
Scottsdale/Tempe, AZ	184.9	61.9	123	33.5%	66.5%
Seattle, WA	80.1	49.5	30.6	61.8%	38.2%
Tampa, FL	98.9	53.9	45	54.5%	45.5%
Walnut, CA	208.8	75.3	133.5	36.1%	63.9%
Waterloo, ON	69.9	54.3	15.6	77.7%	22.3%

Average	147.6	61.8	85.8	41.9%	58.1%
Standard Deviation	64.80	8.00	58.98		
Coefficient of Variation	0.44	0.13	0.69		

Estimates are based on one year of monthly meter readings. Indoor water use is estimated by averaging water use during the non-irrigation season.

Table 2. Summary of indoor water use for 12 cities in North America

	All values in gallons per capita per day				
	Boulder	Denver	Other	Average	% of
User Category	Colorado	Colorado	10 cities	12 cities	Indoor
Baths	1.4	1.6	1.1	1.2	1.7%
Clothes Washers	14.0	15.6	15.0	15.0	21.6%
Dish Washers	1.4	1.2	0.9	1.0	1.4%
Faucets	11.6	10.5	10.9	10.9	15.7%
Leaks*	3.4	5.8	10.5	9.5	13.7%
Showers	13.1	12.9	11.3	11.6	16.7%
Toilets	19.8	21.1	18.1	18.5	26.7%
Other Domestic	0.2	0.5	1.9	1.6	2.3%
INDOOR	64.9	69.2	69.7	69.3	100.0%

*Leaks are assumed to be indoor. They are actually a combination of indoor and outdoor leakage.

Indoor water use does not vary significantly over the year. Some daily variability occurs between weekdays and weekends. Peak usage occurs during the early morning hours of 7 to 10 am. Most of this peak is due to toilet and shower use. Toilet flushing continues at a similar rate for the rest of the day and into the evening. On the other hand, showers are taken primarily in the morning. Peak clothes washing activity occurs from 9 am to 1 pm. In general, water use in houses declines during the middle of the day since fewer people are at home. Use increases in the evening as people return home and prepare dinner, and then reaches its lowest level between midnight and 6 am when people are asleep. A general discussion of individual indoor water use components is presented below.

Toilet Flushing: Toilet flushing is the most regular and predictable of all of the indoor water uses with an average of 18.5 gpcd. Conservation options for toilets have focused on reducing the gallonage per flush from 4-5 gallons to 1.6 gallons which is mandated nationally in the plumbing

codes beginning in 1993. An important concern with regard to lower volume per flush is that people would double or triple flush. Mayer et al. (1998) divided the NAREUS database into those houses that had only ultra-low flush (ULF) toilets and those that didn't. The results, shown in Table 3, indicate the same number of flushes per day with the ULF houses using only 9.5 gpcd as compared to 19.5 gpcd for non-ULF houses, a major savings of 10 gpcd. The Boulder sample only contained 1.0% of houses that fell into the ULF category while Denver had 6.9% (Mayer et al. 1998). As people replace toilets around the country, the impact of using ULF toilets will become apparent. It is evident from Table 3 that double flushing is not a problem with ULF toilets.

The volume per flush can be reduced to 0.5 gallons using pressurized systems. This technology may gain more widespread use in the future. Dual flush toilets are employed in Australia wherein the user selects whether to use more or less flushing water depending upon the need.

Clothes Washing: Clothes washers use an average of 15.0 gpcd. The traditional Monday wash day has been replaced by a more uniform pattern of clothes washing which is done throughout the day with peaks in the morning and early afternoon. More efficient clothes washers are expected to reduce water use per load by about 25 percent. The timing on clothes washing could be affected by electric or water utility rates that provide time of day incentives and disincentives. For example, water users in Great Britain tend to wash clothes late at night to take advantage of lower electricity rates.

Showers and Baths: Showers (11.6 gpcd) are much more popular than baths (1.2 gpcd) for all 12 cities in the NAREUS study. For Boulder, Colorado, the morning shower is the predominant time for this activity. The other peak in showering occurs during the evening. Showers are taken on a daily basis in Boulder. Thus, no significant variability occurs from day to day. The main conservation option for showers is to use low-flow showerheads.

Results to date indicate only limited reduction in water use since users did not set the older showerheads to the higher flow rates. Federal law mandates a maximum flow rate for showers of 2.5 gallons per minute (gpm). Results of the NAREUS study indicate that most people set their shower flow rate below this level. Thus, conservation savings may not be that significant (Mayer et al. 1998)

The results of the NAREUS study indicate that the average shower used 17.2 gallons and lasted for 8.2 minutes and the average flow rate was 2.1 gallons per minute (gpm). Most showers use between 5 and 20 gallons of water. This indicates that on average people shower at a flow rate below the 1992 plumbing code standard of 2.5 gpm. The LF shower homes used an average of 29.9 gpd and 11.3 gpcd for showering, while the non-LF shower homes used an average of 34.4 gpd and 13.4 gpcd. The net savings for the LF shower homes is therefore 2.1 gpcd. A more significant difference was observed in the mean daily per capita shower duration of the LF and non-LF shower homes. While the occupants of non-LF shower homes averaged 4.6 minutes per person per day of showering, occupants of the LF homes averaged 5.7 minutes per person per day. Nevertheless, the net difference in water use between the two groups is 2.1 gpcd.

Faucet Use: Faucet use includes drinking water, water for washing and rinsing dishes, flushing solids down the garbage disposal, shaving, and numerous other personal needs. Faucet use averages 10.9 gpcd. No breakdown among these uses is available although one can make educated guesses as to the amounts of water used for these purposes. Best estimates of actual drinking water use are in the range of 0.25 to 0.5 gallons per capita per day with a mean of 0.35 gallons per day (Cantor et al. 1987). Garbage disposals add about 1 gpcd to total indoor consumption (Karpiscak et

al. 1990). Faucet use requires the highest water quality because it is the potable water source.

Dishwashers: Dishwashers are a relatively minor water use and newer dishwashers are being designed to conserve energy and water. Present per capita water use averages only 1.0 gpcd.

Water Use for Cooling: For some houses, and for many commercial and industrial establishments, water use for cooling is a significant part of the water budget. Swamp coolers are used in the more arid areas of the United States. Karpiscak et al. (1994) estimate that residential evaporative coolers use about 6 gpcd in Tuscon, Arizona. Because of the relatively small number of houses using coolers, the average usage is quite low, only 0.4 gpcd.

♦ ♦ *Outdoor Water Use* -- Whereas indoor residential water use is very constant across the United States and does not vary seasonally, irrigation water use varies widely from little use to being the dominant water use. Also, it varies seasonally. The 12 cities in the NAREUS are not a representative sample of the United States with regard to climate types. Also, the amount of natural precipitation that occurred during the study periods can have a significant impact on the results. Nevertheless, the results certainly suggest the potential major impact of irrigation on average and peak water use.

Irrigation water use follows a definite pattern of high use rates in the morning and evening with low use rates during the day and late at night. Thus, these customers are following the common recommendations to not water during the middle of the day. Watering late at night is discouraged because of the noise from some types of sprinklers.For the entire NAREUS study, outdoor water use averaged 85,800 gallons per house per year as was shown in Table 1, significantly more than the 61,800 gallons per house per year for indoor water use. Of course, these 12 cities do not constitute a representative sample of all cities in North America. Nevertheless, the dominance of outdoor water use in the more arid western United States is apparent. In Boulder and Denver, outdoor water use averaged over the entire year exceeds indoor water use for the residential users. Thus, for residential areas in the more arid and warmer parts of the country, lawn watering is the largest single use on an annual average basis and is the dominant component of peak daily and hourly use during the summer months. In more arid areas, evapo-transpiration (E-T) requirements are much greater than natural rainfall. In warmer parts of the country, even those with abundant rainfall, e.g., Florida, irrigation water use rates are high because of the long growing season which includes some dry periods. Irrigation water use is a major input to the urban water budget during the growing season. A growing number of people are installing automatic sprinkling systems. These systems tend to use more water than manual systems (Mayer 1995). Also, the timers on these systems are seldom adjusted. Thus, lawn watering occurs even during rainy periods. Experience with soil moisture sensors to control sprinkling use has been mixed. Automatic sprinkling systems do offer the potential for more efficient use of water if they are properly calibrated and operated (Courtney 1997).

Peak hourly use in Boulder, Colorado occurs between 6 and 8 am and is caused predominantly by irrigation (Harpring 1997). Indoor water use at 6 am is about 7.5 gallons per house while the total water use at the same time is about 41 gallons per house. Thus, irrigation constitutes over 80% of the peak hourly use. Options for reducing outdoor water use include using less water loving plants, applying water more efficiently, reducing the irrigated area, and using nonpotable water including stormwater runoff and treated wastewater (Courtney 1997). Sakrison (1996) projects a potential decrease of 35 % in the demand for irrigation water in King County, Washington if higher density urbanization occurs. For King County, the main way that water use is managed is by restrictions on outdoor water use for landscaping. A maximum permissible E-T is allotted that forces the property

owner to reduce the amount of pervious area devoted to turf grass. Stormwater runon to the pervious area can be used for an extra credit.

Lawn watering has increased in the United States as population migration occurs to warmer, more arid areas. Also, urban sprawl means much larger irrigable area per dwelling unit. Lawn watering needs are a dominant component of peak water use in urban areas. Reuse of treated wastewater and stormwater for lawn watering appears to be very attractive possibilities for more sustainable communities.

♦ ♦ *Summary and Conclusions* -- The results of these process-oriented monitoring studies during the past four years provide a major improvement in our understanding of the nature of residential water use. For the 12 cities studied, indoor per capita water use averaged 69.3 gpcd with toilets, clothes washers, showers, faucets, and leaks being the largest indoor end use components. Cost-effective reduction in indoor use can be achieved by using low-flush toilets. This change is occurring nationwide due to the requirements of the national plumbing codes. Retrofitting showerheads is less effective since people do not operate showers at the higher flow rates anyway. Continuing improvements in household appliances are expected to significantly reduce indoor water use. Leaks are primarily the result of faulty toilet flapper valves and miscellaneous faucet and irrigation system leaks and can be repaired. Overall, for indoor water use, the picture is relatively optimistic in terms of reducing per capita water use. The current per capita use of about 65-70 gpcd should be reduced to 40-45 gpcd when existing conservation measures are used for all residential areas. This reduction saves not only on water supply costs but also on wastewater treatment costs since virtually all of the indoor water use must be collected and treated at the wastewater treatment plant.

While indoor water use is expected to decline as described above, the gains in reducing indoor water use may be offset by increases in outdoor water use. Outdoor water use exceeds indoor water use in more arid parts of the country. Also, outdoor water use constitutes the majority of the peak summer demand that taxes the capacity of urban water systems. The trend towards lower density housing increases the irrigable area per capita. Also, more people are installing automatic sprinkling systems. People vary widely in how they use water outdoors. This causes much uncertainty in estimating peak flow rates. A concerted effort is needed to devise more effective ways to reduce outdoor water use in urban areas. Intensive monitoring is needed to evaluate how irrigation water is actually used in urban areas. The possibility of reusing treated wastewater and stormwater for lawn watering should be given serious consideration, especially as the requirements for more stringent water treatment are imposed on cities. It is increasingly difficult to justify providing a very high level of treatment to all of the water brought into a city only to have the majority of it used to irrigate landscapes and flush toilets.

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INVITATION BASIN is a community project actively seeking public participation. We appreciate all feedback and welcome comments, suggestions and contributions. To find out more about how you can be involved, click here. Help BASIN serve your needs, take our "10 questions in 10 seconds" survey.

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Appendix E
2 CFS RESERVATION USER CATEGORIES AND ALLOCATION PROCESS

User Categories

User category requirements are defined as follows:

1. Single Domestic: These owners are exempt from the permit requirements of RCW 90. 44. 050. Owners of newly developed parcels in this category may choose to:

    a. Do no reported measuring and tracking. WDOE can exercise its option to require the owners to furnish information as to the means for and quantity of withdrawals; OR
    b. Measure and report usage data annually. In this case, the owners of new parcels will voluntarily report monthly and annual water usage to the WDOE in January of each year.

    The owner will thus contribute to the database growth and will have a documented level of beneficial use in case of future water right dispute. Parcel owners who choose to report annual usage data will not be subject to any added restrictions, including fees or loss of rights to which they would otherwise be entitled. Owners of already developed Single Domestic parcels can measure and report water usage data to the WDOE if they so desire.

2. Municipalities, Group A and B, and Single Industrial/ Commercial Parcels. In order to benefit from the 2 cfs Reservation water allocations, owners of newly developed parcels in all user categories other than Single Domestic are required to meter and report monthly and annual usage in January of each year to WDOE for inclusion in their database.

All data submitted for inclusion in the data base must use standard Ecology data submission forms. Data received by WDOE can be obtained by request for independent evaluations by the Methow Watershed Council or other interested parties.

Allocation Process

The total annual usage, Qa, available from the 2cfs Reservation is 10,135 acre-feet per year, AF, and the peak monthly usage, Qi, is 14 cfs, Figure 6. The allocation process used to justify the recommended changes in the 2 cfs Reservation was based on a single family residence annual usage of 600 gallons per day per residence and a peak monthly usage rate of 1200 gallons per day. The Town of Twisp is the source of this data, and the data are consistent with data from other Eastern Washington sources, Table E-1. Stock Water consumption is negligible, Table E-2. The Okanogan County Assessors database was used to determine the total number of parcels developed since WAC 173-548 went into effect in 1976. This database and current zoning laws were combined to determine the

number of parcels subject to WAC 173-548 that have been developed since that date, and the above usage rates were applied to determine the Qa (0.85cfs) and Qi (1.7 cfs) values already used (Table E-3 and Figure 6) . When developments between 1976 and 2002 are deducted from total values available under the 2 cfs Reservation, a maximum annual usage of 9530 AF (Qa) and a maximum instantaneous usage rate of 12.3 cfs (Q i) are available for Future Development (Figure 6). Table E-4 defines the total capped values for Twisp, Winthrop, and Group A Community systems, including current planned developments and an allowance for growth. When the total 1243 AF (Qa) and 4.1 cfs (Qi) values are deducted from the Future Development Totals , 8287 AF (Qa) and 8.2 cfs (Qi) remain for Single Domestic, Single Industrial / Commercial, and Group B Domestic new developments (Figure 6). Only 6% of the total 14 cfs reserved has been used for development of exempt residences in the 1976-2002 period, and only 7 % has been included in planned development for Municipalities and Group A Systems. The remaining 87 % is allocated for future growth as it develops under the 2 cfs Reservation Management Program. These allocations satisfy all present and known future residential growth needs. Thus, Figure 6 defines the limits within which the 2 cfs Reservation actual usages will be managed.

In considering annual usage, Qa, there are three reserve sources which are not readily quantifiable, but will be significant as follows.

