INTRODUCTION

In October of 2006, Uintah Water Conservancy District (UWCD/District) retained Bowen, Collins & Associates (BC&A) to conduct a Supply and Demand Study. The purpose of this study was to project future District demands in the Ashley Valley and to evaluate the adequacy of existing supplies to meet these demands. The purpose of this report is to present the findings of the Supply and Demand Study and provide recommendations to UWCD for meeting future water demands in Ashley Valley.

SYSTEM DEMAND PROJECTIONS

There are several methods that can be used to estimate future water demand. This study develops demand projections by projecting population for the District's service area based on existing and projected patterns of development, and then converting the projected population to water demand based on historic per capita water use and conservation trends. Each step of this process is summarized in the sections below.

Service Area

The UWCD service area consists of the combined service areas of four retail water providers:

- Ashley Valley Water Improvement District (AVWID),
- Jensen Water Improvement District (JWID),
- Maeser Water Improvement District (MWID), and
- Vernal City.

These four providers serve the water needs of nearly all the residents in the Ashley Valley portion of Uintah County. The service area used in this analysis is shown in Figure 1. It includes the current UWCD service area plus a small area for potential expansion in Dry Fork Canyon. It is assumed that the area shown as "Potential Expansion" in Figure 1 will be annexed to MWID by 2020. For the purposes of this report, the terms "Ashley Valley" and "UWCD service area" are synonymous.

Population Projections

Ashley Valley has experienced boom and bust periods of population growth related to oil and anticipated shale oil development in the past. As shown in Figure 2, population growth in Vernal (the largest city in Uintah County) has varied from positive 6.3 percent average annual growth in the 1970's (boom) to negative 0.7 percent average annual growth in the 1980's (bust). During the 1990's, annual growth was close to the long term average for growth in the City of 1.5 percent. Assuming Vernal is representative of historic growth in Ashley Valley, we may conclude that population growth in Ashley Valley has been volatile and greatly influenced by actual and anticipated economic development.

Based on the most recent census data, the 2000 Census population residing within Ashley Valley was 20,191. Future growth is expected to continue to be volatile making it difficult to project with any certainty. In recent years, major growth has occurred in Ashley Valley as demonstrated by the sharp increase in water service connections shown in Table 1.

Table 1
UWCD Service Area Historic Growth

Year	Number of Connections AVWSID	Number of Connections Jensen	Number of Connections Maeser	Number of Connections Vernal	Number of Connections Total	Annual Growth
2000	3,026	464	792	2,536	6,845	--
2001	3,050	475	814	2,580	6,919	1.1%
2002	3,075	486	825	2,600	6,986	1.0%
2003	3,100	493	834	2,618	7,045	0.8%
2004	3,120	501	875	2,637	7,133	1.2%
2005	3,250	524	930	2,658	7,362	3.2%
2006	3,378	621	1,000	2,751	7,750	5.3%

This growth is primarily a result of recent renewed interest in natural gas development in the region, combined with historic low interest rates. Technology has advanced and energy prices have increased to the point where natural gas production in the area is becoming cost effective. This economic driver is not expected to decrease anytime in the near future. The U.S. Energy Information Administration projects the demand for natural gas in this country will grow at an average annual rate of 2 percent per year for the next 20 years. It seems reasonable to assume that gas development in vicinity of Ashley Valley will continue to help satisfy this growing demand.

Historic low interest rates have also stimulated an increase in residential and commercial construction in Ashley Valley and the State of Utah as a whole. Table 1 shows that growth, in terms of total number of water connections, has increased from about 1 percent per year to over 5 percent per year since 2000. In addition to these properties that have been constructed in recent years, there are over 3,300 lots are currently approved for future development in Ashley Valley.

Because of the volatility of historic growth in the Ashley Valley, it is not known how long this recent growth trend will continue. With this in mind, this report includes three different sets of population projections to consider the full range of likely growth rates:

- **Minimal Growth Projections –** The Governor's Office of Planning and Budget (GOPB) has projected population for Uintah County through the year 2050. The UWCD study area contains about 80 percent of the county's population. Assuming this population distribution remains constant, the population in Ashley Valley will increase to only 26,046 by the year 2050. This is an average annual

growth rate of less than 0.5 percent. This appears to be an extremely low estimate for growth in the service area considering the projected growth for the rest of the state for the same period is nearly 2 percent annually. GOPB population projections are based on current population plus estimated birth rates, death rates, and net migration to the area (positive or negative). The GOPB estimates for Uintah County project a net migration loss each year (i.e. more people will move from the area than move to the area) through 2050. Therefore, the growth projected in the county is significantly lower than the natural birth rate.

