HELENA MONTANA

QUEEN CITY OF THE ROCKIES

Helena Water Facilities Plan

CHAPTER 5 – WATER DEMAND FORECAST

Prepared by:

Amanda B. McInnis, P.E.

Michelle Johnson

Reviewed by:

Gary Fuller, P.E.

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Introduction

This chapter presents a description of:

- City of Helena water service planning area;
- Results of a water demand analysis to characterize existing demands;
- Methodologies used to project future demands for the City; and
- Comparison of current supplies with future demands.

The results from this chapter will be used in Chapter 6 and Chapter 7 to evaluate if the City's water treatment and distribution facilities are adequately sized to ensure reliable water supply for current and future conditions.

Planning Areas

The City of Helena's current water service area includes:

- City of Helena current City limits and
- Fort Harrison area.

Currently, water service is provided in the City limit boundaries and to Fort Harrison. The City of East Helena has its own water system, which is supplied by three wells from 150 to 160 feet deep. This report will not include an evaluation of the City of East Helena area. The City of East Helena provides their own water and wastewater services and will likely continue to provide these services. All other areas outside the City limits are currently served by groundwater.

In addition to the existing service areas, the future water service areas evaluated for this plan include the following:

- Central Valley;
- North Valley; and
- West Side.

These areas are shown in Figure 5-1. The Central Valley and North Valley are both experiencing water quantity and water quality problems.

Central Valley

Water availability has become a concern in the Central Valley over the last five years, due to drought conditions. In 2000, water flows in Tenmile Creek were very low and may have influenced ground water levels in the Central Valley area. Numerous wells were reported dry in 2000 and 2001. Reports of dry wells in this area have since ceased, presumably due to increased water flows in Tenmile Creek and in spite of continued low precipitation.

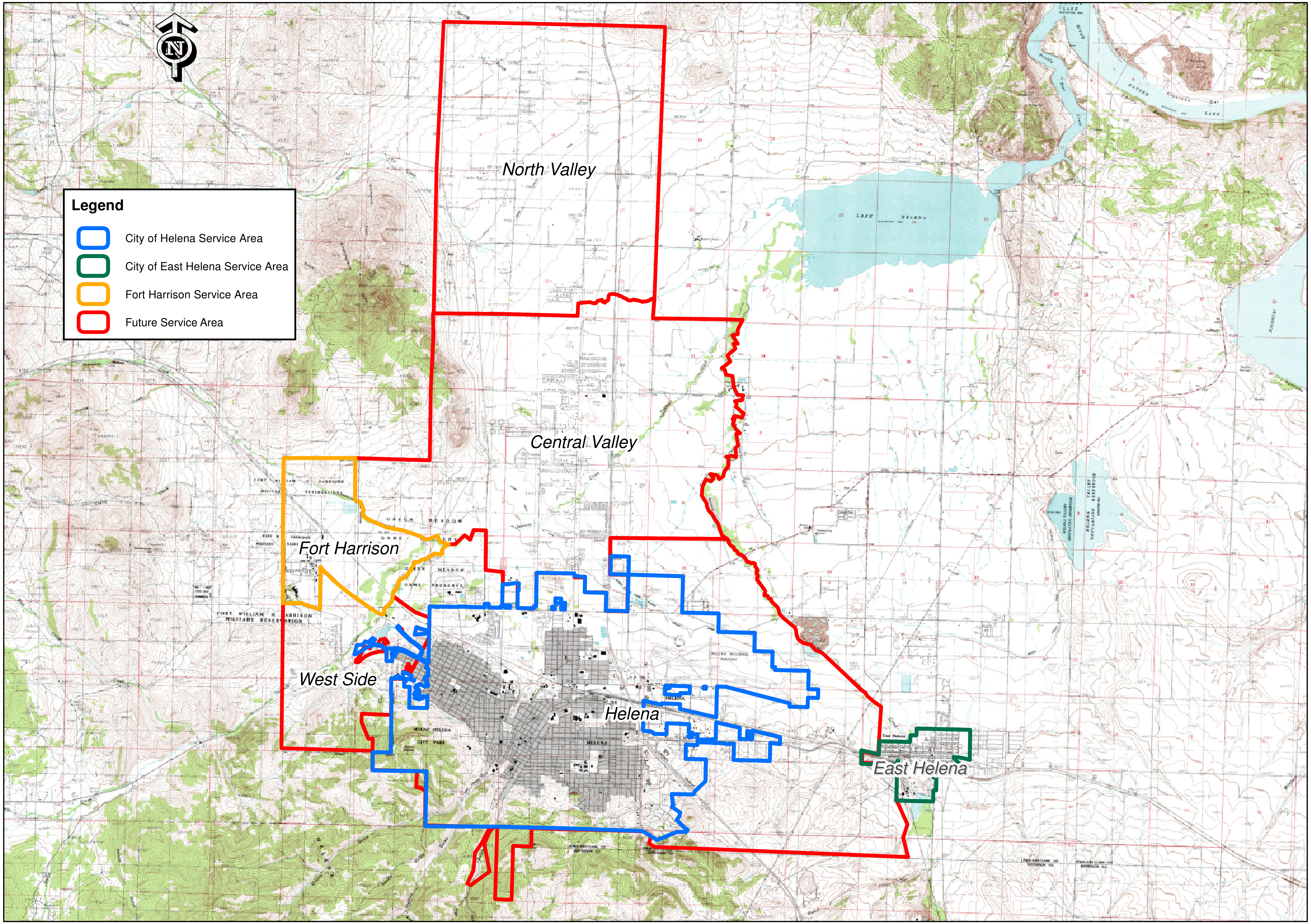
Ground water nitrate concentrations have been increasing in this area over the past 10 years. Typical nitrate concentrations range from 2 mg/L to as high as 5 mg/L. Past USGS reports indicate the natural background nitrate of 1 mg/L or less in the Helena Valley.