1. There are 580 AF set aside for additional growth for Twisp, Winthrop, and Group A Systems (Table E-4). Dividing 580 by the total 9530 AF available equals a 6 % reserve.
2. Also, all parcels were assumed to have full time residences in the estimating approach. However, based on Okanogan County Assessor's 2002 parcel data, 42% of Methow Valley residences have out-of-basin zip codes . A reasonable assumption is that occupants maintaining mailing addresses at other locations are in the valley less than half time. If this is true, 42 % of the residences will have an average annual usage of less than 300 gpd per residence which will significantly increase the reserve.
3. There are several thousand parcels available for new residences with current valley zoning. However, the number of parcels available for residences will increase with time as large parcels are converted from undeveloped and agricultural uses and divided into smaller parcels for residential use. The number of parcels with residences will also vary with owner choice of uses. For example some owners may choose to surround their residences with vacant parcels to provide added privacy or to use their parcels for only occasional recreational vehicle use.

It is not practical to accurately predict this residence growth, since the number of new residences is dependent on a large number of independent owner decisions over future years and on possible changes in zoning laws. However, new residences will increase significantly over time. Thus, the 2 cfs Reservation Management Program has been designed both to validate the usage rate estimating numbers and to track the change in the number of developed residences at any given point in time.

In considering maximum usage, Qi, the maximum usage rate is twice the annual usage.Thus, the maximum usage rate may limit development before all possible residential parcels have been developed. Two other observations are pertinent.

1. Owners in all user categories have the ability to reduce maximum usage rates by using conservation methods, such as storage and limiting water usage outside residences. The use of conservation methods can not be readily estimated with currently available data, but can be significant.
2. Also, many years of additional data development will have passed by the time that the presently available parcels have been developed, and significantly more accurate data will be available for prediction before that time is reached.

CONCLUSIONS

Conversion of undeveloped and agricultural land to residential use will increase the number of residential parcels developed over time, and the eventual number is unpredictable. Either Qa or Qi may limit residential growth in the future. Therefore, the 2 cfs Reservation Management Plan must both validate the water usage rates and track the ever changing number of developed residences at any given point in time.The water usage tracking approach defined will reveal when this limit is being approached and further growth will be limited unless water is obtained from new sources other than the 2 cfs Reservation.

TABLE E-1

Comparison of Residential Water Use in Eastern Washington

Location	Source	Water use per residence (gallons per day)
Town of Twisp (Maximum Withdrawal)	*WRIA 48 Phase II*	*1,189*[1]
Town of Twisp (Average Annual Withdrawal)	*WRIA 48 Phase II*	*598*[2]
City of Spokane	WRIAs 55/57 Phase II	490-980
City of Waterville	WRIAs 44/50 Phase II	367
City of Mansfield	WRIAs 44/50 Phase II	670
City of Yakima	WRIAs 37/38/39 Phase III	900

Notes: Water use for other WRIAs reported as total use (i.e. including consumptive and non-consumptive use).

(1) – Assumes maximum monthly withdrawal and 2.54 persons per residence

(2) – Assumes average annual use and 2.54 persons

TABLE E-2

Estimates of stock water consumption from subject to the 2 cfs reservation

Sub Basin	Estimated Total Head[1]	Stock Water Consumption		
		Gallons[2]	Acre Feet	Cubic Feet per Second
Chewuch	898	4,915,546	15.09	0.02
Early Winters	--	--	--	--
Lower Methow	1069	5,852,751	17.96	0.02
Methow Headwaters	335	1,836,157	5.63	0.01
Middle Methow	683	3,739,258	11.48	0.02
Twisp	348	1,903,100	5.84	0.01
Upper Methow	667	3,653,188	11.21	0.02
Total	4000	2,1900,000	67.21	0.09

Notes:

(1) - Estimate based on information from Okanogan National Forest and Methow Basin Planning Unit. Head are allocated to sub-basins basin on relative irrigated pasture area according to 1995 M.A.P.A. coverage (Ecology, 2001).

(2) Assumes 15 gal/day/head.

TABLE E-3

Estimated exempt water use subject to 2 cfs reservation

(WAC 173-548) under current conditions[1].

Sub-Basin	Existing Currently Developed Parcels[2]	Number of Existing Developed Parcels Subject to 2 cfs Rule (Parcels developed since 1976 – March 2002)
Chewuch	415	194
Early Winters		
Lower Methow	671	154
Methow Headwaters	188	75
Middle Methow	429	199
Twisp	319	165
Upper Methow	308	131
Total	***2,332***	***917***
Water use per residence per day of occupancy	**Total Use (cfs)**	
1200 gpd (Qi)	4.4	1.7
600 gpd (Qa)	2.2	0.85 (605 AF)

Notes:
[1] – Values are gross amounts with no estimate of ground water return.
[2] - Source: GIS Coverage - Okanogan County Assessors Office, March 2002.
[3] - Corrected for parcels served by Group A/Group B systems.
- Corrected for parcels within closed basins where exempt wells are prohibited.
- Corrected for parcels existing prior to WAC 173.548 in 1976.

Table E-4

Currently developed and potentially developable parcels
and parcels subject to the 2 CFS reservation at build-out

Reach	Developed	Existing Developable Parcels	Potential Developable Parcels	Total Developable Parcels	Total Developed and Developable	Commun. Water	Pre '77 High	Subject to 2 CFS Reservation High	Pre '77 Low	Subject to 2 CFS Reservation Low
Methow Headwaters	290	113	227	340	630	150	56	424	50	430
Early Winters	0	0	0	0	0	0	0	0	0	0
Upper Methow	663	584	1703	2287	2950	339	108	2503	96	2515
Chewuch	546	403	796	1199	1745	198	240	1307	214	1333
Middle Methow	138	216	304	520	658	0	258	400	230	428
Twisp	372	270	956	1226	1598	0	124	1474	110	1488
Lower Methow	543	662	5720	6382	6925	190	502	6233	446	6289
TOTAL	2552	2248	9706	11954	14506	877	1288	12341	1145	12484

Legend

Developed: number of parcels currently developed for single domestic use, based on map analysis (DOR codes 11, 19, and 81 0; and codes 81, 83, & 91 w/WA in comments)
Developable: number of existing parcels large enough to develop for single domestic use
Potential: number of new parcels that could be created under current zoning, on both developed and undeveloped land
Commun. Water: estimated number of parcels served by community water systems in 1977
Pre '77 High: estimated number of single-domestic wells in the Methow Valley in 1977, based on analysis of Census data
Pre '77 Low: estimated number of single-domestic wells in the Methow Valley in 1977, based on analysis of Census data and information from the 1982 DEIS
Subject to 2 CFS reservation: estimated number of parcels that could exist and be subject to the 2CFS reservation at build out

Assumptions

Parcels zoned MD must be at least 6 acres to qualify as large enough to divide
All parcels must be at least 3 acres to qualify as large enough to develop
Development potential of parcels with conservation easements = 1 additional parcel, if large enough based on current zoning
All parcels that could be on community water systems are included in the estimate of developable parcels; this may not be the case due to deletion of lots smaller than 3 A.
The estimated numbers of single domestic wells developed in the Methow Basin between 1/77 and 7/90 that are shown in "Recent water use in the Methow River valley: An estimate", published by Ecology in 1991, are correct

Table E-5a

	Start	Correction #1		Correction #2			Correction #3				
	Total Parcels	Parcels in Closed Basins	Parcels Not in Closed Basins	Parcels served by Group A Systems	Parcels Served by Group B Systems	**Sub-Total : Non Group A/B parcels and not in Closed Basin**	1980-2000 Population growth factor	Currently Developed Parcels (not in closed basin)	Pre-1976 Currently Developed Parcels	**Existing Parcels currently subject to WAC 173-548**	**Remaining Developable Parcels subject to WAC 173-548**
Methow Headwaters	914	60	854	225	150	504	2.34	176	75	403	328
Upper Methow	1,450	395	1,055	175	150	752	1.71	224	131	659	528
Early Winters											
Chewuch	1,110	234	876	150	198	561	1.69	328	194	427	233
Middle Methow	1,610	377	1,233	75	0	1,158	1.65	329	199	1,029	829
Twisp	873	238	635	50	0	585	1.41	232	165	518	353
Lower Methow	3,224	2169	1,055	200	12	845	1.43	220	154	779	625
Total	**9,181**	**3,473**	**5,708**	**875**	**510**	**4,405**		**1,508**	**917**	**3,815**	**2,897**
Highlands Data						**4,800**			**1,145**	**2,635**	**2,248**

Table E-5b

Build-Out Projection

	Remaining Developable Parcels subject to WAC 173-548	Parcels >10 acres	Expected Subdivision Factor	Potential Additional Parcels	Maximum Subdivision Factor	Potential Additional Parcels
Methow Headwaters	328			596		775.18
Upper Methow	528			960		1,247.63
Early Winters						
Chewuch	233			424		551.81
Middle Methow	829			1,508		1,960.31
Twisp	353			642		834.19
Lower Methow	625			3,074		6,034.11
Total (Above Carlton)		790	2.5	1,975	5	3,950
Total (Below Carlton)		268	8.5	2,278	17	4,556
Total	**2,897**	1,058		4,253		8,506
Adjusted Total		1,839		**6,092**		**10,345**

Notes:

Starting Point Based on GIS query of all parcels in Methow Basin

Correction 1 : Based on GIS overlay (subtraction) of closed basins specified in WAC 173-548

Correction 2 : Based on Washington Department of Health database of water systems
Group A systems = 25 connections per system
Includes transient and non-community Group B systems

Correction 3 : Corrected for parcels designated as "developed" in parcel database
This column represents "remaining parcels for build-out" (see Correction 5)
Scaling factors based on population increase between 1980 and 2000, by sub-basin
Thic column accounts for developed parcels subject to WAC 173-548

Build-Out Based on GIS query of undeveloped parcels (code 11, 19, 91) not in closed basins
Expected subdivision factors based on average parcel size divided by minimum starting parcel area
Above Carlton : average parcel/minimum parcel = 25 acres/10 acres
Below Carlton : average parcel/minimum parcel = 17 acres/2 acres
Maximum subdivision factors based on total parcel acreage divided by minimum parcel size (5-acres)
Above Carlton : total parcel acreage/minimum parcel = 19,750 acres/10 acres

TABLE E-6

Projected future water uses allocated under the 2 cfs reservation

Purveyor	Planned Development				Additional Growth				Total			
	Annual Withdrawal (Q_a)		Maximum Monthly Withdrawal (Q_i)		Annual Withdrawal (Q_a)		Maximum Monthly Withdrawal (Q_i)		Annual Withdrawal (Q_a)		Maximum Monthly Withdrawal (Q_i)	
	Acre-feet	*cfs*	Gallons per minute	*cfs*	Acre-Feet	*cfs*	Gallons per minute	*cfs*	Acre-Feet	*cfs*	Gallons per minute	*cfs*
Winthrop	141	*0.19*	360	*0.8*	210	*0.29*	350	*0.78*	351	*0.48*	710	*1.58*
Twisp	240	*0.34*	305[1]	*0.68[1]*	170	*0.24*	213[1]	*0.48[1]*	410	*0.58*	869	*1.16*
Group A	282	*0.40*	359[1]	*0.80[1]*	200	*0.28*	251[1]	*0.56[1]*	482	*0.68*	598	*1.36*
Total	663	*0.93*	1024	*2.28*	580	*0.81*	814	*1.82*	1243	*1.74*	2177	*4.10*

Notes:

(1) Twisp and Group A instantaneous maximum withdrawal values for Planned Development and Additional Growth wer calculated using a peaking factor of 2 based on data from the Phase II Report.

Population and Growth Data for the Methow River Basin

September 10, 1993

Prepared for:

Local Government Caucus
of the
Methow River Basin Pilot Planning Project

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Introduction

This document, prepared for the Local Government Caucus of the Methow River Basin Pilot Planning Project, assembles and summarizes information on population growth and development trends for the Methow River Basin in general and for the area lying north of the Weeman Bridge in particular. The document is organized into four parts: Data Overview and Detail; Analysis and Projections for Entire Basin; Development Potential North of the Weeman Bridge; and, Summary and Conclusions.

Over the last twenty years, a number of studies have estimated population growth rates for some or all of the Basin. Growth rates from these studies are applied to 1990 baseline population (1990 census data) to give a range of predictions for growth of permanent and seasonal residents. It should be noted that many of these studies focused on School District 350 and thus did not include any effort to analyze population or growth trends in that portion of the Valley lying downstream from Methow.

Data on population, building permits, subdivision history, and the number of existing lots have been assembled and, where possible, spatially distributed by river reach. The resulting information provides some indication of the geographic distribution of recent growth in the Basin and reveals which areas of the basin are likely to grow in the near future if present trends continue. When a comparison is made between the number of existing lots and the current population of each reach, some preliminary conclusions on the potential of each reach to absorb population growth on existing lots can be drawn.

Data was also collected on the amount of indoor water used by typical households, both with and without conservation measures. This information has been applied to the graph of population growth to provide an illustration of the impact of various population growth scenarios on indoor water consumption. The data on population and indoor water use projections are inherently speculative, and this is true for the information presented here. Where possible, sources of uncertainty such as family size and per capita water use have been identified and discussed.

A word of caution is that population growth, water consumption, development and building permit activity can be drastically affected by changes in local, state and federal land use policy, and by changes in the economy of the region and nation. This report in no way attempts to predict these trends.

PART I: Data Overview and Detail

Population

Studies in Print

The Methow Basin has been the subject of many population studies over the last twenty years. Studies in print were reviewed and summarized, and where appropriate, annual growth projections were applied to the present baseline population. One note of caution is that many of the studies/reports were limited to the confines of School District 350.

The following studies were reviewed:

1. Methow Valley Plan. An Addendum to Okanogan County's Comprehensive Plan. April 5, 1976.

2. Early Winters Alpine Winter Sports Study. Draft Environmental Impact Statement. USDA Forest Service. July 30, 1980.

3. The Social and Economic Effects of the Proposed Ski Development at Early Winters. Prepared for USDA Forest Service. Social Impact Research. April, 1981.

4. Social and Economic Effect of the Proposed Ski Development at Early Winters Ski Area. Prepared for Methow Recreation Inc. by UniPlan Associates. July, 1981.

5. Okanogan County Comprehensive Transportation Study for the Methow Valley. Wilsey and Ham. December 20, 1985.

6. Early Winters Resort Development Economic and Fiscal Impacts on the State of Washington and Local Governments in Okanogan County. R.E. Hansen Research Associates, Inc. November, 1988.

7. Community Master Plan, Methow Valley Planning Area, Subunit A. An Amendment to the Okanogan County Comprehensive Plan and Methow Valley Addendum. June 26, 1989.

8. Early Winters Preliminary Draft Environmental Impact Statement. Early Winters Resort Corp. June 1990. Population projections from The Ferris Company. Includes reviews of current Bonneville Power Administration population projections.

9. Methow Valley School District enrollment figures.

10. Okanogan County Electric Cooperative service forecast.

11. Public Utility District #1 forecast for Loup Loup substation.

12. Washington State Office of Financial Management, Population Forecast. 1992.

13. PTI Communications, interview.

Each of these studies/reports are summarized in the following section.

Summaries

1. *Methow Valley Plan. An Addendum to Okanogan County's Comprehensive Plan. April 5, 1976.*

This land use plan included a 15-year population projection done by Lloyd Irland and Maggie Coon. No description of methodology is given. Projections are made for futures with and without the Early Winters development, which at the time was the Aspen Corporation proposal. Projections for the "Without Ski Area" future (page 19) are reproduced below, the study area is School District 350 (Methow Review District):

Table 1
Methow Valley Plan
Population Projections

	Approx. 1975-76 population	Projected 1982-83 population	Projected 1989-90 population
Permanent Population	2,800	3,100	3,300
Transient Population[1]	3,700	5,300	6,700

[1] Based on non-resident average daily traffic counts and projections.