- **Aggressive Growth Projections –** To account for the recent increase in service connection growth and planned development, a set of aggressive growth projections has been prepared. These projections are based on growth continuing at 5 percent annually until 2010 to cover the current boom period and then leveling off to 2 percent per year based on the overall average growth for the State.

- **Moderate Growth Projections –** This set of population projections is based on the average of the two previous sets of projections.

Table 2 summarizes the results of these projections for the entire UWCD service area. This information is also shown graphically in Figure 3. From Table 2 we see that the population estimate in 2050 will vary significantly depending on which set of growth projections is used. Based on aggressive growth, population in 2050 (61,166) is approximately 2.3 times the GOPB estimate (26,046). From Figure 3, we can also see that the GOPB baseline estimate for 2005 is already significantly lower than actual population as reported by water service providers (21,066 vs. 21,705). This appears to confirm the assumption that the GOPB projections represent only minimal growth and that actual growth in Ashley Valley should fall within the ranges given in Table 2. A breakdown of growth projections by individual retail water provider is given in Appendix A.

Table 2
Projected UWCD Service Area Population

Year	Projected Population (Minimal Growth)	Projected Population (Moderate Growth)	Projected Population (Aggressive Growth)
2010	21,670	24,858	27,702
2020	23,445	28,146	33,768
2030	24,527	31,869	41,163
2040	25,306	36,084	50,178
2050	26,046	40,857	61,166

Comparison of Projected Population to Potential Buildout Population

As part of this study, BC&A analyzed potential buildout population in the Ashley Valley. According to 2003 land use data, Ashley Valley has approximately 40,300 acres of potentially developable land. Of this, approximately 87 percent of the land is currently used for farm related purposes (crops, pasture, etc.), 11 percent is used for urban residential development, and 2 percent for industrial development (as shown in Figure 1). Based on US 2000 Census data, Vernal accounts for about 38 percent of the population in the valley and has an urban residential density of about 5.2 people per acre. If it is assumed that all farm related land is developable and an that it will eventually be developed as an urban residential density similar to Vernal, the buildout population in Ashley Valley is estimated to be about 210,000 people. From Table 2 we see that, even using the aggressive growth population projections, Ashley Valley as a whole will be only a fraction of the buildout population by 2050.

Converting Population to Demand

The final step in developing water demand projections for UWCD service area is to convert the population projections developed above into water demand. This was done by taking the population projections above, multiplying them by a per capita demand, and then considering conservation.

Estimated UWCD water demand in the year 2003 is shown in Table 3. Total average demand for UWCD service area for 2003 was 290.6 gallons per capita per day (gpcd). Table 3 shows 2003 demand varies between the retail providers. MWID and JWID have calculated per capita demands (213.3 and 223.5 gpcd, respectively) that are lower than the average demand of 290.6 gpcd. Conversely, the AVWSID demand of 339 gpcd is higher than the study area average. Only Vernal's demand of 286.6 gpcd is very close to the study area average.

There are two possible reasons for the variations in usage between the water providers. First, the usage data is based only on water distributed by the various water providers and does not include private water sources. In Jensen and Maeser, it is likely that there are a number of residents that currently depend on wells and other private supplementary water sources. These sources are not included in the total water use shown in Table 3 and could be artificially lowering the calculated per capita demand for these two providers. A second possible cause of the variations in per capita water use is imprecise distribution of population between the water providers. Because of limitations in available population data, 2003 population numbers may be slightly over estimated in Jensen and Maeser and underestimated in AVWSID. Despite these possible problems, the overall per capita demand of 290 gpcd appears to be reasonable relative to average water use measured in other parts of the State.