Population projections used in this facilities plan are summarized in Table 5-1. Populations are based on estimates provided in the Wastewater Treatment Plan (1998). In addition, estimates were checked against two projections provided in the City of Helena Transportation Plan (2004). The wastewater plan numbers matched the high growth estimates for the service area and were ten percent higher than the moderate projections for the same area.

Table 5-1 Population Projections [1]

	2004	2025[1]	Buildout
City of Helena	31,005	35,986	40,493
Central Valley	330	9,670	15,166
North Valley	0	853	4,588
West Side	540	3,300	4,060
Fort Harrison	162	212	258
Service Area Population	**32,037**	**50,021**	**64,565**

[1] Population projections based on 1998 Helena Area Wastewater Treatment Plan.



City of Helena Water Facilities Plan

Figure 5-1
Current and Future Water Service Area

North Valley Service Area

Problems in the North Valley service area include high ground water concentrations of nitrate in two areas: the Griffin-Davis subdivisions and the Cedar Hills/Townview areas. These areas are shown in Figure 5-1. The Griffin-Davis subdivision demonstrates ground water nitrate concentrations from 2.5 mg/L to the north to over 20 mg/L to the south. Probable sources are septic systems, since little agricultural activity occurs in this area and there are very few horses and cattle in the area. Peaks in nitrate contamination occur October through January.

A second area of high nitrate concentration is the Cedar Hills/Townview area, where nitrate concentrations range from 2 to over 10 mg/L. There is no agricultural or ranching in the area. In some cases, chloride levels in wells are as high as 140 mg/L, well above typical values in the Helena valley of 5 mg/L to 30 mg/L. The most likely source is septic system effluent. Nitrate peaks occur in November through January.

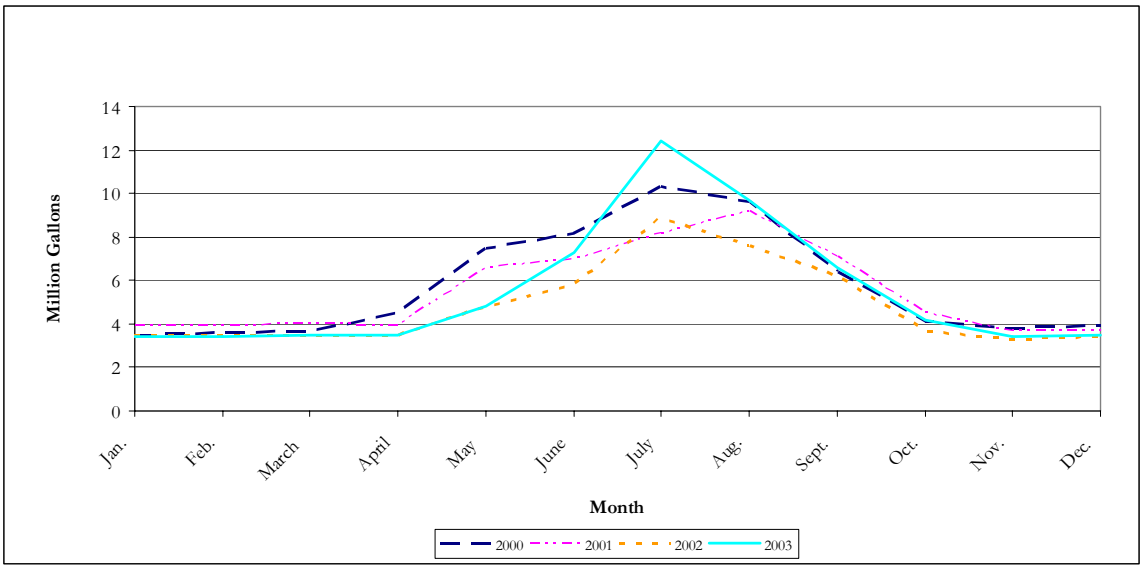
Water Demand and Production Analysis

The following section presents a description of the water demand and production analysis for the City. Projections were developed based on historic use data.

Historic Usage

The average monthly water production for 1999 to 2003 is shown in Figure 5-2. A seasonal increase in production can be seen during the summer months, primarily due to landscape irrigation and outdoor use. The average annual production reported for each year is the treated water flow delivered to the service area. A summary of average monthly water production from 1999 to 2003 is shown in Table 5-2.

Figure 5-2 Average Monthly Water Production 1999-2003



Average annual water use for the City of Helena water service area from 1995 to 2003 has been approximately 175 gpcd. This value is significantly lower than the 260 gpcd presented in the 1978 Master Plan. This difference may be attributed to the addition of meters to the

distribution system and an aggressive water line replacement program. This value matches well with the per capita wastewater production, 112 gpcd, reported at the wastewater treatment plant over the same time period.