2. *Early Winters Alpine Winter Sports Study. Draft Environmental Impact Statement. USDA Forest Service. July 30, 1980.*

The following table summarizes the projections for resident and seasonal population contained in the Draft EIS. "Future I" is the baseline projection without the proposed Early Winters Resort.

Table 2
Early Winters dEIS
Population Projections
FUTURE I

Year	Permanent	Seasonal	Total
1980	3,700	1,050	4,750
1985	4,028	1,577	5,606
1990	4,381	2,016	6,397
1995	4,769	2,410	7,179
2000	5,194	2,903	8,097

3. *The Social and Economic Effects of the Proposed Ski Development at Early Winters. Prepared for USDA Forest Service. Social Impact Research. April, 1981.*

This document was a background report prepared for the Early Winters Draft EIS. The report was very thorough with a fairly comprehensive discussion of methodology. Social Impact Research (SIR) compared the forecasts made by the Bonneville Power Administration and the Office of Financial Management for the 1970 - 1980 period. It concluded that the BPA forecast was the most accurate in predicting overall County population growth. SIR then modified the 1980 BPA forecast to reflect what it considered the differences between growth in the Methow Valley and growth in the County as a whole, to produce an estimate of 1.7 percent annual growth in permanent population. This method was examined and used by The Ferris Company in 1989 (see summary #8).

4. *Social and Economic Effect of the Proposed Ski Development at Early Winters Ski Area. Prepared for Methow Recreation Inc. by UniPlan Associates. July, 1981.*

This document includes the following estimates for baseline population growth:

Table 3
Social and Economic Effect of Early Winters
Population Projections

Year	Population
1980	3,700
1985	4,028
1990	4,381
1995	4,769
2000	5,194
2005	5,655
2010	6,159

This is an average of 1.01 percent per year. Methodology is not discussed.

5. *Okanogan County Comprehensive Transportation Study for the Methow Valley. Wilsey and Ham. December 20, 1985.*

This study makes the important observation that the trend in population increase has been strongly towards growth in unincorporated areas. This trend has been much sharper in the Methow Valley than in the County as a whole. The following table is taken from the study, with additional percentages added from the text.

Table 4
Transportation Study For the Methow
Population Projections
(Valley Wide)

Year	County Total	Methow Valley Total
1970	25,867	2,743
1980	30,639	3,997
1984	31,900	5,410
2000		8,097

Table 5
Transportation Study for the Methow
Population Projections
(Unincorporated Population Percentages)

Year	Percent of population in unincorporated area - County	Percent of population in unincorporated area - Methow Valley
1970	47.6	58.9
1980	53.7	66.6
1984	56.0	76.5

The document states:

> "Population growth in the Methow Valley since 1970 through 1980 has grown an average of 4.6 percent per year. In more recent years, the growth rate has nearly doubled to 8.8 percent. Almost all of this growth occurred in the unincorporated areas of the study area." .... " Currently, population growth in the study area is increasing eight times faster than the county's average of approximately one percent per year."

6. *Early Winters Resort Development Economic and Fiscal Impacts on the State of Washington and Local Governments in Okanogan County. R.E. Hansen Research Associates, Inc. November, 1988.*

This document makes population projections for the Towns of Twisp and Winthrop, assuming annual population growth rates of 1.53 percent. Methodology is not discussed.

7. *Community Master Plan, Methow Valley Planning Area, Subunit A. An Amendment to the Okanogan County Comprehensive Plan and Methow Valley Addendum. June 26, 1989.*

This subunit plan quotes population projections from the Forest Service Environmental Impact Statement for the Early Winters Project, listed above.

8. *Early Winters Preliminary Draft Environmental Impact Statement. Early Winters Resort Corp. June 1990. Population projections by The Ferris Company.*

Although this document did not progress beyond the preliminary draft stage, it includes population projection work done by The Ferris Company. In particular, Ferris discusses the methodology and performance of the projections made by Social Impact Research in April, 1981, as follows:

> "In 1981, SIR projected that, between 1980 - 2010, the Study Area population would grow at an average rate of 1.7 percent annually. This projection was based, in part, on a Bonneville Power Administration (BPA) projection of an

average annual growth rate of 1.4 percent for all of Okanogan County.

To determine whether the Methow Valley Study Area and Okanogan County growth occurred at a similar pace, SIR reviewed historic growth patterns in these two areas. Based on this review, SIR concluded that, during the 1970's, the Study Area began to grow more rapidly than Okanogan County as a whole.... SIR assumed that the trend toward relatively more rapid growth in the Methow would continue through 2010. Therefore, SIR assumed a 1.7 percent growth rate for the Methow Valley Study Area, slightly higher than the BPA projection of 1.4 percent for the County as a whole. The SIR projection for 1989 permanent population in the Study Area was 4,310.

For the period between 1980 and 1989, The Ferris Company compared the SIR projections to estimates of actual development levels (based on Okanogan County building permit and Electric Cooperative records) in the Methow Valley... Using the 1989 housing estimate of 1,960 units and the household size an vacancy rate assumptions set forth by SIR, the total 1989 permanent Study Area population is estimated to be at 4,248 persons.... the annual growth rate between 1980 and 1989 was 1.65 percent.

"The 1.65 percent growth rate compares very closely to the SIR projection of 1.7 percent. Based on this comparability, The Ferris Company concluded that the SIR methodology of using an adjusted BPA growth factor resulted in an accurate projection. Therefore, an updated version of this methodology was used to develop the baseline projection...

"Between 1989 - 2008, the BPA projects that Okanogan County population will increase at a rate of 0.58 percent annually. This indicates a significant slowdown relative to the growth experience during the 1980's. Therefore, the SIR projection of 1.7 percent annual growth, while very accurate during the 1980's, may be high for the upcoming twenty year period. Accordingly, it is assumed that a 1.7 percent annual growth factor represents an upper limit for growth in the Methow Valley Study Area....

"In the future, The Ferris Company assumes that the Methow Valley growth rates will continue to be as least 51 percent greater than the County-wide growth rate. Under this assumption, the Methow Valley growth rate during the 1989 - 2008 period would be 0.88 percent (0.58 x 1.510). Therefore, is assumed that a 0.88 percent growth factor represents the lower limit for growth in the Methow Valley Study Area."

Seasonal population and housing: "Seasonal population was projected based on the records of the Okanogan County Electric Cooperative. To develop the housing projection, it was assumed that the average 4.3 percent seasonal housing growth rate experience during the 1980's would continue."

9. *Methow Valley School District.*

The Methow Valley School District (District 350), provided data on enrollment from 1987 to the present. These are not a reliable guide to overall population growth, since families with no children, single people, etc., are not counted. However, the accelerating increase in the number of school-age children may indicate, for instance, that not all population growth is in the retirement-age sector.

Table 6
Methow Valley School District
Population Projections

Year	Enrollment	Increase	% Increase
1987	651		
1988	674	23	3.5
1989	678	4	0.6
1990	706	28	4.1
1991	741	35	5.0
1992	788	47	6.3
1993 (est)	847	59	7.5

10. Okanogan County Electric Cooperative (Coop).

The Coop makes forecasts of system requirements, including the number of residences. The recent survey of Coop customers generated average residents per household for permanent and seasonal homes. These were 2.50 persons for full-time and 2.37 persons per part-time residence. These can be used to project population from numbers of residences. However, these numbers are only for the service areas of the Electric Coop, which generally includes the area north of Twisp.

Table 7
Electric Coop
Population Projections

Year	Full-time housing	Full-time population	Seasonal housing	Seasonal population
1991	926	2,315	553	1,311
1992	933	2,333	596	1,413
1993	944	2,360	623	1,477
1994	958	2,395	658	1,559
1995	972	2,430	693	1,642
1996	996	2,490	728	1,725
1997	1,010	2,525	763	1,808
1998	1,030	2,575	798	1,891

Overall, the Coop predicts a 1.53 percent average annual increase for full-time residents, and a 5.4 percent average annual increase for seasonal residents.

11. Public Utility District #1.

The PUD provided a forecast done by Bonneville Power Administration which estimated growth of electrical demand for each of the PUD's substations. This is the only forecast which specifically addresses the Methow Valley portion of the PUD's service area. (The Loup Loup substation in Twisp serves all of the Valley portion.) This forecast was made in June, 1986. Other Bonneville forecasts are done more frequently, but address the County as a whole. See item 8 for a more detailed discussion of Bonneville Power Administration forecasts.

Table 8
PUD
Population Projections

Year	Annual Energy (MPH)
1986	30532
1987	29287
1988	30071
1989	30511
1990	31204
1995	32741

Between 1986 and 1990, projected increases range between 2.5 and 4.9 percent. Between 1990 and 1995, the projected average annual increase is 0.96 percent. Like the school district figures, this is not a particularly reliable estimate, since it includes commercial and industrial, as well as residential, energy use. However, since the Valley is primarily residential in character, increasing energy use may correlate roughly with increased population.

12. *Washington State Office of Financial Management (OFM), Forecasting Division.*

The OFM provided the following estimates of population growth for Okanogan County:

Table 9
OFM
Population Projections

Year	Population
1990	33,350
1995	34,801
2000	36,316
2005	38,221
2010	39,885

4.35 percent each 5 years, or 0.87 percent per year

13. *PTI Communications.*

The Twisp and Winthrop district encompasses the entire Methow Valley, not including the City of Pateros. The Division Engineer at PTI stated that they do not make written projections of population growth, but that the Methow Valley district was experiencing an annual increase in new phone service of between five and seven percent. As these figures include commercial phone service in addition to residential, they are not a reliable indicator of population growth.

Baseline Population

Permanent

As noted in the preceding section, the population of the Methow Basin has been estimated in a number of studies, using a variety of methods based on census data. The table which follows present historical data on permanent population within the Basin.

Table 10
Methow Valley
Permanent Population*

Year	Population
1950	2,886
1960	2,377
1970	2,629
1980	3,700
1990	4,544

* Source: 1950 - 1980: Census, quoted in The Social and Economic Effects of the Proposed Ski Development at Early Winters. Social Impact Research. 1981. Source for 1990: census data assembled by EES. EEG cautions that "The following are estimates based on official 1990 census data distributed by the Washington State Redistricting Commission. The Commission makes no warranty for errors and/or omissions."

Incorporated Area Population:

By subtracting the populations of Twisp and Winthrop, the population outside of the incorporated areas can be calculated. Twisp's population in 1990 was 876 and Winthrop's was 322. The 1990 population of the unincorporated area can thus be estimated at 3,348.

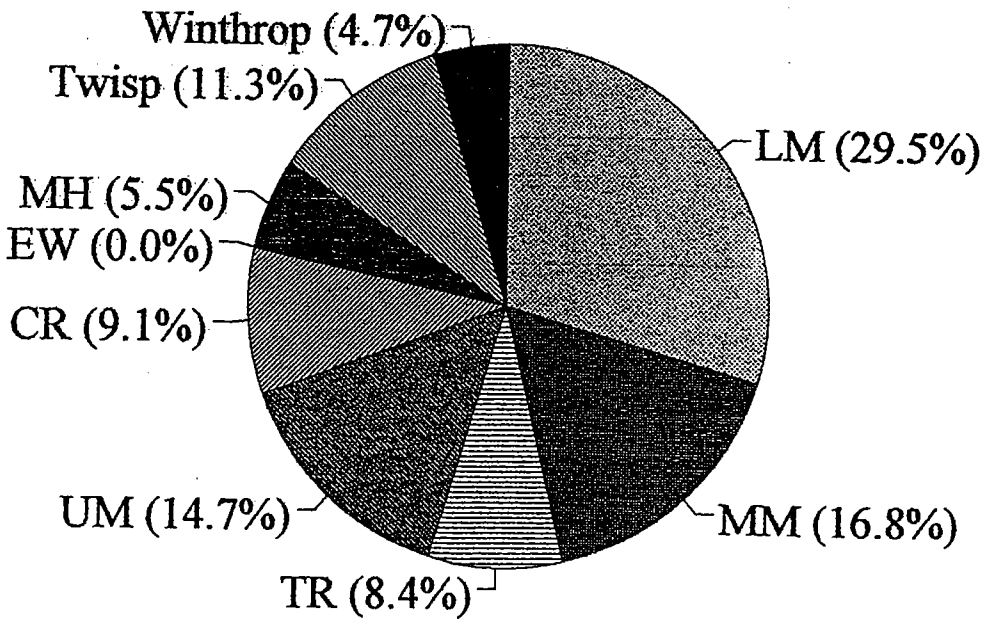
Permanent Population by River Reach:

The following table and figure presents information on permanent population by River Reach and municipality. Reach information was based on 1990 census block data, which was distributed by reach using the Geographic Information System database being developed by EES, Inc., for the Pilot Project. Corrections to reflect the populations of Winthrop and Twisp were made using the 1990 census totals for those towns.

Table 11
Permanent Population by River Reach and Municipality
(1990)

Reach	Population	Percent
Lower Methow (LM)	1,473	32.4
Town of Twisp	876	19.3
Middle Methow (MM)	390	8.6
Town of Winthrop	322	7.1
Twisp River (TR)	731	16.1
Upper Methow (UM)	369	8.1
Chewuch River (CR)	293	6.5
Early Winters (EW)	25	0.6
Methow Headwaters (MH)	62	1.4
TOTAL	**4,541**	**100%**

Figure 1
Permanent Population by River Reach
(1990)



Seasonal

Seasonal population within the Basin has been estimated by The Ferris Company, by SIR, and by the Okanogan County Electric Coop. All of these studies rely of data provided by the Coop, which separates seasonal from year-round accounts.

Seasonal population was estimated by multiplying the number of accounts by the estimated average family size. It should be noted that this method is quite speculative since it applies only to the service area of the Coop (north of Twisp). However, as these are the only figures presently in print, it was assumed that they would suffice for this report. Therefore, the 1990 estimate of 540 seasonal residences at 2.25 persons per residence was used, yielding a seasonal population of 1,215. This baseline figure accords reasonably well with the studies in print, for example Ferris's 1989 figure of 1,107 seasonal residents. However it is not as reliable as the census figures for permanent residents. No good method has been found to separate seasonal population by river reach.

Parcel Data

Parcel data was collected to reveal development trends. The number of existing lots was determined, and the creation of lots by short plat, long plat and planned development was tabulated and broken down by river reach. A similar sort was done for building permits and real estate sales, to the extent that each could be determined from readily available sources.

Existing Parcels

The following table, which presents data on parcel sizes and number by river reach, and figure, which depicts total parcels by river reach, are based on existing parcels outside of the incorporated towns. Data was obtained from the Okanogan County Assessor's Real Estate Database and sorted. Data was available down to the section level, meaning that there will be some inaccuracies where river reach boundaries divide sections, particularly around the mouth of Early Winters Creek. While a few parcels will be assigned to the wrong reach, the overall picture is believed to be accurate. Please note that this table does not include parcels in reserve forest land. There are 95 such parcels in the basin, with an average size of forest reserve of 50.3 acres.