Table 3
2003 Historic Water Demand [1]

Water Supplier	Residential Indoor Use (Ac-Ft/yr)	Residential Outdoor Use (Ac-Ft/yr)	Commerical Indoor & Outdoor Use (Ac-Ft/yr)	Institutional Indoor & Outdoor Use (Ac-Ft/yr)	Industrial/ Stockwater Indoor & Outdoor Use (Ac-Ft/yr)	Total Potable M&I Use (Ac-Ft/yr)	Estimated 2003 Population (From Water Reports)	Average Per Capita Water Use (Ac-Ft/yr)	Average Per Capita Water Use (GPCPD)
	Municipal and Industrial Potable Water Demand								
	Total Usage						**Per Capita Usage**		
Ashley Valley Water & SID (AVWSID)	820.4	705.0	149.2	0.0	511.8	2,186.4	8,000	0.273	244.0
Maeser Water Improvement District	227.5	237.9	19.7	44.8	18.0	547.9	3,505	0.156	139.5
Jensen Water Improvement District	81.6	129.7	41.5	0.0	70.2	323.0	1,290	0.250	223.5
Vernal City Municipal Water	856.2	862.5	137.6	300.0	220.0	2,376.2	7,400	0.321	286.6
Total	**1,985.7**	**1,935.1**	**348.0**	**344.8**	**820.0**	**5,433.5**	**20,195**	**0.269**	**240.2**

Water Supplier		Residential Use (Ac-Ft/yr)	Commercial Use (Ac-Ft/yr)	Institutional Use (Ac-Ft/yr)	Industrial/ Stockwater Use (Ac-Ft/yr)	Total Secondary Use (Ac-Ft/yr)	Estimated 2003 Population (From Water Reports)	Average Per Capita Water Use (Ac-Ft/yr)	Average Per Capita Water Use (GPCPD)
		Municipal and Industrial Secondary Water Demand [2]							
		Total Usage					**Per Capita Usage**		
Ashley Valley Water & SID (AVWSID)		500.0	0.0	352.0	0.0	852.0	8,000	0.107	95.1
Maeser Water Improvement District		289.7	0.0	0.0	0.0	289.7	3,505	0.083	73.8
Jensen Water Improvement District		0.0	0.0	0.0	0.0	0.0	1,290	0.000	0.0
Vernal City Municipal Water		0.0	0.0	0.0	0.0	0.0	7,400	0.000	0.0
Total		**789.7**	**0.0**	**352.0**	**0.0**	**1,141.7**	**20,195**	**0.057**	**50.5**

Water Supplier		Residential Use (Ac-Ft/yr)	Commercial Use (Ac-Ft/yr)	Institutional Use (Ac-Ft/yr)	Industrial/ Stockwater Use (Ac-Ft/yr)	Total Potable + Secondary Use (Ac-Ft/yr)	Estimated 2003 Population (From Water Reports)	Average Per Capita Water Use (Ac-Ft/yr)	Average Per Capita Water Use (GPCPD)
		Municipal and Industrial Potable + Secondary Water Demand							
		Total Usage					**Per Capita Usage**		
Ashley Valley Water & SID (AVWSID)		2,025.4	149.2	352.0	511.8	3,038.4	8,000	0.380	339.0
Maeser Water Improvement District		755.1	19.7	44.8	18.0	837.6	3,505	0.239	213.3
Jensen Water Improvement District		211.3	41.5	0.0	70.2	323.0	1,290	0.250	223.5
Vernal City Municipal Water		1,718.6	137.6	300.0	220.0	2,376.2	7,400	0.321	286.6
Total		**4,710.4**	**348.0**	**696.8**	**820.0**	**6,575.2**	**20,195**	**0.326**	**290.6**

1. 2003 Usage Data taken from Utah Department of Natural Resources Division of Water Resources' Feb 2006 "Uintah Basin M&I Water Supplies and Uses" Report and District Water Reports

2. Secondary usage estimated based on acereage of land currently irrigated using secondary water (excluding pasture, farmland irrigation).

The current State conservation goal is to reduce per capita water demand by 25 percent by the year 2050, with 12.5 percent of this conservation achieved by 2020 and the remaining 12.5 percent achieved between 2020 and 2050. If UWCD meets the State's conservation goal, the projected annual demands for each of the growth scenarios discussed previously will be as summarized in Table 4.

Table 4
Projected UWCD Service Area Demand (with Conservation)

	Minimal Growth		Moderate Growth		Aggressive Growth	
Year	Annual Demand (acre-ft)	Peak Day Demand (mgd)	Annual Demand (acre-ft)	Peak Day Demand (mgd)	Annual Demand (acre-ft)	Peak Day Demand (mgd)
2010	6,623	16.6	7,597	19.0	8,466	21.2
2020	6,687	16.7	8,028	20.1	9,632	24.1
2030	6,663	16.7	8,657	21.6	11,182	28.0
2040	6,531	16.3	9,312	23.3	12,949	32.4
2050	6,368	15.9	9,989	25.0	14,954	37.4

The projections in Table 4 are based on the assumption that UWCD service area as a whole will meet State conservation goals, even though current per capita demands and conservation may vary between individual water providers in the District service area. Projected demands for individual retail water providers are shown in Appendix A.