Table 5-2 Historical Water Production, Population and Per Capita Demand

Year	Population [1]	Average Annual Production (MGD)	Maximum Daily Production (MGD)	Average Per Capita Demand (gpcd)	Maximum Day to Average Day Ratio	Maximum Month Production
1999	29,968	5.1	12.7	171	2.5	August
2000	30,208	5.8	12.3	192	2.1	July
2001	30,578	5.5	11.6	179	2.1	August
2002	30,592	4.9	11.7	157	2.4	July
2003	31,330	5.5	15.7	176	2.9	August
Average		**5.4**	**12.8**	**175**	**2.4**	

[1] Based on Helena Area Wastewater Treatment Plan Population Projections

Water Conservation

Conservation encourages lower average water production and reduces peak demand factors. The City has an ordinance that presents specific guidelines for water conservation during water shortage emergencies and penalties for infractions during mandatory restrictions. The specific actions taken during times of water shortage are found in the City Water Conservation Ordinance, included as Appendix 5-A.

Water Conservation Plan

In order to comply with the requirements of the Water Service Contract with the Bureau of Reclamation (BOR), the City has completed a water conservation plan. This plan lays out the steps the City is taking in minimizing lost water and increasing conservation awareness. The plan is centered around the City's meter replacement program to encourage water conservation. Currently, the City has adequate supply to meet its demands. If needed in the future, further conservation steps will be implemented. A copy of the City Water Conservation Plan can be found in Appendix 5-B.

Peaking Factors

Peaking factors are used to estimate the maximum hour use, which is a factor in estimating the volume required for storage, and the infrastructure needed in the distribution system.

Maximum Day

One important parameter in demand analysis is estimating the maximum demand that occurs during a month, a day, or an hour. The maximum day to average day peaking factor is determined based on historical peak day to average day ratios. Historic peak day, average day and peak day to average day ratios for the years 1984 to 2003 are included in Appendix 5-C. The average value for the historic data was 2.4. The average will be used in this

analysis, rather than a more conservative factor, for three reasons. First, the golf course is moving to irrigation wells. In addition, the meter replacement program will lead to more accurate reports of water usage and may increase sensitivity to water use. Also, water costs will increase over time and will lead to farther conservation.

Peak Hour

Storage and conveyance systems must be able to meet the anticipated peak hour demand, which typically occurs during a maximum day. To quantify the peak hour demands, water delivered from all sources, including storage reservoirs, would need to be continuously monitored on an hourly basis. There is currently no way to extract this information, therefore, a factor of 3.5 times the average day was used to compute the peak hour demand for plan projections.

Unaccounted for Water (UAW)

The meter replacement program will reduce unaccounted for water.

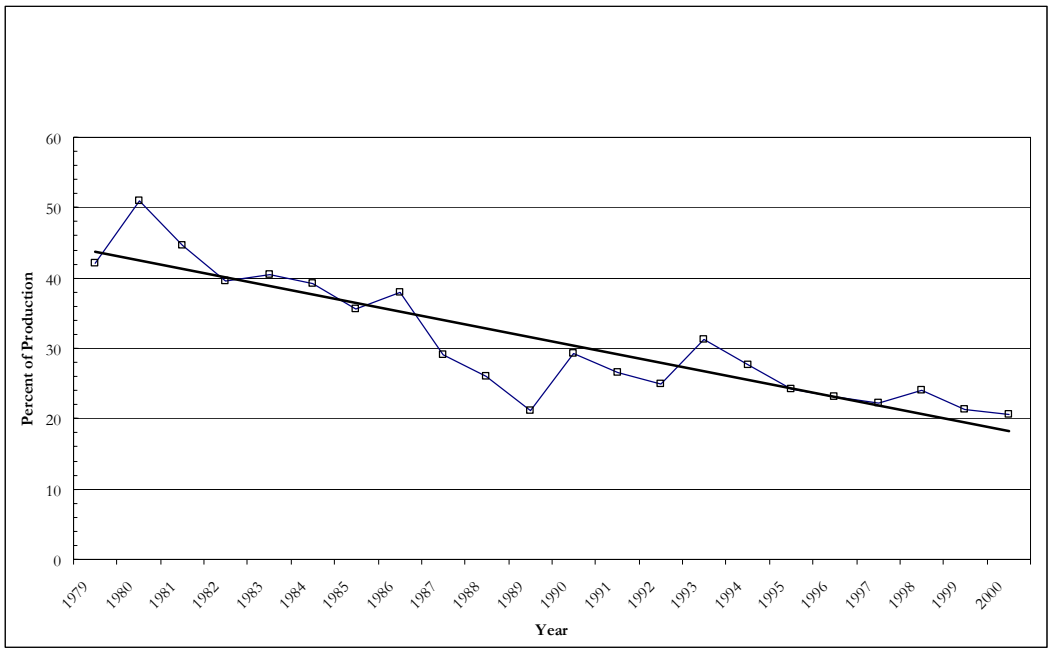
Unaccounted for water use occurs within all water systems and is calculated as the difference between the quantity of water delivered into the distribution system as measured at the treatment plants and the total amount of all water metered to be used by customers. UAW encompasses leaking in the distribution system, conveyance losses, main flushing, fire hydrant flow testing, inaccurate metering and unauthorized connections or use.

The downward trend in UAW shows improving leak detection and repair.

UAW trends for the Helena system for the last 25 years can be seen in Figure 5-3. The figure shows that there is a general downward trend in the percentage of water that is unaccounted for, indicating that water loss is gradually being curtailed. The most current water loss statistics show that the system had a loss of about 23 percent in 2002.

To further reduce the fraction of lost water, the City is currently undertaking a meter replacement program that will replace 7,000 to 10,000 meters in the commercial and residential sectors of the City over the next five years. When the replacement program is complete, UAW is anticipated to drop 5 percentage points to approximately 18 percent.

Figure 5-3 UAW 1979-2000



Future Demands

Estimating future population and demand is crucial in planning for water system development. Accurately forecasting for water needs will determine the necessary system upgrades that need to be implemented and when they will need to take place in order to meet increasing demand.