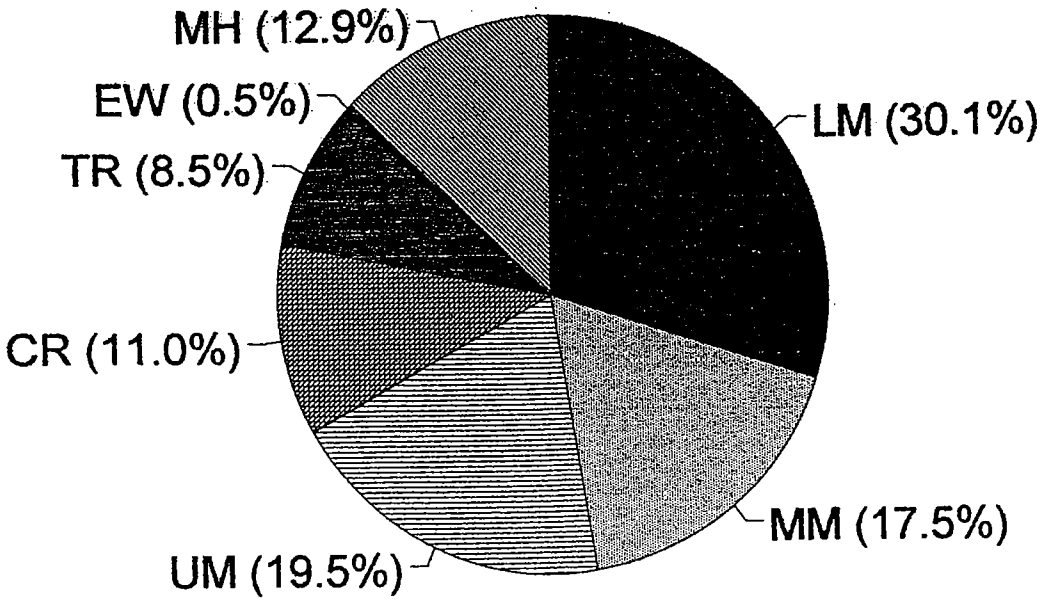
In order to separate lots by reach, the correlation list between river reaches and Section/ Township/Range was updated. Two attempts have been made to assign Section/Township/ Range blocks to river reaches, one by Ecology and one by Nim Titcomb. At first glance there appears to be considerable disagreement between these lists. However, essentially all of these are located in remote areas on National Forest where drainages converge at ridge-tops. In most areas of private land the lists are in agreement. The Okanogan National Forest maps were consulted in the few areas of disagreement on private land. The complete correlation list appears as Appendix A.

This lot tabulation does not distinguish between developed and undeveloped parcels.

Table 12
Existing Parcels by Size and River Reach
(1992)

Reach	0 - 1 acre	1 - 5 acres	5 - 20 acres	20 - 40 acres	40+ acres	Total Parcels
Lower Methow (LM)	241	445	736	448	291	**2,161**
Middle Methow (MM)	118	623	325	104	85	**1,255**
Upper Methow (UM)	434	592	231	70	75	**1,402**
Chewuch River (CR)	217	180	232	91	74	**794**
Twisp River (TR)	81	232	177	93	30	**613**
Early Winters (EW)	18	11	5	1	2	**37**
Methow Headwaters (MH)	595	170	93	18	15	**891**
TOTALS	**1,704**	**2,253**	**1,799**	**825**	**572**	**7,153**

Figure 2
Parcels by River Reach
(1992)



The information on size and river reach presented above compares favorably with the work done by Ecology in 1990 (Methow River Basin Single Domestic Water Use Estimate). This paper counted 9,164 parcels in the basin, which is higher than the number counted here. This may be due in part to the fact that mobile homes are given a parcel number by the County Assessor's office, separate from the parcel number of the land on which they are placed. There are 291 mobile homes listed on the tax rolls in the basin; they are not included in this count. Also, this count does not include the 530 lots inside the boundaries of Winthrop and the 580 lots within the boundaries of Twisp. These lots were excluded because they are served by the municipal water systems of the towns, and projections of future growth and water demand for the towns have been addressed separately in estimates from the towns to the Committee. If all mobile homes and in-town lots are included, the Assessors office lists 9,281 parcels as of May, 1993, which is rather close to Ecology's estimate.

Development History

Short Plats:

A total of 91 short plats were examined, covering the years 1984 through 1992. This is believed to represent all short plats approved for the Methow basin in this period. Short plats awaiting approval were not included in this count. Plats were separated by reach and by year, yielding the following data:

Table 13
Number of Lots Per Short Plat
(1984-1992)

Number of Lots	Plats	% of Plats
1	5	5.5
2	40	43.9
3	17	18.7
4	29	31.9

The average number of lots created via the short plat process was 2.8. Another important piece of information is the size of the parcels created. The table which follows summarizes the size of lots created depending on the number of lots contained in the short plat.

Table 14
Lot Sizes in Short Plats

Lot Number	Size
Lot 1	4.8 acres
Lot 2	5.2 acres
Lot 3	2.6 acres
Lot 4	2.2 acres

As can be seen, the greater the number of lots contained in the plat, the smaller the lots become. Research also found that the average size of the short platted parcel was 14.6 acres with the majority of the short plats located adjacent to improved County roads or state highways. The table on the following page summarizes the distribution of short plats and lots in short plats by river reach approved from 1987 through 1992.

Table 14
Distribution of Short Plats and Lots by Year and River Reach
(1987-1992)

	84	85	86	87	88	89	90	91	92	Total
EW plats	1	0	0	0	0	0	0	0	0	1
EW lots	4	0	0	0	0	0	0	0	0	4
HW plats	0	0	0	0	3	0	1	3	7	14
HW lots	0	0	0	0	9	0	3	9	21	42
UM plats	0	3	5	1	0	0	2	2	3	16
UM lots	0	12	15	3	0	0	4	6	6	46
MM plats	2	4	1	1	1	0	3	3	3	18
MM lots	8	13	2	2	4	0	10	8	7	54
CR plats	1	1	5	4	2	1	0	2	4	20
CR lots	4	4	13	10	6	2	0	4	10	53
TR plats	0	0	0	0	1	0	1	0	2	4
TR lots	0	0	0	0	2	0	2	0	4	8
LM plats	2	3	3	2	0	0	0	0	5	15
LM lots	7	8	6	6	0	0	0	0	12	39
TOTAL	**29**	**48**	**50**	**29**	**28**	**3**	**26**	**37**	**84**	**334**

Long Plats:

Since 1986 there has been only one Long Plat approved in the Methow Basin, according to County Planning Department records. This was the Methow Valley Estates plat, which was approved in 1987 creating 24 lots in the Chewuch River reach.

Planned Developments:

Planned Developments (PDs) include a variety of uses, not all of them residential. For the purposes of this study, residential lots in PDs were separated from those uses catering solely to the transient population, such as lodges, inns, and campgrounds. The Okanogan County Office of Planning & Development April 1993 monthly report lists 13 PD applications presently under review. Many of these PDs have been on hold for several years, primarily due to their inability to receive approval for group domestic water systems. These PDs were not included in the parcel count, since even if water systems were allowed, some may not be approved on other grounds. However, this method is misleading, since some of the approved PD's, which contained parcels which were counted, were approved with stipulations that limit building until group domestic water systems are approved. Until the water system question is resolved, either through a change in law or through re-submittal of the PD's as long plats or as PD's with well fields, the number of residential lots created through PD's must remain a moving target, and these numbers should be treated with caution.

For this study, all PD's approved since the mid-1980s were reviewed. Of these, 12 PDs with residential lots were approved between 1987 and 1993. The table on the following page presents the number of residential lots created by these PDs. The remaining PDs were for inns, campgrounds, lodges, and the like, and were not included in this count since they will not be used by permanent residents.

Table 16
Lots Created by Planned Development
(1987-1993)

Year	Upper Methow Lots	Methow Headwaters Lots	Chewuch River Lots	Lower Methow Lots
1987	0	30	0	0
1988	0	0	0	0
1989	11	0	0	0
1990	12	24	0	0
1991	0	0	0	0
1992	12	0	14	0
1993	9	0	0	40
Totals	**44**	**54**	**14**	**40**

Exempt Divisions:

Parcels may be divided without platting if the resultant parcels are over twenty acres. It is difficult to determine the number of exempt divisions which have occurred in the Basin, and not estimate is included here.

Building Permit Data

Building permits on file with Okanogan County were examined to determine patterns of development in the basin as a whole, within the separate reaches and that area north of the Weeman Bridge. While data on all types of building permits was collected, this report only presents data on permits issued for residential purposes. The following table summarizes, by reach, data on residential building permits issued from 1980 through 1992:

Table 17
Residential Building Permits
By Reach and Year
(1980 - 1992)

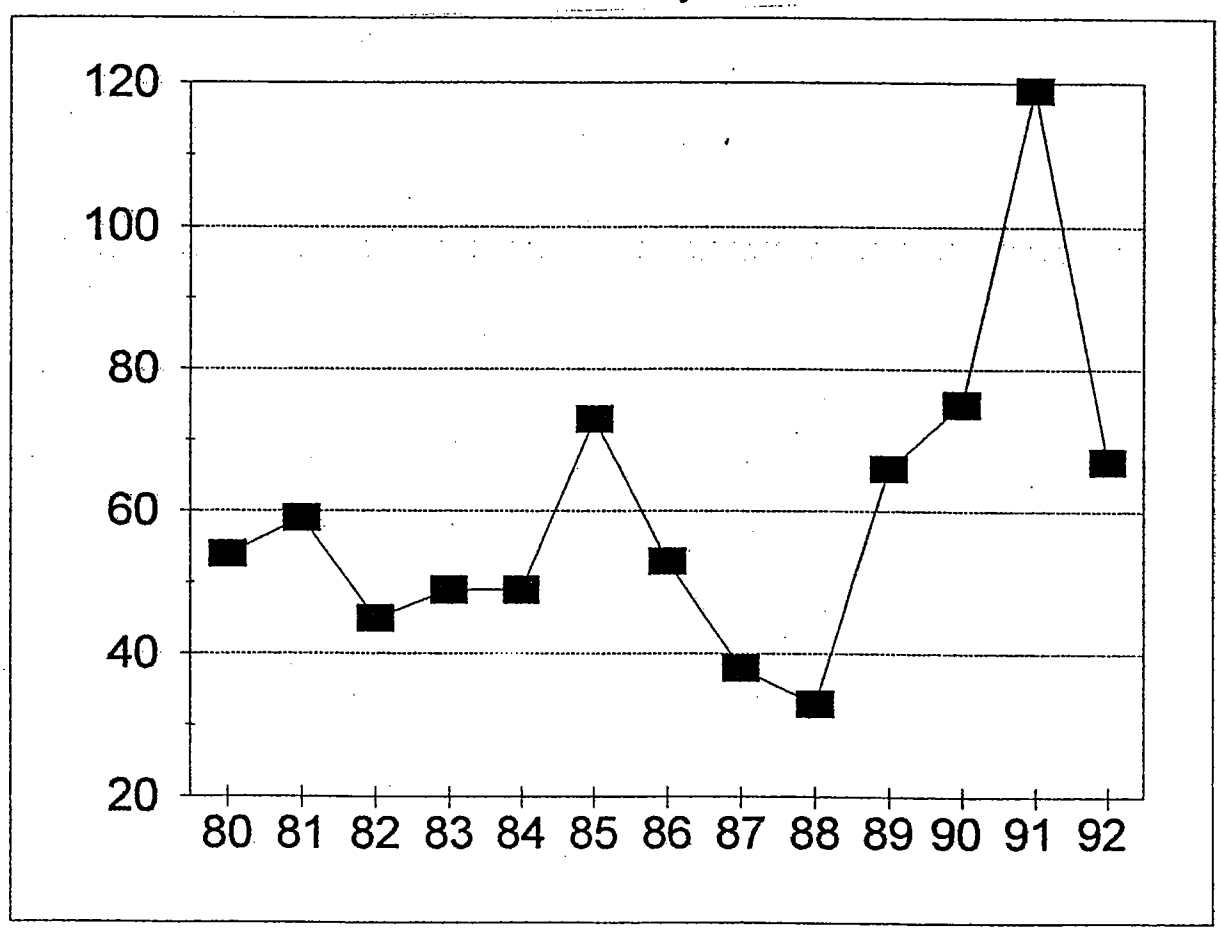
Year	Winthrop	Twisp	L M	MM	UM	TR	CR	EW	MH	TOT
80	2	3	17	14	5	5	5	3	5	59
81	5	1	14	17	7	4	12	0	5	65
82	1	8	21	5	4	4	6	1	4	54
83	7	4	17	15	3	2	9	0	3	60
84	5	12	14	14	7	2	6	3	3	66
85	3	6	18	11	14	8	18	1	3	82
86	3	7	17	11	14	2	6	1	2	63
87	1	5	12	6	8	3	5	0	4	44
88	2	6	12	0	10	6	4	0	1	41
89	5	2	25	9	18	7	6	0	1	73
90	0	0	26	17	16	2	9	0	5	75
91	2	0	26	23	18	9	24	2	17	121
92	1	1	20	18	10	5	14	0	0	69
TOT	**37**	**55**	**239**	**162**	**134**	**59**	**121**	**11**	**53**	**874**
%	**4.2**	**6.3**	**27.3**	**18.5**	**15.3**	**6.8**	**13.8**	**1.7**	**6.1**	

The above table summarizes building permits issued for residences of any type, including recreational cabins, year-round homes, etc. No separation was attempted between seasonal and permanent homes, partly because not all building permit cards note this distinction, and partly because seasonal homes are sometimes converted to permanent homes.

Also, county records include 33 residential permits which were issued for parcels within the Basin but did not include a section, township and range or parcel number. Of these, 14 were located in Winthrop or Twisp, leaving 19 residences which could not be located by river reach. These are not included in the above table. Building permit data from 1980 through 1993 is now available as a computer file, and where parcel numbers exist (the vast majority) this data can be integrated into the county's Geographic Information System.

The following figure graphically depicts the total number of permits issued by year within the basin.

Figure 3
Total Permits by Year



The following figure depicts the reach by reach distribution of total residential building permits issued from 1980 to 1992.