Using the population projections, per capita usage values (175 gpcd), and peaking factors described earlier in this section (2.4 max day to average day ratio, 3.5 peak hour to average day ratio), future demands were projected for 2025 and 2045 in Table 5-3 and Table 5-4.

Table 5-3 2025 Water Demands for City of Helena Service Area

	2025 Population	Average Annual (MGD)	Maximum Day (MGD)	Peak Hour (MGD)
City of Helena	35,986	6.3	15.1	22.1
Central Valley	9,670	1.7	4.1	6.0
North Valley	853	0.1	0.2	0.4
West Side	3,300	0.6	1.4	2.1
Fort Harrison	212	0.04	0.1	0.1
Total	**50,021**	**8.7**	**20.9**	**30.7**

Table 5-4 Buildout Water Demands for City of Helena Service Area

	Buildout Population	Average Annual (MGD)	Maximum Day (MGD)	Peak Hour (MGD)
City of Helena	40,493	7.1	17.0	24.8
Central Valley	15,166	2.7	6.5	9.5
North Valley	4,588	0.8	1.9	2.8
West Side	4,060	0.7	1.7	2.5
Fort Harrison	258	0.05	0.1	0.2
Total	**64,565**	**11.3**	**27.2**	**39.8**

It is estimated that the City of Helena service area will include approximately 50,000 people in 2025. In 2025, the average annual water required will be 8.7 MGD. In 2045, the service area population is estimated to be close to 65,000, and the average daily demand will be 11.3 MGD.

Appendix 5-A City Water Conservation Ordinance

6-2-3: RULES GOVERNING WATER DIVISION:

The following rules shall regulate the use and supply of water:

RULE 1: All applications for the use of water must be made at the office of the building and safety division of the community development department on the printed form for that purpose. Every such application must be made by the owner of the property to be served or the owner's authorized agent and must include the purposes for which the water is required. The applicant must agree to conform to these rules as a condition of use of water.

RULE 2: No person supplied with water from the city mains will be entitled to use it for any other purpose than those stated in the application, or supply in any way other persons or families.

RULE 3: The service pipes must be so arranged that the supply to each separate house or premises may be controlled by a separate shutoff valve placed within the right of way near the property to be served, which valve shall be placed within a visible and accessible curb box, and one person, company or association must pay for all the water used through said service for his, her or their own use, or for the use of others to whom it may be accessible.

RULE 4: Where water is now supplied through one service to several houses, families or persons, the public works director may either decline to furnish water until separate services are provided, or may continue the supply on the condition that one person shall pay for all on the same service.

RULE 5: The water may be shut off at any time from the mains without the notice for repairs, extension or other necessary purposes, and persons having boilers supplied by direct pressure from the mains are cautioned against danger of explosion or collapse. The city will not be responsible for the safety of the boilers on the premises of any water consumer.

RULE 6: Water will not be furnished where there are defective or leaking faucets, closets or other fixtures, and when such may be discovered, the supply will be withdrawn until the proper repairs are made.

RULE 7: The city shall not be responsible for pipes and fixtures; all owners, at their own expense, must keep service pipes from city mains and all their apparatus in good working order and properly protected from frost or other dangers. No claims shall be made against the city on account of the breaking of any service pipes or apparatus, or for accidental failure in the supply of water. No reduction from the regular rates shall be made for any time that service pipes or fixtures may be frozen. (Ord. 2900, 9-25-2000)

RULE 8:

A. All usage of city produced water is subject to the water use reduction staging plan which provides for voluntary and mandatory water reduction measures that will be in effect for various water supply statuses.

B. The water use reduction staging plan for each stage is as follows:

STAGE I

Water Supply Status: Normal with adequate reservoir levels and all supply sources available.

Water Reduction Measures: None.

STAGE II

Water Supply Status: Peak daily demand greater than eighty five percent (85%) of system capacity; or mountain reservoir levels low with risk of future shortage.

Water Reduction Measures: Voluntary restrictions.

STAGE III

Water Supply Status: Peak daily demands at or exceeding system capacity; in town reservoirs less than seventy percent (70%) full with continuing decline; extended electrical power outage; treatment plant failure; or major pump or transmission failure.

Water Reduction Measures: Mandatory watering and irrigating restrictions as follows:

1. Designated days for watering corresponding to the last digit of the street address for the property; and

2. Hours for watering restricted to designated hours.

STAGE IV

Water Supply Status: Water supply emergency by peak daily demand exceeding system capacity by two (2) MGD in a twenty four (24) hour period; in town reservoirs less than twenty five percent (25%) full with continuing decline; catastrophic systems failure of a duration of more than twenty four (24) hours and in town reservoirs less than twenty five percent (25%) full; or severe prolonged drought of more than one week with the foregoing conditions.

Water Reduction Measures: Mandatory restrictions as follows:

1. All outdoor water uses prohibited; and

2. All other water uses prohibited except for necessary domestic indoor use for drinking water and sanitation.

C. The following actions and penalties may be imposed for infractions of mandatory restrictions:

1. First Infraction:

a. Notice of infraction may be posted on violator's door, stating penalties for infractions of mandatory restrictions and providing water conservation tips; and

b. If the violator is not the owner of the property a copy of notice must be sent by first class mail, postage prepaid, to the owner of the property upon which the infraction occurred.

2. Second Infraction Occurring Within A Six Month Period:

a. During a stage III status, a civil offense punishable by a civil penalty imposed by the court; and

b. During a stage IV status, a civil offense punishable by a civil penalty imposed by the court.

3. Third Infraction Occurring Within A Six Month Period:

a. During a stage III status, a civil offense punishable by a civil penalty of not less than seventy dollars ($70.00); and

b. During a stage IV status, a civil offense punishable by a civil penalty of not less than one hundred forty dollars ($140.00).

4. Fourth Infraction Occurring Within A Six Month Period:

a. During a stage III status, a civil offense punishable by a civil penalty of not less than one hundred five dollars ($105.00);

b. During a stage IV status, a civil offense punishable by a civil penalty of not less than two hundred ten dollars ($210.00); and

c. Water service may be shut off without notice to prevent future violations. If water service is discontinued, service may not be restored until applicable fees charged for turning the water on and off and outstanding civil penalties are paid. (Ord. 2934, 4-8-2002)

RULE 9: No plumber or other person will be allowed to make connections with the city mains or make connections in any conduit, pipe or fixture connecting therewith, or to

connect pipes when they have been disconnected, or to turn water off or on for any premises without permission of the building and safety division.

RULE 10: None but competent and licensed plumbers shall be allowed to do any work in connection with the city service where water may be drawn from the city mains, and all plumbers must make in writing an accurate return of the work done within twenty four (24) hours after completion, and before water will be turned on the plumber must describe the position of the service pipes, ferrules, stop cocks, shutoff valves and other fixtures, outside of buildings, by reference to street and lot corners, in a form required by the public works department.

RULE 11: Plumbers failing to perform their work according to the established rules and regulations, or executing it unskillfully to the detriment of the city waterworks, may be barred from making connections to the city mains by order of the public works director.

RULE 12: Employees of the utility maintenance division have free access at proper hours of the day to all parts of buildings in which water is delivered from the city mains for the purpose of inspecting the condition of the pipes and fixtures, the manner in which the water is used, and for the purpose of reading meters.

RULE 13: The water rates shall be charged against the property to which it is furnished and against the owner thereof, and if for any cause any sums owing therefor become delinquent, the water shall be shut off from the property and in no case turned on again until all such delinquencies have been paid in full. No change of ownership shall affect the application of this rule.

RULE 14: All accounts for water shall be kept in the name of the owner of the property and not in the name of any tenant, and the owner only, or his legally authorized agent, shall be held responsible for payment of water rates.

RULE 15: On failure to comply with the rules and regulations established as a condition to the use of water, or to pay the water rates or meter rent, or any charge or penalty imposed, in the time and manner herein provided, the water may be shut off until payment of the amount due is made, together with an amount to be set by resolution to cover the expense of turning the water on and off. In addition, any time an individual requests that the water to a home or place of business be turned on or off, there shall be assessed an amount to be set by resolution for turning the water on and off.

RULE 16: Should the occupant of the premises turn on the water, or cause it to be turned on after it has been shut off at the curb cock or shutoff valve, it will be turned off at the main, and an amount to be set by resolution to cover the expense of turning it off and on, payable before the water is turned on.

RULE 17: The following acts are prohibited:

A. To use city water or permit it to be used for any other purpose than that for which the party pays water rates.

B. To permit water pipes or fixtures to remain in a leaky condition.

C. To allow water fixtures to be run when not in use for the purpose intended.

D. To open, close, turn or interfere with, or to attach to, or connect with any fire hydrant, stop valve or stop cock belonging to the public works department.

E. To disturb or damage any pipe, machinery, tools or other property of the public works department.

F. To throw any deleterious matter into any of the reservoirs.

G. To deface or injure any buildings or other improvements of the public works department.

H. To place any foreign thing upon the grounds of the public works department or such portion of the grounds and streets as may be under its control.

I. To disturb or injure any watershed, lawn, grass plot, flowers, vines, bushes or trees belonging to the public works department.

RULE 18: All meters shall be and remain the property of the city and may be removed at the discretion of the director of public works. Should a meter fail to register accurately, the consumer shall be charged at the average daily consumption as shown by the meter during the last three (3) months that the same was in good order. In the event a consumer notifies the utility maintenance division that the meter is not registering accurately, the director of public works may in his discretion require a deposit in an amount to be set by resolution, refundable to the consumer if the meter is defective, to be forfeited to the city in the event that the meter, when tested by the utility maintenance division, is found to be registering accurately. City conducted tests to determine the accuracy of the meter shall be conclusive in determining whether the deposit shall be refunded.

RULE 19: When meters are in use for determining the amount of water used by consumers, the water rent shall be payable on or before the fifth day of every month, and if not paid within thirty (30) days thereof, said consumer shall be subject to the penalties provided in section 6-2-1 of this chapter.

RULE 20: No person other than an authorized employee of the utility maintenance division shall make any tap or connection with any main or distributing pipe of the city.

RULE 21: All water service must be provided from public mains in public rights of way or easements to the city. Each service shall be placed, to the extent practical, perpendicular to the public main, right of way or easement. All water service lines installed for consumers of the city water system must be placed at a minimum depth of six feet six inches (6'6") from the surface of the ground.

RULE 22: It shall be the responsibility of the owner of the water service to disconnect said service upon abandonment or nonuse at the point of connection with the public main by a method acceptable to the director of public works. Should the owner fail to satisfactorily disconnect such service, the utility maintenance division may make such disconnection and charge the owner the actual cost thereof.

> A street opening permit is required for disconnecting water service lines at the water main in the street right of way. A city building/plumbing inspector shall inspect any water service being abandoned. The service line shall be disconnected from the corporation stop and the corporation stop shall be in the off position. If the corporation stop is leaking, the inspector will advise the utility maintenance division so the leak can be repaired prior to filling the ditch.