Figure 4
Residential Building Permits
By Reach
(1980 - 1992)

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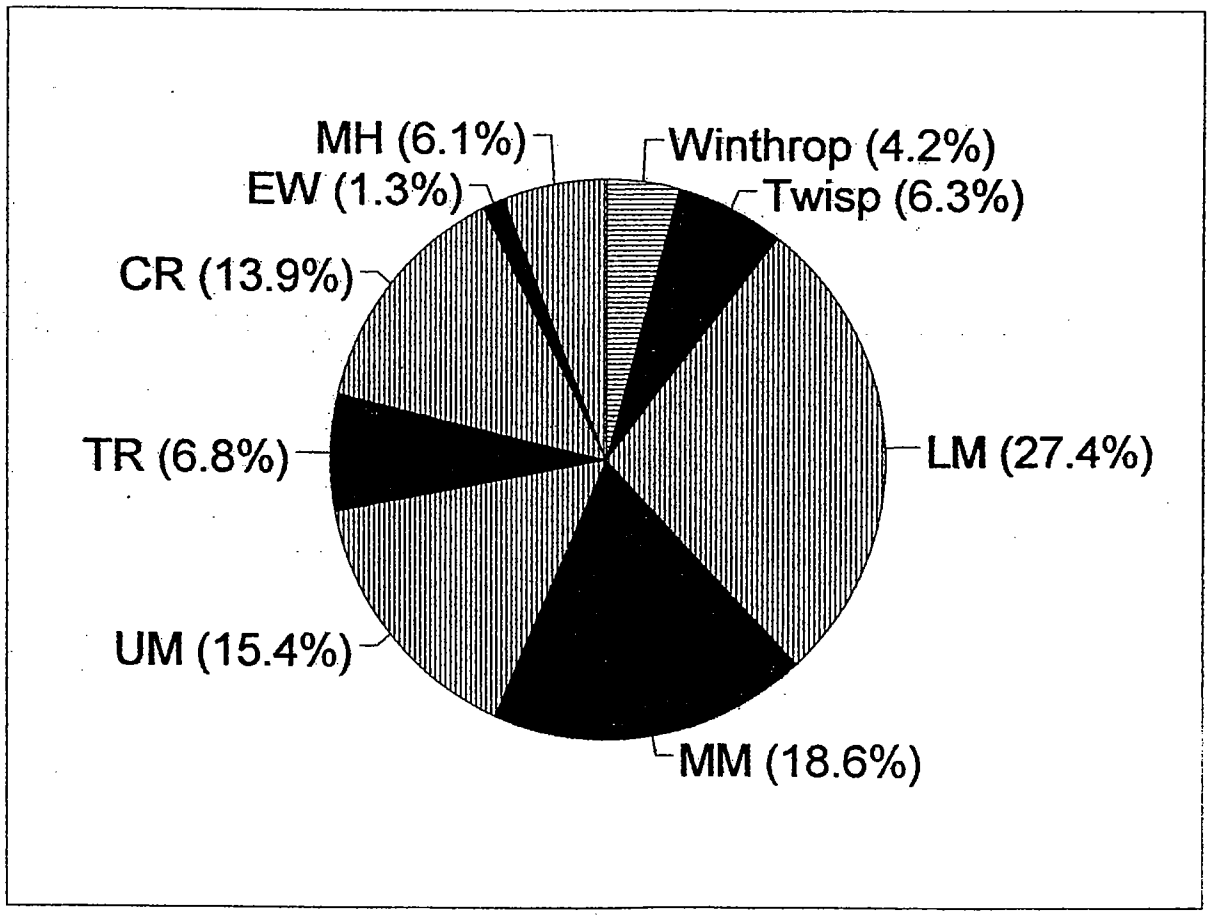


Real Estate Sales Data

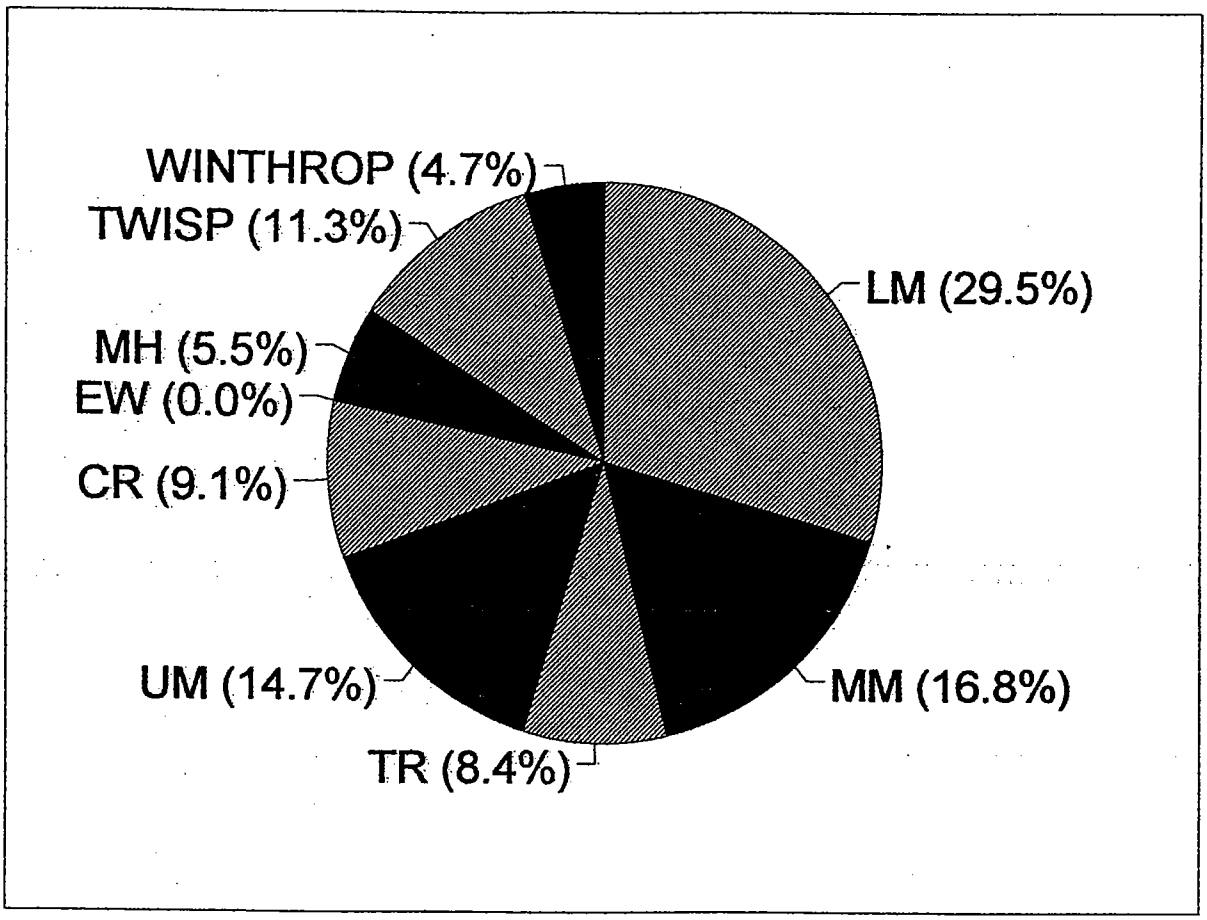
Records of 762 real estate sales in the Methow Basin between 1991 and May, 1993, as well as partial sale records from 1990 were examined. This represents all of the sales data available on the County computer system; earlier data would have to be searched by hand. While this data does not go back far enough to establish a trend, it does show where sales have occurred in the recent past.

Table 18
Real Estate Sales by Reach
(1991 - 1993)

River Reach	Number of Sales	Percentage of Total
Lower Methow (LM)	225	29.5
Middle Methow (MM)	128	16.8
Twisp River (TR)	64	8.4
Upper Methow (UM)	112	14.7
Chewuch River (CR)	69	9.1
Early Winters (EW)	0	0.0
Methow Headwaters (MH)	42	5.5
Twisp (tca 340)	86	11.3
Winthrop (tca 310)	36	4.7
Total	**762**	**100.0**

The data from the above table is graphically displayed on the following page.

Figure 5
Real Estate Sales by Reach
(1990 - 1993)



PART II: Analysis and Projections for Entire Basin

Projections

The following section contains an analysis and a variety of projections of potential population and growth for the entire Methow River Basin.

Rates of Growth

Permanent Population:

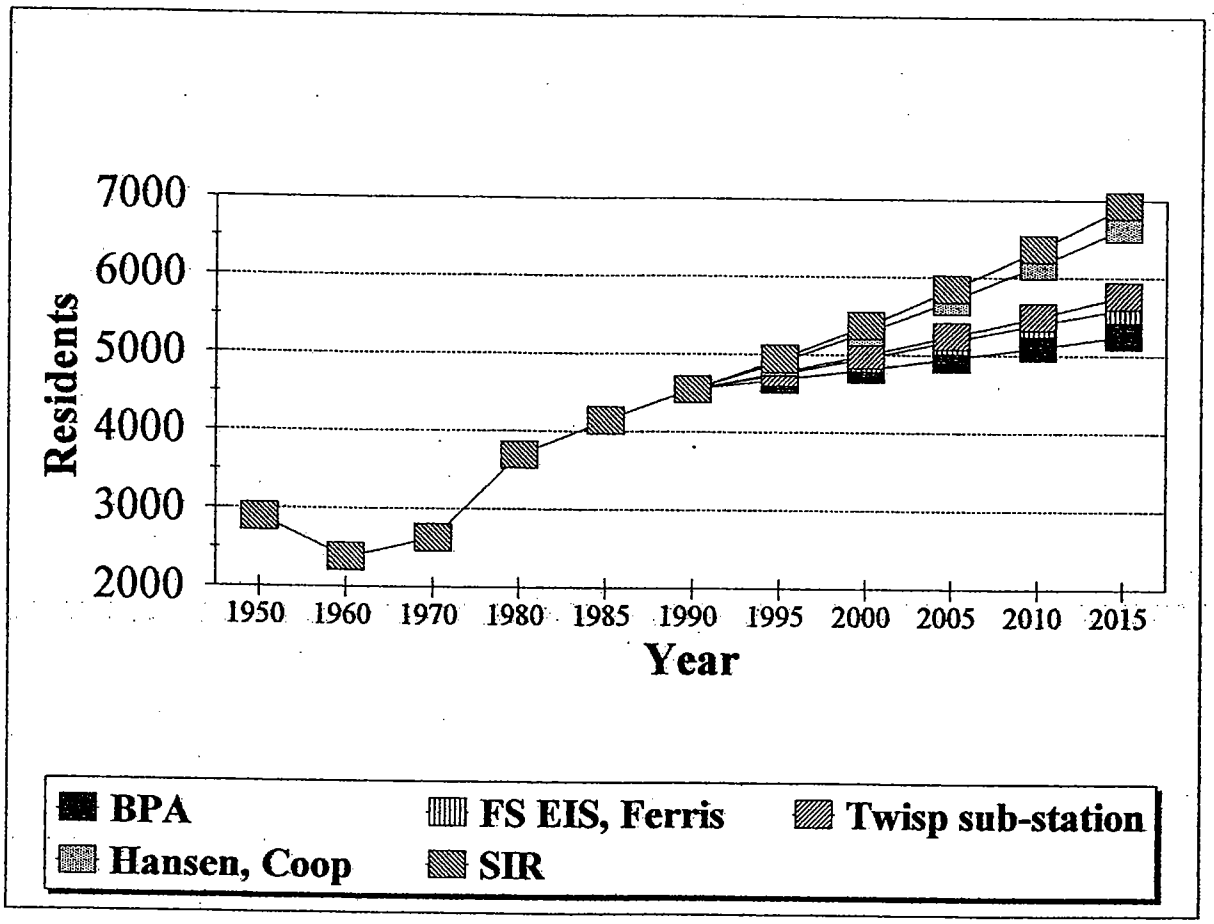
The following annual percentage rates for growth of permanent population were derived from the studies summarized in Part I.

Table 19
Population Growth Percentages
Permanent Residents

Source	Annual Percentage
BPA - 1989 County Forecast	0.58%
OFM and Ferris (low)	0.88%
BPA - Twisp Substation	0.96%
Electric Coop and Hansen	1.53%
SIR and Ferris (high)	1.70%

These percentages, which are for annual growth in permanent population, are applied to the 1990 baseline population of 4,544. The percentages quoted in Wilsey and Ham of 4.5 and 8.8 percent were not used since they were for the 1970 - 1980 period and were shown to be incorrect for the 1980 - 1990 period. The growth rates for school enrollment and for new telephone service were excluded since they apply to only part of the population. The figure which follows depicts population projections using the annual percentages contained in the above table.

Figure 6
Permanent Population Projections



Seasonal Population:

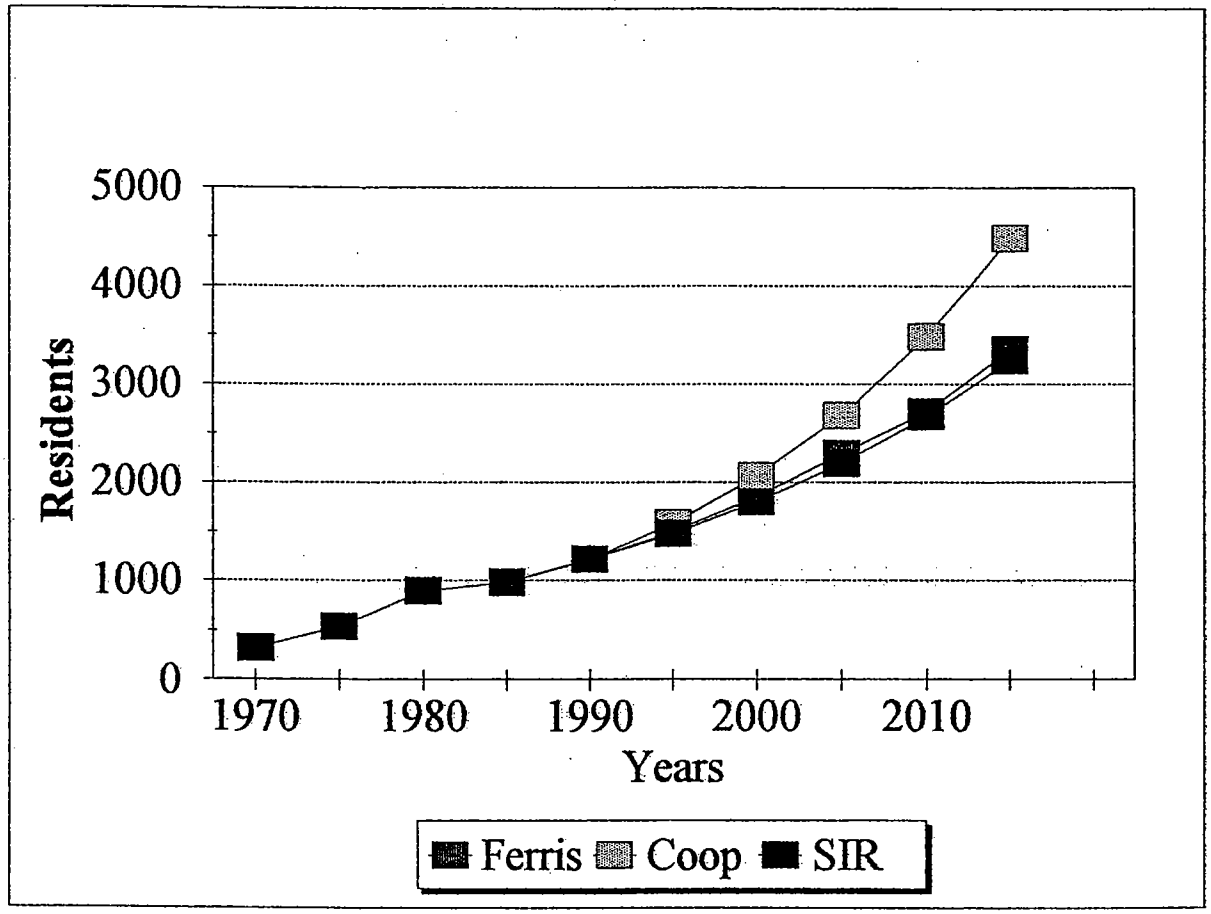
The following table contains estimates of percentages for annual growth in seasonal residents.