RULE 23: No adjustment shall be made on estimated water and sewer bills on the estimated cycle. Rather, any such adjustment must be made only on the regular reading cycle after the meter is read by approved city meter readers.

RULE 24: Any unpaid water bill that is more than thirty (30) days past due shall have assessed against it interest at the rate of 1.5% per month. (Ord. 2900, 9-25-2000)

Appendix 5-B City Water Conservation Plan

HELENA MONTANA

QUEEN CITY OF THE ROCKIES

Helena Water Conservation Plan

Prepared by:

Amanda McInnis, P.E.

Michelle Johnson

Reviewed by:

Name:

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Executive Summary

The City of Helena's conservation plan centers on its meter replacement program. By replacing 7,000 to 10,000 meters, the City hopes to reduce unaccounted for water by 5 percent. The City has budgeted, and is in the process of spending, $3.3 million on this work.

Introduction

The City of Helena water system relies on two surface water sources (Missouri River and Tenmile Creek) and two groundwater sources (Eureka and Orofino). Recently the City negotiated a 40-year agreement with the Bureau of Reclamation to secure water from the Missouri River source. As part of that agreement, the City agreed to complete a water conservation plan. This water conservation plan reviews its existing program.

Description of Conservation Area

This conservation plan is for City of Helena and some of the surrounding area, including the Fort Harrison area to the west, and the Central Valley and North Valley. The Helena area is growing; population projections are shown in Table 1, below. In 2004, the service area population was more than 32,000. In 2024, it is estimated to be more than 50,000. A more detailed discussion of population projections is included in Chapter 5 of the Facilities Plan.

Table 1 - Population Projections

	2005	2025	Buildout
City of Helena	31,005	35,986	40,493
Central Valley	330	9,670	15,166
North Valley	0	853	4,588
West Side	540	3,300	4,060
Fort Harrison	162	212	258
Service Area Population	**32,018**	**50,021**	**64,565**

Inventory of Water Resources and Water Budget

Water Supply

The City currently relies on three primary sources of supply:

- Missouri River
- Tenmile Creek
- Hale Collector (Eureka/Orofino)

The Missouri River and Tenmile Creek are surface water sources. They have historically supplied most (85%) of the City's demand. The Tenmile supply currently serves as a year-round source. The Missouri River source is currently used in the summer months only.

The Hale Supply is a groundwater source served by two collectors: Eureka and Orofino. Together these two sources have historically supplied the remaining 15 percent of the City's demand.

Water Use

Average annual per capita water use for the City of Helena water service area from 1995 to 2003 has been approximately 175 gpcd, significantly lower than the 1978 value of 260 gpcd. This difference may be attributed to the addition of meters to the distribution system and an aggressive water line replacement program. This value matches well with the per capita wastewater production reported at the wastewater treatment plant over the same time period, 112 gpcd. The remaining 68 gpcd represents irrigation, unaccounted for water and other uses.

Water use for projections for the City for 2024 from the Facilities Plan are shown in Table 2.

Table 2 - 2024 Water Demands for City of Helena Service Area

	2025 Population	Average Annual (MGD)	Maximum Day (MGD)	Peak Hour (MGD)
City of Helena	35,986	6.3	15.1	22.1
Central Valley	9,670	1.7	4.1	6.0
North Valley	853	0.1	0.2	0.4
West Side	3,300	0.6	1.4	2.1
Fort Harrison	212	0.04	0.1	0.1
Total	**50,021**	**8.7**	**20.9**	**30.7**

Ability of Water Supplies to Meet Future Demands

The City of Helena's water supply must be capable of meeting the maximum day demand of the water systems' customers. Both the raw water delivery and treatment facilities must be capable of meeting these requirements, with the raw water source capable of sustaining the supply of water throughout the year.

The City is contemplating reversing the roles of the treatment plants and using the MRTP as the main source of supply for the City. The following is a discussion of flows required from each facility during both current roles and if the plant roles were reversed. The capacity of the Tenmile system (8 mgd) and the Missouri River system (14 mgd) would be the same for both scenarios.

If the current plant roles were maintained, a total of 1,960 MG of water would be withdrawn from the Tenmile system in 2025 and 1,335 MG of water would come from the Missouri River system. If the plant roles were reversed, 744 MG of water would come from the Tenmile system and 2,551 MG would come from the Missouri River system. In the current roles, flows are limited for Tenmile to 1,960 MG, the reliable hydraulic yield of the Tenmile system; however, in the reversed roles, Tenmile would be limited to the available raw water reservoir storage volume of 744 MG (550 MG in Chessman, 194 MG in Scott). Direct

stream diversions to TTP would be eliminated. Table 3 shows the changes in the total amount of water used from each source for 2025 demands.

Table 3 - Total Volume of Water Used in Current Roles and Reversed Roles at 20205 Demands

	Tenmile (MG)	Missouri River (MG)	Total 2025 Demand (MG)
Current Roles	1960	1335	3295
Reversed Roles	744	2551	3295

In the case that system roles remain the same, flows to the TTP will be drawn completely from reservoir storage, not from stream flow. The following summary assumes that plant roles remain the same, and that the Hale Zone supply would not be used in 2025 and 2045, in order to provide the worst case scenario water demand estimates for the Tenmile and Missouri River supplies.

Table 4 - Existing Capacities and Projected Use

Water Source	Estimated Capacity (MG/yr)			Projected Annual Use in 2025 (MG/yr)			Projected Annual Use in 2045 (MG/yr)		
	Raw	Finished	Percent	Raw	Finished	Percent	Raw	Finished	Percent
Tenmile Supply	1,960[1]	1,867	33.5	1,960	1,867	59.5	1,960	1,867	45.3
MR Supply	3,676[2]	3,501	62.9	1,335	1,272	40.5	2,370	2,257	54.7
Hale Zone Supply	200	200	3.5	0[3]	0[3]	0[3]	0[3]	0[3]	0[3]
Total	**5,810**	**5,568**	**100**	**3,295**	**3,139**	**100**	**4,330**	**4,124**	**100**

[1] Dependable annual yield reported in 1978 Master Plan.
[2] Maximum water allocation available from BOR based on 11,284 AF/year.
[3] For purposes of this analysis, 0 MG/year water supply assumed from the Hale Zone source in the future. Refer to subsequent discussion on viability of the Hale Zone supply.

In this analysis, the Tenmile supply will remain as the highest priority water source for the City in the future, with use of this source maximized, as shown in Table 4. However, the Tenmile supply capacity will be completely utilized by 2025, requiring that the Missouri River supply provide the additional needed capacity. In 2045, the reliance on the Missouri supply grows, providing 55 percent of the total available water supply to the City (2,257 MG/yr out of 4,124 MG/yr of finished water produced).

Existing Water Management Measures and Programs

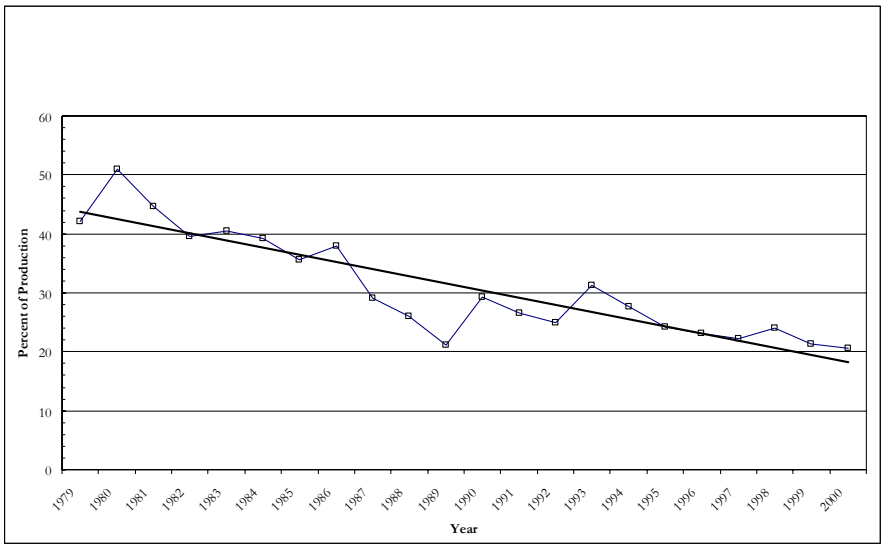
Unaccounted For Water

Unaccounted for water (UAW) use occurs within all water systems and is calculated as the difference between the quantity of water delivered into the distribution system as measured

at the treatment plants and the total amount of all water metered to be used by customers. UAW encompasses leaking in the distribution system, conveyance losses, main flushing, fire hydrant flow testing, inaccurate metering and unauthorized connections or use.

UAW trends for the Helena system for the last 25 years can be seen in Figure 1. The figure shows that there is a general downward trend in the percentage of water that is unaccounted for, indicating that water loss is gradually being curtailed. The most current water loss statistics show that the system had a loss of about 23 percent in 2002.

Figure 1 UAW 1979-2000



Meter Replacement Program

To further reduce the fraction of UAW, the City is currently undertaking a meter replacement program that will replace 7,000 to 10,000 meters, in the commercial and residential sectors of the City, over the next five years. Half of all meters are read each month, and the other half are estimated, so each meter is read every other month. The meters installed during the meter replacement program will have radio output and will provide monthly readings and eliminate the need for estimating.

Leak Detection

The City allocates money annually to complete leak detection of the system. A leak detection service spends approximately one week completing its assessment. In general, the leak detection contractor has not found significant leaks and reports the system is in good condition.

Water Line Replacement

The City has implemented a successful program to replace water lines. They spend approximately $300,000 per year in the program.

Information and Education

Conservation education for the City of Helena is available on the City's Website. In addition, the local Water Quality district conducts water programs with local elementary

schools and community groups to discuss water issues and conservation. The text of the website is included as Appendix A-1.

Conservation Ordinance

The City has a conservation ordinance in place that outlines steps that should be taken during times of water shortages. The ordinance outlines four stages of action:

Stage 1: Supply: Normal.

Action: No water reduction measures.

Stage 2: Supply: Peak daily demand more than 85% of system capacity or mountain reservoirs low with future risk of shortage.

Action: Voluntary restrictions.

Stage 3: Supply: Peak daily demand at or exceeding system capacity; in-City reservoirs less than 70% full; extended power outage, treatment plant failure or distribution system failure.

Action: Designated days for watering and restricted watering hours.

Stage 4: Supply: Peak Day demand exceeds system capacity by 2 MGD in a 24 hour period; in-City reservoirs less than 25% full; catastrophic system failure more than 24 hours with in-City reservoirs less than 25% full; or severe drought for more than one week

Action: All outdoor water use prohibited. All other use prohibited except for domestic drinking water and sanitation.