Table 20
Population Growth Percentages
Seasonal Residents

Source	Annual Percentage
SIR	4.0%
Ferris	4.3%
Electric Coop	5.4%

These have been applied to the estimated 1990 baseline population of 1,215. These growth rates are more speculative than those for permanent residents, as they are based primarily on data from the Okanogan County Electric Coop, which does not serve the entire Basin. The figure on the following page depicts growth in seasonal population using the above percentages.

Figure 7
Seasonal Population Projections



Using Parcels to Predict Population Growth

In June, 1993, the Basin contained 7,153 parcels exclusive of those within the incorporated towns. A rough projection of potential population growth using an estimate of 2.4 residents per parcel (assumes each parcel would be occupied by a dwelling) times the 7,152 parcels would yield a total of 17,169 people at full buildout. This figure represents an increase of 12,625 over the present population. Keep in mind that this calculation does not include population increases inside the incorporated communities. Also note that this total is larger than any of the population projections for the year 2015 presented above. Of course, some lots will be occupied by tourist accommodations, some will be occupied seasonally, others are unbuildable by virtue of size or location, and many others could still be subdivided. A more meaningful analysis of the population potential of full buildout would require more detailed study of specific areas.

Some river reaches contain large numbers of vacant lots, as shown by the following table. The implication of this table is that for these reaches, substantial population growth could occur even in the absence of further subdivision.

Table 21
Parcels and Population
by
River Reach

Reach	Number of Lots	Population
Lower Methow	1,581	1,473
Town of Twisp	580	876
Middle Methow	1,255	390
Town of Winthrop	530	325
Twisp River	613	731
Upper Methow	872	369
Chewuch River	794	293
Early Winters	37	25
Methow Headwaters	891	62

The information from the preceding table is graphically depicted below.

Figure 8
Parcels and Population
by
River Reach

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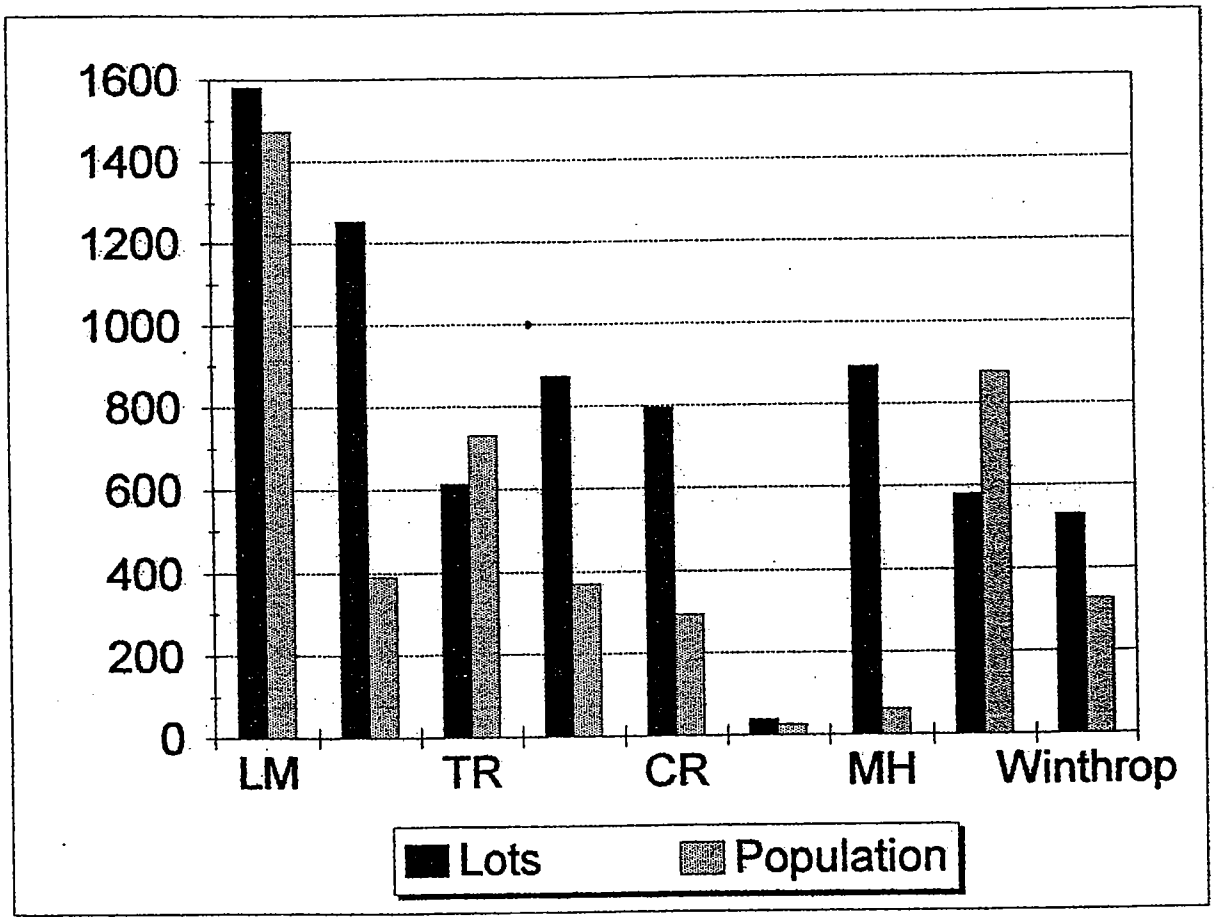


Please note that the population figures for the Lower Methow and Middle Methow reaches have been adjusted to remove the population of Twisp and Winthrop. Thus, the populations and lots shown are for unincorporated areas unless shown as Town of Winthrop or Town of Winthrop.

Water Use Estimates

The following section presents estimates of water use at present and in the future.

Current Use

Estimates of current water use are summarized from Klohn-Leonoff's report, "Methow Valley Water Planning Pilot Project Proposed Water Conservation Standards." (1993).

For the town of Twisp, the average daily residential water use is estimated to be 220 - 260 gallons per household, or 92 - 108 gallons per capita per day (gpcd). Klohn-Leonoff noted that Winthrop appears to be using about twice as much water per capita as Twisp, both in water pumped and in sewer flows returned. They speculate that this may be the result of the larger tourist population in Winthrop. They note that Winthrop's rate of use is similar to those experienced by the City of Leavenworth prior to the installation of water metes. Winthrop also experiences a substantial discrepancy between the amount of water pumped and the amount returned as sewer flows, even in the winter months when there is no outdoor use.

The Klohn-Leonoff report also lists the following two standard estimates of current indoor water use:

- Department of Housing and Urban Development (1984): 77 gpcd or 185 gpd per household for the Methow Valley . (Household size is assumed to be 2.4 persons throughout). This figure is also quoted in the Department of Ecology Focus sheet entitled "Conserving Water in Your Home." (January 1991).

- American Water Works Association (1987): 150 gpcd or 360 gpd per household.

The Washington Rural Water Association (WRWA) was also contacted for this study. WRWA suggested use of the Washington State Health Department figure of 168 gpcd or 403 gpd per household, even though they felt this figure was a bit high.

Klohn-Leonoff's Methow Valley estimate of 220 - 260 gpd per household, quoted above, is equivalent to 92 to 108 gpcd, which is within the range of the estimates from the other referenced sources. The following table summarizes these water use estimates both per capita day and total gallons per day per household.

Table 22
Daily per Capita and Household Water Use Estimates

Source	Gallons Per Day Per Household gpd	Gallons Per Capita Day gpcd
Klohn-Leonoff	220-260 gpd	92-108 gpcd
Housing and Urban Development (and Ecology)	185 gpd	77 gpcd
American Water Works Association	360 gpd	150 gpcd
Washington Rural Water Association (and Department of Health)	403 gpd	168 gpcd

Using the range of use cited above, the estimated current water use by permanent residents can be roughly estimated. The following table uses the population per river reach, outside of the incorporated area, and the 1990 population for Winthrop and Twisp multiplied by the low figure of 77 gpcd and the high figure of 168 gpcd. The resulting figures are for indoor use only, and for permanent population only.

The following table gives conversions between commonly used flow and volume measurements:

Table 23
Conversion Table for Flow and Volume Measurements

1 mg (million U.S. gallons)	=	3.07 acre-ft.
1 acre-foot	=	325,000 U.S. gallons 43,560 cubic feet
1 cubic foot/second (cfs)	=	0.645 mgd (million gallons per day) 645,000 gpd (gallons per day)
1 inch of rain	=	approx. 27,200 gallons per acre
1 mgd (million gallons per day)	=	1.547 cfs
1 cfs	=	1.98 acre-ft. per day

Table 24
Estimated Daily Indoor Water Use by Permanent Population

Reach	Population	Water Use at 77 gpcd	CFS	Water Use at 168 gpcd	CFS
Lower Methow	1,473	113,421.00	0.18	247,464.00	0.38
Middle Methow	390	30,030.00	0.05	65,520.00	0.10
Twisp River	731	56,287.00	0.09	122,808.00	0.19
Upper Methow	369	28,413.00	0.04	61,992.00	0.10
Chewuch River	293	22,561.00	0.04	49,224.00	0.08
Early Winters	25	1,925.00	0.00	4,200.00	0.01
Methow Headwaters	62	4,774.00	0.01	10,416.00	0.02
Winthrop	325	25,025.00	0.04	54,600.00	0.08
Twisp	876	67,452.00	0.10	147,168.00	0.23
Total	**4,544.00**	**349,888.00**	**0.54**	**763,392.00**	**1.18**

Potential Reduction Through Conservation

Implementation of conservation strategies can significantly reduce the gpd and gpcd figures cited above. The Klohn-Leonoff paper presents target figures of 71 gpcd (170 gpd per household) for homes retrofitted with conserving fixtures, and 58 gpcd (140 gpd per household) for new construction. This target is reached by application of conservation strategies listed in the Klohn-Leonoff report, and the use of ultra-low flow fixtures for new construction. Please note that these figures are for indoor use only. Klohn-Leonoff also estimate that a 50 percent reduction is possible in outdoor water use through incentives such as metering and education programs on efficient water use and xeriscaping.

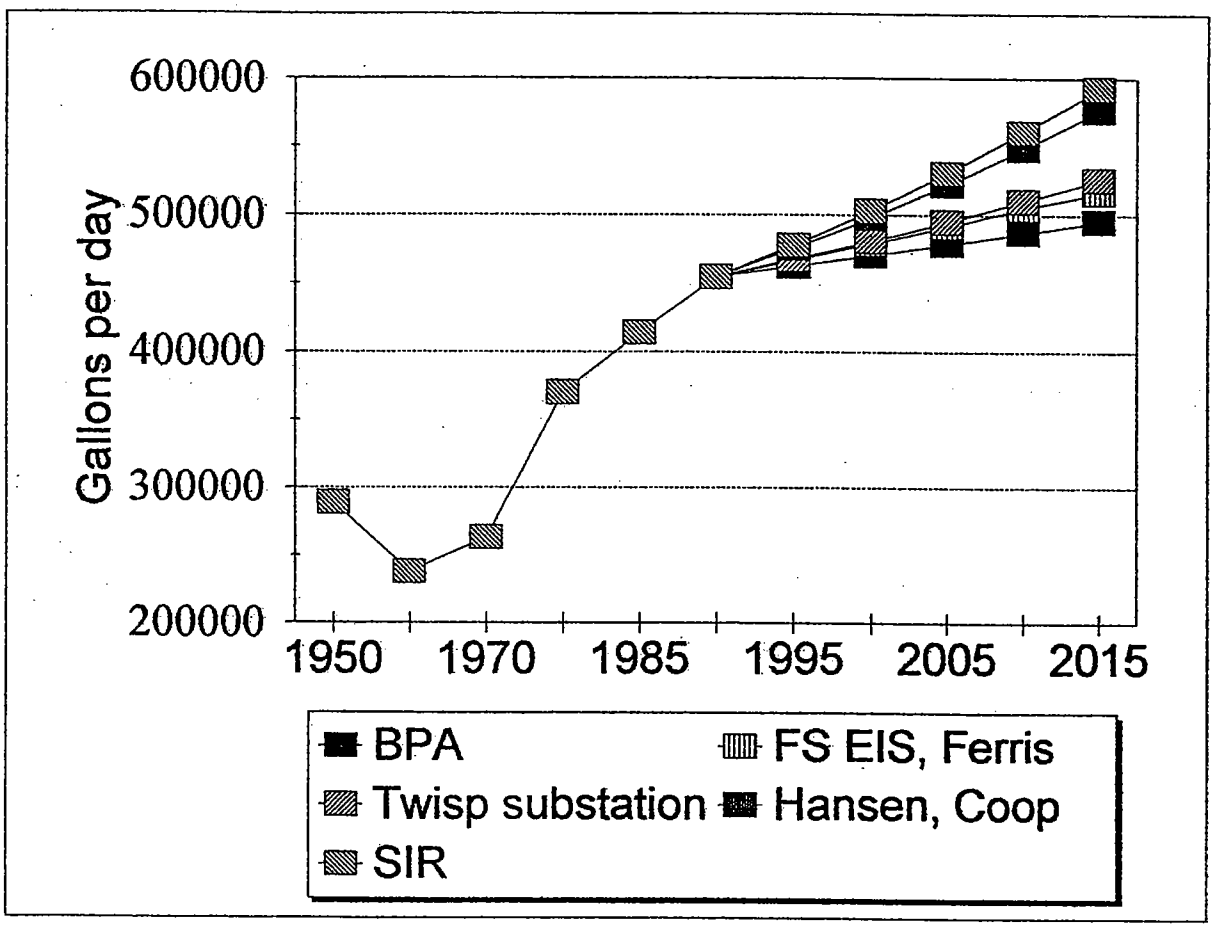
Application to Population Figures

Figure 9 depicts historical and potential future water use (indoor only) for the Basin as a whole. The consumption figures were derived using a figure of 100 gpcd for past and present population and 58 gpcd figure for future population. The figure 100 gpcd

is a median based on the range of estimates given above. The low figure for future population is assumed since all new construction will fall under conservation plumbing codes that went into effect July 1, 1993.

For reference, one cubic foot per second is equivalent to 645,000 gallons per day, (Technical Supplement to the Hydrographic Atlas. Okanogan -Methow River Basins Study Area. Osborn and Sood. 1973.)

Figure 9
Historical and Projected Indoor Daily Water Use



The preceding graph must be treated with caution, for the following reasons:

1. It is for indoor use only. Most Valley residents will insist on growing some lawn, garden, etc.

2. New construction may not always meet the standard set above, regardless of code requirements.

3. Family size may be different from the assumptions.

4. This graph does not include any water use for seasonal residents.

5. Figures for current per capita use may differ from the 100 gallons used.

PART III: Development Potential North of the Weeman Bridge

In response to the Pilot Project Committee's request, the following section was added to the general Basin study. This Part of the report contains data on existing development and rough estimates of the development potential for the area north of the Weeman Bridge in the Methow River basin.

Study Area

The area studied includes private lands in the upper Methow River Basin, north of the Weeman Bridge on SR 20. The area includes all of the Methow Headwaters and Early Winters river reaches, and a portion of the Upper Methow reach. Included are all of Township 36, Range 19, Township 36/Range 20 and sections 2 - 11 of Township 35, Range 20.

Parcels

The number of parcels in the study area were derived from records of the Okanogan County Assessor. This count found the total number of parcels to be 1,529.

"Developed" and "Vacant" Parcels:

The number of parcels presently developed is, in part, a matter of definition. This report attempts to estimate which lots are occupied by a structure in which people can live. The County Assessor's field sheets were examined to determine what improvement value for a parcel appeared to qualify as a cabin, and a value of $5,000 was chosen. Parcels with an improvement value under this number were assumed to be vacant. This count will be in error where there are outbuildings with a value over $5,000 but no house, or where a cabin exists which is valued under $5,000.

Using this definition, the number of developed parcels was determined to be 224. This then means that 1,305 parcels are vacant.

"Buildable" Parcels:

Although the parcels listed as vacant all have legal existence, not all can be developed. Health department regulations limit the size of parcels which can have a well and septic system, zoning regulations prohibit structures for human habitation in the 100 year floodplain and flood damage prevention regulations prohibit development of parcels which are entirely within the floodway. The list of vacant parcels created above was examined and compared to known group water systems and to floodplain maps. Parcels which were too small to meet Health District minimum standards or were within the floodplain and floodway were counted as unbuildable. This method for determining buildable parcels assumed the following:

- All parcels lying entirely within the floodplain are unbuildable.
- All parcels over 1.0 acres are buildable if not in floodplain, possibly with the requirement for mound systems.
- For parcels not served by a group water system, parcels under 1.0 acres will not receive Health District approval for a septic field.
- For developments served by a group water system, parcels under .33 acres will not receive Health District approval for a septic field.
- For developments served by a group water and group sewer system, essentially all parcels will be buildable if not in floodplain.

Discussion:

The assumptions listed above err towards the presumption that, in cases of doubt, approval to build will be granted. While this appears consistent with actual practice and with prudent planning, it will not always be accurate. For instance, to receive approval for a 1.0 acre lot, a higher-cost mound-style septic system will often be required rather than a standard drainfield. However, such systems have been built in the study area as a condition of short plat approval, indicating that this is considered a viable option by at least some property developers. Some parcels which are too small could be developed by acquiring an easement to locate a well on an adjacent property. Current Health District policy is to handle applications on a case-by-case basis, assuming State standards can be met, and in some cases they have required larger lots. The 1.0 acre limit was suggested by Health District staff as a safe planning assumption.

Another critical assumption was that lots in long plats with sizes under one acre often do not have acreage listed. In these cases, size determination was made by reference

to the plat maps. Also, all group water and sewer systems in the study area were located, and their service areas identified insofar as possible. The capacity of the sewer and water system was assumed to be adequate to serve the development with which it was associated unless other information was provided by Health District staff.

Floodplain and floodway areas were identified from FEMA maps. This process was not absolutely accurate: the floodplain maps have not been overlaid onto parcel maps, and judgements had to be made by eye. Also, the FEMA maps themselves are subject to some controversy. The GIS work being conducted by EES, Inc, should help clarify some of the potential errors in identification of parcels within floodplain areas.

Finally, it should be noted that this estimate does not attempt to predict which, if any, of these lots will actually be developed, or how quickly this might occur.

Results:

The results of applying the assumptions noted above found that of 1,305 vacant parcels, approximately 190 were considered unbuildable due to floodplain or insufficient size to meet septic requirements. This is approximately 14.5% of vacant parcels. This leaves approximately 1,117 parcels which could be built upon.

Group Water and Sewer Systems

A search of the records of the Okanogan County Health District found 26 group water systems in the study area, (listed in Appendix B). These systems currently have 63 residential and 48 non-residential connections, serving a permanent population of 155 and a maximum seasonal population of 295. Some of these are seasonal residents and some are non-resident tourists. Separation of these two groups has not been attempted. The study area also contains four group sewer systems, with a fifth permitted but not yet constructed. Most of the group water systems serve campgrounds and quasi-commercial uses such as lodges. Only a few serve significant numbers of residential lots. The largest are the Edelweiss Maintenance Commission Water System and the Lost River Airport Association Water System, with several other planned developments and smaller subdivisions contributing small numbers of potential hookups.

Building Permit History

A total of 134 residential building permits were issued in the study area between 1980 and 1992. Of these, approximately 90 were in areas with group domestic water supplies. A breakdown of these permits by year is contained in the following table.

Table 25
Residential Building Permit History
North of Weeman Bridge
(1980 -1992)

Year	Permits	Year	Permits
1980	9	1986	4
1981	8	1987	8
1982	7	1988	3
1983	4	1989	11
1984	7	1990	12
1985	9	1991	24
		1992	4

The average number of permits issued is 9 per year.

Dividable Parcels

Subdivision of parcels is governed by the Okanogan County Subdivision and Zoning Ordinances. The study area is in the Methow Review District, and all but around 80 acres is classified Valley Floor. As such, the minimum size for a platted lot is five acres, and thus a parcel must be at least 10 acres to be divided. There are 125 parcels of 10 acres or greater.

However, some of these parcels are part of planned developments or have other covenants preventing further subdivision. In counting dividable parcels, the following assumptions were used:

- Parcels which are part of a Planned Development will not be further divided, even if over 10 acres. Parcels which are part of PD's were examined individually, and almost all are listed as "Open Space" portions of the PD.

- Federal property, such as that owned by the Forest Service at the Early Winters Visitors Center, will not be further divided.

- Property owned by churches, such as the Mazama Bible Camp, will not be further divided.

- Parcels in open space or common use area in long plats, such as the common area in the Edelweiss development, will not be further divided.

Conversations with John Hayes, a local land use planning consultant, and others indicate that parcels exist which have deed restrictions prohibiting development of some or all of the property. These deed restrictions typically do not appear on Assessor's records which makes determination of the exact number of such parcels difficult if not impossible, however, the number is not large. For the purpose of this study, 10 such parcels are assumed. Also, the search of Assessor's records reveals no parcels owned by the State Department of Wildlife in the study area.

Results:

Of the 125 parcels of ten acres or greater, 14 are part of Planned Developments, are common space in long plats, or are federal or church property. Ten were assumed to have some form of deed restriction on further development. This leaves 101 parcels which can be further subdivided. Of these, 21 are 40 acres or larger, and could be divided through exempt division into 20 acre parcels.

For the area as a whole, 101 parcels represents 6.6% of the total of 1,529 parcels. Thus, given the assumptions, 94.4% of the parcels cannot be further subdivided. However, this calculation is somewhat misleading, since it does not represent land area. The parcels which can be subdivided are the larger parcels. Parcels which can be further divided represent approximately 3,600 acres.

Accurate acreage calculations for the fully divided land cannot be easily made, since 482 lots of under one acre do not have an acreage figures listed on the Assessor's records. However, a rough estimate could be made as follows: parcels under 10 acres with listed sizes total 1,525 acres. If the 482 lots with no acreage listing average .5 acre each, this would represent 241 additional acres. Of parcels over 10 acres, those known to be in Planned Developments, church property, federal property or other common use represent another 408 acres. Altogether, this comes to around 2,170

acres which cannot be further divided. (This does not include those parcels with deed restrictions.)

The total of these two figures is approximately 5,770 acres, thus the 101 parcels which can still be divided represent around 62% of the total private lands in the study area, with fully divided land representing the remaining 38%. Obviously, these figures should not be taken as exact.

Summary

- There are a total of 1,529 parcels in this area.
- Of these, approximately 224 are presently developed, and 1,305 are vacant.
- Of the 1,305 vacant parcels, approximately 190 were judged unbuildable due to floodplain or size constraints. This represents 14.5% of the vacant lots. Thus, 1,117 vacant lots remain which can be developed without further subdivision.
- Of the approximately 1,117 vacant, buildable parcels noted above, approximately 570 are in areas served by group domestic water systems. This is just over 50% of the vacant, buildable parcels.
- The number of parcels which can be further subdivided is approximately 101. These parcels represent approximately 3,600 acres, or around 62% of the private lands in the study area.
- The parcels which cannot be further divided represent approximately 2,170 acres, or around 38% of the private lands in the study area.
- A total of 134 residential building permits were issued in the study area between 1980 and 1992, with yearly totals between 4 and 24. Of these, approximately 90 were in areas with group domestic water systems.

Please keep in mind that these estimates rely on a number of assumptions. Some are more reliable than others, but all should be treated as approximate. Assumptions and cautions are stated throughout the text. Valuable information was provided by Okanogan County staff, local realtors and land developers.

Further Study

This study of the area north of the Weeman Bridge has not attempted to estimate what densities could result from further subdivision. This would depend on a number of factors, including at least the following:

- Will the status of group domestic water systems change?
- How many PD's are currently in preparation, and which properties do they involve?
- Will a sewer system be developed in Mazama, and what will be its service area?
- What kind of development will take place on the R.W. Merrill property?
- What effect will County completion of required Growth Management Planning have on the study area?

Another factor that could change the results of this report is the submittal of six PD's which have not yet approved in the study area. Others are known to be in preparation but have not yet been submitted.

PART IV: Summary and Conclusions

The studies reviewed quoted a range of expected population growth for permanent residents of between 0.58 percent (BPA) and 1.7 percent (SIR) annually. This would result in an increase in the present population of 4,544 (1990) to between 5,251 and 6,926 in 2015. The studies reviewed quoted a range of expected population growth for seasonal residents of between 4.0 (SIR) and 5.4 percent (REA) annually. This would result in an increase in the estimated 1990 seasonal population of 1,215 to between 3,239 and 4,486 in 2015.

A sufficient number of lots exists to accommodate the entire projected growth of permanent and seasonal population to 2015 without further subdivision. In no reach is the Basin approaching buildout of existing lots.

Growth in the Basin has generally occurred outside of the incorporated towns and the commercial centers of Mazama, Carlton and Methow. Although these areas are zoned for higher densities and allow commercial development, this has not been a sufficient inducement for residential growth to occur there, thus the notion that development has been occurring in "growth nodes" has not been borne out by actual experience.

Substantial unanswered questions remain about population growth in the Basin. Among them are the following:

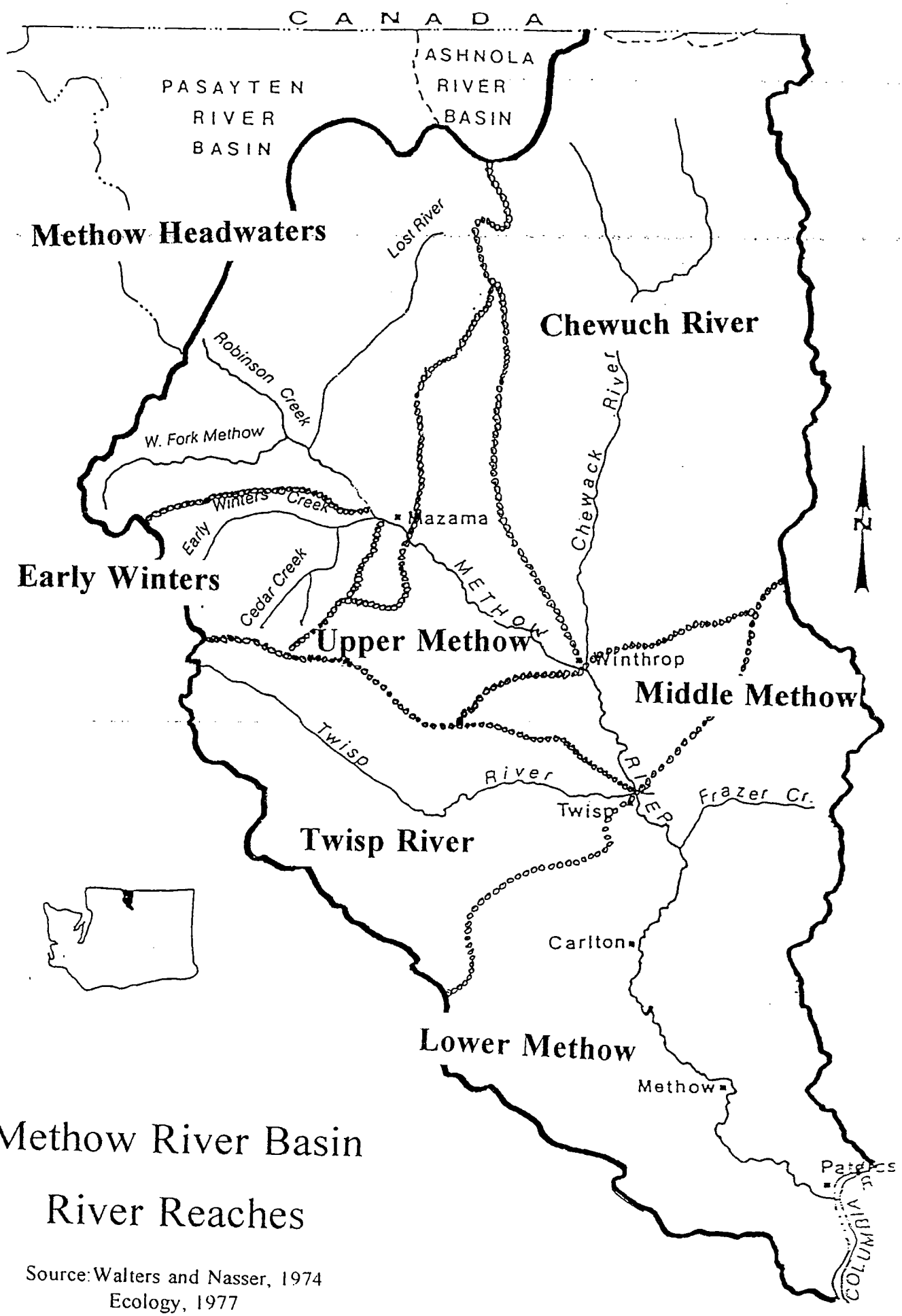
1. How shall we adjust growth estimates for the Methow Review District to reflect the basin as a whole? Earlier studies have often focused on the Methow Review District, which extends only to Carlton. How much shall projections of overall growth be modified?

2. Will the Planned Developments which are now unable to get approval for group domestic water systems re-apply as long plats in order to get around the limitation on group domestic water systems? If so, more lots will be created, but lower overall population densities will be allowed.

3. What level of development will take place at Early Winters?

4. Will the relatively large number of small lots in the upper Basin become the norm for areas outside of the Methow Review District where the 5-acre minimum does not apply?

5. Will the Town of Twisp be successful in converting the former mill site into an industrial area? Will such an area, if successful, draw more residents to the area?