In 2000, the City went to a Stage 2 supply situation. The City has used local news TV and print media in the past to inform the public about the status of the water supply and requested voluntary restrictions. This approach was very effective in reducing peak demands.

In addition, the City curtailed its own water use significantly during that time, limiting watering at all City facilities.

Possible Future Measures

Water Pricing

The City charges a monthly base rate of $2.07 plus $2.22 per 100 cubic feet used. This is a flat pricing structure with no disincentive for using large volumes of water. This pricing structure has served the City well over the last 30 years. If in the future, however, a graduated pricing structure (charging more for using larger volumes of water) is needed to encourage water conservation and will be considered by the City commission.

Water Efficient Landscaping

The City has one water-efficient landscape area at the City/County Health department. In addition, the City wastewater plant has recently retrofit its irrigation system with a more water-efficient nozzle. The City will continue to explore opportunities for water-efficient landscaping on its own projects.

Fixture Replacement

The City has not chosen to include a fixture replacement element in its conservation plan at this time. To date, even in severe drought situations, the City has been able to effectively meet its system demands. If, in the future, additional conservation measures are deemed necessary, fixture replacement will be considered.

Selected Measures and Projected Results

Selected Measures

The conservation measures selected are described in the previous section: water meter replacement, providing conservation information on the City website, and continued implementation of the Conservation Ordinance.

Projected Results

The City has projected that when the replacement program is complete, UAW will decrease by 5 percentage points to approximately 18 percent.

Implementation Schedules and Budget

The meter replacement program is currently in progress. Over the next 2 years, all City meters will be new. The City has allocated $3.3 million for this process.

Anticipated Environmental Effect

There are no anticipated environmental effects expected as a result of this conservation plan.

Appendix A - City Water Conservation Ordinance

Water Conservation Tips and Links

By conserving water and using it wisely, you pay less. Not only will your monthly bill be lower but you can reduce the size of future water production costs, reducing everyone's costs.

Below we have listed several tips to help you conserve water.

- *Fix all leaks. Even small leaks can add up to a substantial waste of water.*
- *Keep a pitcher of water in the refrigerator instead of running the water until it is cold. This avoids wasting water down the drain.*
- *Don't let the water run when you brush your teeth.*
- *Turn off the hose while washing your vehicle. Soak your car once. Turn off the hose and use a bucket of soapy water to wash the vehicle. Then turn the hose back on and rinse. Always wash it in the early morning or evening, this gives you time to wipe off the water, reducing water spots.*
- *Water your lawn in the early morning, preferably or late evening. Avoid watering between 10:00 AM and 5:00 PM. , substantial water is lost to evaporation if you water in the heat of the day.*
- *Water by hand. Don't use sprinklers that water the streets. Pavement does not grow with watering. Always be sure when watering you don't waste water down the gutter.*
- *Don't water every day, the lawn needs time to grow roots. If you water lightly every day the roots tend to grow up. This makes for a drought sensitive lawn with poor root growth.*
- *Don't water until your foot steps are visible in the lawn. When you walk on your lawn the grass should spring back up, if it doesn't, it's time to water. The lawn may take on slightly bluish cast when it needs water too.*
- *Don't under water, as it may damage your lawn and use up to three times as much water to restore your lawn.*
- *Water 1/2" to 1" three times a week. Depending on your grass type, and whether it is shaded, will dictate on how much you need to water. Go by how the grass is growing more than by any arbitrary number of inches to water.*
- *Don't bag your grass clippings. You waste the grass as a natural mulch and expose the soil to direct sunlight drying it faster. Use a mulching mower or rake the clippings evenly over the lawn.*
- *Don't over mow, leaving the lawn slightly longer shades the soil and does not stress the lawn as much. When it is really hot, let the grass grow to 4"-6" between mowing and then only cut about an inch or two.*
- *Mow in the late evening or early morning. The grass weeps water from the cut ends.*

- *Keep your sprinkler system tuned. A well designed and maintained sprinkler system can help conserve water. Adjust station timing to make sure that you are not over watering sections. Use a rain gauge to check. Install a rain sensor or turn the system off when it rains. Make sure that the spray patterns are adjusted and you are not watering the street. Again, early morning is the best time to water.*
- *Over watering can cause mold and mildew, damaging your lawn and turning it brown.*
- *Don't over fertilize. Fertilizer can burn the lawn requiring extra watering.*
- *Consider xeriscaping your lawn. Choose the grass, shrubs, and trees that grow with the least amount of watering.*

Appendix 5-C Historic Peak Day and Average Day Flows - 1984 to 2003

Year	Annual Avg. Daily Demand (MGD)	Peak Daily Demand (MGD)	Peak Day to Average Annual Day Ratio
1984	6.64	17.00	2.6
1985	6.68	17.40	2.6
1986	6.1	15.80	2.6
1987	5.88	12.70	2.2
1988	5.98	13.10	2.2
1989	5.43	13.50	2.5
1990	5.47	14.50	2.7
1991	5.28	13.70	2.6
1992	5.29	12.60	2.4
1993	4.33	8.80	2.0
1994	5.5	13.60	2.5
1995	4.89	12.50	2.6
1996	5.25	12.60	2.4
1997	4.87	10.40	2.1
1998	5.11	12.20	2.4
1999	5.11	12.70	2.5
2000	5.79	12.30	2.1
2001	5.49	11.60	2.1
2002	4.87	11.70	2.4
2003	5.53	15.70	2.8
20-year 50th percentile (average)			**2.4**
20-year 90th percentile			**2.6**
10-year 50th percentile (average)			**2.4**
10-year 90th percentile			**2.6**