Methow River Basin

River Reaches

Source: Walters and Nasser, 1974
Ecology, 1977

Appendix A: Correlation list between river reach and T/R/S block

Lower Methow:

Township	Range	Section
29N	22E	1 - 6, 8 - 15, N 1/2 16
29	23	2 - 11, 14 - 18
30	21	1 - 6, NE 1/2 7, 8 - 16, NE 1/2 17, NE 1/2 21, N 1/2 22, 23 - 24, NE 1/2 25, NE 1/4 26
30	22	1 - 36
30	23	4 - 9, SW 1/4 10, 15 - 22, SW 1/3 26, 27 - 34, SW 3/4 35
31	21	1 - 36
31	22	1 - 36
31	23	W 1/2 2, 3 - 10, SW 1/2 14, 15 - 23, 26 - 34, NW 1/2 35
32	20	1 - 30, 32 - 36
32	21	1 - 36
32	22	1 - 36
32	23	1 - 36
33	21	24 - 26, 35, 36
33	22	1 - 4, 9 - 17, 19 - 36
33	23	1 - 36
34	22	1, 2, 10 - 15, 22 - 28, 34 - 36
34	23	1 - 36
35	23	1 - 36

Middle Methow:

Township	Range	Section
33N	22E	5 - 8
34	21	1,2, 11 - 30, 35, 36
34	22	4 - 9, 16 - 21, 29 - 33
35	22	32

Twisp River:

Township	Range	Section
33N	19E	1 - 36
33	20	1 - 36
33	21	1 - 23, 27 - 34
33	22	18
34	18	1 - 36
34	19	S 1/2 12, 13 - 14, S 1/2 15, S 3/4 16, 17 - 36
34	20	7 - 9, 15 - 18, SW 1/2 14, 19 - 23, SW 1/2 24, 25 - 30

Chewuch River:

Township	Range	Section
35N	21E	1 - 16, NE 1/2 17, NE 1/2 21, 22 - 27, NE 1/2 34, 35 - 36
35	22	1 - 31, 33 - 36
36	20	1,2, E 1/2 10, 11 - 14, E 1/2 15, 23 - 25, E 1/2 26, NE 1/2 35, 36
36	21	1 - 36
36	22	1 - 36
36	23	3 - 10, 15 - 21, NW 1/2 22, NW 1/2 28, 29 - 32
37	20	1,2,11 - 14, 23 - 26, 35, 36
37	21	1 - 36
37	22	1 - 36
37	23	3 - 10, S 1/2 11, SW 1/4 12, NW 1/4 13, NW 1/4 14, 15 - 22, W 1/2 27, 28 - 34
38	22	1 - 36
38	23	W 1/2 3, 4 9, W 1/2 10, SW 1/4 15, 16 - 22, 27 - 34, SW 1/3 35

Upper Methow:

Township	Range	Section
34N	19E	1 - 5, 8 - 12, N 1/2 15, N 1/2 16
34	20	1 - 6, 10 - 13, NE 1/4 14
34	21	3 - 6, 7 - 10
35	19	1,2, 11 - 14, N 1/2 15, E 1/3 22, 23 - 26, SE 3/4 27, S 1/2 28, S 1/2 29, S 1/2 30, 31 - 36,
35	20	1 - 36
35	21	18 - 20, SW 1/2 21, 28 - 33, SW 1/2 34
36	20	16 - 22, W 1/2 26, 27 - 30, 33, 35
37	20	3 - 10, 15 - 22, 27 - 34

Methow Headwaters:

Township	Range	Section
36N	19 E	N 1/2 25, 26, SE 1/2 34, 35 - 36
36	20	30 - 32
37	19	1 - 36

Early Winters:

Township	Range	Section
35N	18E	1 - 17, E 1/2 18, E 1/4 19, 20 - 25, N 1/2 26, 27, N 1/2 28, N 1/2 29
35	19	3 - 10, W 1/2 15, 16 - 22, NW 1/3 27, N3 1/3 28, N 1/2 30
36	19	19 - 22, 27 - 33

Appendix C: Group Domestic Water Systems North of Weeman Bridge

Further information on all of these water systems is available from the Okanogan County Health District in Okanogan.

Early Winters Visitor Information Center Water System
Edelweiss Maintenance Commission Water System
Lost River Airport Association Water System
Mazama Country Inn Corporation Water System
Rainy Pass Water System
Riverbend Campground Water System
Timberline Meadows P.D. Water System
Washington Pass Well Water System
Ballard Campground Water System
Buck Lake Campground Water System
Chokecherry Inn Water System
Deer Run P.D. Water System
Heath Short Plat Water System
Heath Short Plat Water System #2
Liberty Woodlands Water System
Mazama Country Store Water System
Mountain Valley P.D. #91 Water System
North Cascade Base Camp Water System
Rainbow Pine Heliport Water System
Riverfront Partners P.U.D. Water System
Storey Water System
Talus Planned Unit Development Water System

An estimate of the potential for single-family development in the Methow Valley

October 22, 2003

Prepared for:

The Methow Basin Planning Unit
and
Okanogan County

by:

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P. O. Box 1431
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An estimate of the potential for single-family development in the Methow Valley

This report was developed to estimate the number of parcels that will be subject to the 2 CFS reservation in the Methow River basin (WRIA 48) at build-out. To do that, Highlands Associates has developed the following estimates:

- The number of parcels currently developed for single-family use
- The number of parcels that could be developed for single-family use under current zoning, including existing parcels and parcels that could be created by subdivision
- The number of existing single-domestic wells that pre-date the adoption of the Methow River Basin Management Program and so are exempt from the 2 CFS reservation
- The number of parcels that could be subject to the 2 CFS reservation at build-out

All of the estimates can be found in Table 1 on page 5.

Estimates were developed as follows:

Parcels currently developed and potentially developable for single-family use

GIS mapping and analysis

1. Downloaded Okanogan County's current parcel, zoning, shorelines, and floodplain data was
2. Downloaded subbasin and closed basin boundaries provided by Golder Associates
3. Downloaded well adequacy data provided by Okanogan County Health District
4. Created a GIS map for each of the seven reaches in the basin
5. In each map, added columns to the relational database for attributes to be used in analysis: Methow Conservancy easements, Common Area or Open Space designation, Zoning, shorelines and floodplain designations, water adequacy
6. Assigned attributes to each parcel
7. Eliminated publicly-owned parcels (including land owned by cemetery districts, PUDs, irrigation districts, towns, Okanogan County, state agencies, and federal agencies) and land without owners (primarily rights of way; also islands and similar undevelopable land)
8. Eliminated the Early Winters reach, as there are no privately-owned parcels to analyze
9. Output the data about remaining privately-owned parcels to spreadsheets (one for each reach)

Spreadsheet analysis

1. Parcels sorted by TCA
2. Town parcels deleted. Parcels in towns are served by public water systems and are not subject to the 2 CFS reservation
3. Parcels sorted by DOR code (use classification)

4. Parcels developed for single-family use segregated. Includes: codes 11, 19, and 81 0; and codes 81, 83, & 91 w/WA in comments. "WA" indicates that the Okanogan County Health District has issued a water adequacy certificate for a dwelling since April 14, 1992
5. Parcels identified as undeveloped or in agricultural use (DOR codes 81, 82, 83, 91, 92, 93, 96, 97, 99) segregated
6. All other parcels deleted
7. Parcels in closed basins segregated
8. Undeveloped/agricultural use parcels sorted by size
9. Undeveloped/agricultural use parcels too small to develop (<3 A.) deleted
10. Undeveloped/agricultural use parcels sorted by zoning
11. Undeveloped/agricultural use parcels in each zoning classification (MRD1, Uplands, Valley Floor, etc.) sorted by size
12. Within each zoning classification, undeveloped/agricultural use parcels large enough to develop but too small to divide segregated. Each will be counted as one potential single domestic use
13. Column for number of lots inserted
14. For each undeveloped/ agricultural use parcel large enough to be divided, potential number of lots under current zoning entered. Note that the number entered is the total number of lots, not the number of new lots. Each will be counted as one potential single domestic use
15. Parcels developed for single-family use sorted by zoning
16. Parcels developed for single-family use in each zoning classification (MRD1, Uplands, Valley Floor, etc.) sorted by size
17. Within each zoning classification, parcels developed for single-family use large enough to develop but too small to divide segregated. Each will be counted as one potential single domestic use
18. For each parcel developed for single-family use large enough to be divided, potential number of lots under current zoning entered. Note that the number entered is the total number of lots, not the number of new lots. Each will be counted as one potential single domestic use
19. Parcels large enough to be divided screened for conservation easements. Parcels with Methow Conservancy easements will be counted as one existing and one new single-domestic use
20. Parcels developed for single-family use counted and numbers entered in table
21. Existing and potential undeveloped parcels counted and numbers entered in table. Includes: existing undeveloped/agricultural use parcels; new parcels that could be created by dividing undeveloped/agricultural use parcels; and new parcels that could be created by dividing parcels developed for single-family use

Wells predating adoption of the Methow River Basin Management Program

The estimates of number of wells predating adoption of the Methow River Basin Management Program are based on U. S. Census data from 1970, 1980, and 1990. The data have been analyzed in two different ways to give "high" and "low" estimates of well numbers. The high and low estimates are fairly close to each other.

Census data include the number of housing units in Twisp and Winthrop in 1970, 1980, and 1990; and the number of housing units in the Methow Valley in 1980 and 1990. Those data were used to estimate the number of housing units in the Methow Valley, Twisp, and Winthrop in 1977, just after adoption of the Methow River Basin Management Program. The assumptions on which those estimates are based follow Table 2 on page 6.

The number of housing units served by community wells in 1977 was estimated by analyzing development rates in the subdivisions served by community wells that had been recorded as of 1976. The bases for those estimates follow Table 4 on page 8.

For the first analysis, the estimated numbers of housing units in Twisp and Winthrop were subtracted from the estimated number of housing units in the Methow Valley, as was the estimated number of parcels served by community wells, to arrive at an estimate of the number of housing units served by private wells. Each housing unit was assumed to be served by one well.

The second analysis is based on a statement in the Early Winters Alpine Winter Sports Study Draft Environmental Impact Statement (DEIS), published in 1982. The DEIS states that "about 60 percent of the Methow Valley population obtains water from private wells and springs. The other 40 percent are served by the two municipal systems within the town limits of Twisp and Winthrop." For the second analysis, the estimated number of housing units in the Methow Valley was multiplied by 0.6 to arrive at an estimate of the number of housing units served by wells. The estimated number of parcels served by community wells was then subtracted to arrive at an estimate of the number of housing units served by private wells. As in the first analysis, each housing unit was assumed to be served by one well.

The Department of Ecology's 1991 report *Recent water use in the Methow Valley: An estimate* estimates the number of wells developed in each of the Methow Valley's seven reaches between 1977 and 1990. This report assumes that wells existing prior to 1977 were distributed among the seven reaches in the same proportion as those developed between 1977 and 1990. Table 3, on page 7, shows the percentages used and the assumed distribution of wells among reaches.

Parcels that will be subject to the 2 CFS reservation at build-out

This report presents two estimates of the number of parcels that may exist in each reach and be subject to the 2 CFS reservation at build-out—one based on each of the two estimates of numbers of wells predating the Methow River Basin Management Program. In each case, the estimated number of wells developed prior to 1977 was subtracted from the number of parcels currently developed and potentially developable for single-family use to arrive at an estimate of the number of parcels that would be subject to the 2 CFS reservation at full build-out under current zoning.

TABLE 1

Currently developed and potentially developable parcels and parcels subject to the 2 CFS reservation at build-out

Reach	Developed	Existing Developable Parcels	Potential Developable Parcels	Total Developable Parcels	Total Developed and Developable	Commun. Water	Pre '77 High	Subject to 2 CFS Reservation High	Pre '77 Low	Subject to 2 CFS Reservation Low
Methow Headwaters	290	113	227	340	630	150	56	424	50	430
Early Winters	0	0	0	0	0	0	0	0	0	0
Upper Methow	663	584	1703	2287	2950	339	108	2503	96	2515
Chewuch	546	403	796	1199	1745	198	240	1307	214	1333
Middle Methow	138	216	304	520	658	0	258	400	230	428
Twisp	372	270	956	1226	1598	0	124	1474	110	1488
Lower Methow	543	662	5720	6382	6925	190	502	6233	446	6289
TOTAL	2552	2248	9706	11954	14506	877	1288	12341	1145	12484

Legend

Developed: number of parcels currently developed for single domestic use, based on map analysis (DOR codes 11, 19, and 81 0; and codes 81, 83, & 91 w/WA in comments)
Developable: number of existing parcels large enough to develop for single domestic use
Potential: number of new parcels that could be created under current zoning, on both developed and undeveloped land
Commun. Water: estimated number of parcels served by community water systems in 1977
Pre '77 High: estimated number of single-domestic wells in the Methow Valley in 1977, based on analysis of Census data
Pre '77 Low: estimated number of single-domestic wells in the Methow Valley in 1977, based on analysis of Census data and information from the 1982 DEIS
Subject to 2 CFS reservation: estimated number of parcels that could exist and be subject to the 2CFS reservation at build out

Assumptions

Parcels zoned MD must be at least 6 acres to qualify as large enough to divide
All parcels must be at least 3 acres to qualify as large enough to develop
Development potential of parcels with conservation easements = 1 additional parcel, if large enough based on current zoning
All parcels that could be on community water systems are included in the estimate of developable parcels; this may not be the case due to deletion of lots smaller than 3 A.
The estimated numbers of single domestic wells developed in the Methow Basin between 1/77 and 7/90 that are shown in "Recent water use in the Methow River valley: An estimate", published by Ecology in 1991, are correct

TABLE 2
Methow Valley housing units

	1970	1980	1990	Annual change 1970-1980	Annual change 1980-1990	1977 est.
Methow		2033	2447		41	1909
Twisp	312	421	421	11	0	388
Winthrop	162	216	206	5	-1	200
		1396				1321
On community system						33
Estimated number of wells						1288

Assumptions

The rate of change in the number of housing units in the Methow Valley from 1977-1980 was the same as the average rate of change from 1980-1990
The rate of change in the number of housing units in Twisp and Winthrop was steady from 1970-1980
Every housing unit that was not in a town or on a community system had one single-domestic well
See Table 4 for assumptions used to estimate the number of units on community systems

TABLE 3
Well distribution

	'77-'90	Pre-'77
Methow Headwaters	4.36%	56
Upper Methow	8.37%	108
Chewuch	18.66%	240
Middle Methow	20.05%	258
Twisp	9.59%	124
Lower Methow	38.97%	502
TOTAL	100.00%	1288

Legend

'77-'90: percent of the Methow Valley's single-domestic wells in each reach, based on proportions in Ecology's "Recent Water Use in the Methow River Valley: An Estimate"
Pre-'77: estimated number of wells in each reach, based on the percentages shown in the previous column

Assumptions

Wells developed prior to 1977 were distributed among the seven reaches in the same proportion as the wells developed from 1977-1990 (the proportions used in Ecology's "Recent Water Use in the Methow River Valley: An Estimate")

TABLE 4
Community water systems

Community water systems

Number of systems

Name	Date	Lots	Dev.	Lots/year	Lots in 1977
Cottonwood Meadows	1973	32	14	0.47	2
Edelweiss no. 1	1969	36	3	0	1
Edelweiss no. 2	1970	100	45	1.36	10
Edelweiss no. 3	1971	65	21	0.66	4
Green Meadows	1973	33	4	0.13	1
Lost River Airport Tracts	1962		9	0.22	3
Lost River 1st add	1970	60	27	0.82	6
Lost River 2nd add	1973	227	57	1.90	8
		553	180		33

Assumptions

The rate of development in each subdivision with a community water system has been steady since the date the land was subdivided