Peak Day Demand

Included in Table 4 is an estimate of Peak Day Demands (PDD) in UWCD service area through 2050. Peak day demands were estimated based on the historic peaking factor in the system. A peaking factor is the ratio of PDD in the system to average day demands. Historic peak and average day demand data from 2000-2006 water years (September-August) were used to calculate an average peaking factor. Using this data, the overall average Ashley Valley peaking factor is about 2.8. This value was used for calculating the peak demands shown in Table 4.

UWCD ANNUAL WATER SUPPLY

Existing sources of supply for UWCD and its member agencies are summarized in Table 5. A list and brief description of each of these water sources is include in the sections below:

Table 5
Municipal and Industrial Water Supply

Water Supplier	Average Year Water Supply [a] (Ac-Ft/yr)	Reliable, Dry Year Water Supply [b] (Ac-Ft/yr)
Ashley Valley Water & SID (AVWSID)		
Ashley Creek Primary Allotment (2.1% of Flow between July 1-October 31) Average	784.5	290.0
Ashley Creek Winter Stock Water	90.8	90.8
Steinaker M&I Water	640.0	640.0
Ashley Reservoir Company Stock	224.0	30.7
Red Fleet Via Tyzack Aquaduct	500.0	500.0
AVWSID Secondary (non-potable) [c]	852.0	852.0
Total	**3,091.3**	**2,403.5**
Maeser Water Improvement District		
Ashley Creek Primary Allotment (0.6% of Flow) Average	250.7	82.9
Ashley Creek Winter Stock Water	36.1	36.1
Maeser Hullinger Well (Artesian flow to Ashley Creek)	335.8	335.8
Steinaker M&I Water	200.0	200.0
Ashley Reservoir Company Stock	69.6	8.2
Maeser WID Secondary (non-potable) [c]	289.7	289.7
Total	**1,181.9**	**952.7**
Jensen Water Improvement District		
Ashley Creek Primary Allotment (0.06% of Flow between July 1-October 31) Average	25.9	10.0
Ashley Creek Winter Stock Water	20.0	20.0
Ashley Reservoir Company Stock	8.9	4.0
Red Fleet Via Tyzack Aquaduct	300.0	300.0
Total	**354.9**	**334.0**
Vernal City Municipal Water		
Ashley Creek Primary Allotment (3.8% of Flow between July 1-October 31) Average	1,150.8	654.3
Ashley Creek Winter Stock Water	5.7	5.7
Ashley Creek Claim #1370	140.0	140.0
Steinaker M&I Water	760.0	760.0
Ashley Reservoir Company Stock	734.5	86.6
Red Fleet Via Tyzack Aquaduct	1,000.0	1,000.0
Vernal Secondary (non-potable) [c]	0.0	0.0
Total	**3,791.0**	**2,646.5**
Total Ashley Valley Supply	**8,419.0**	**6,336.7**

a-Average Year Supply is based on average annual supply from September 1999-August 2006, or current water allotment for non-variable supplies.

b-Dry Year Supply is based on September 2001-August 2002 historic yields.

c-Non-potable data based on estimated 2003 demand--actual supply not determined.

- **Direct Flows in Ashley Creek –** All of the water providers in the District have water rights to direct flows in Ashley Creek. These flow rights come under one of three categories:

  - *Primary Allotment* – water rights distributed according to contracts (April-June) and established percentages of base flows in Ashley Creek (July-October). Because these rights are generally based on a percentage of stream flow, their actual production varies throughout the year and will be significantly affected by drought conditions.

  - *Winter Stock Water* – water rights distributed between November and March. These water rights are generally consistent from year to year, but may be reduced in years when Steinaker Reservoir does not fill.

  - *Claim #1370* – an additional primary water right to 140 acre-ft of direct flow held by Vernal City.

- **Storage Water from Ashley Creek -** All of the water providers in the District also have water rights to storage water from Ashley Creek. These water rights fall under one of two categories:

  - *Steinaker M&I Water* – water stored in Steinaker Reservoir. This water is diverted from Ashley Creek at the Fort Thornburgh Diversion Dam on Ashley Creek, 4 miles northwest of Vernal. From the diversion dam, the water is conveyed eastward to the reservoir through the 2.8 mile long Steinaker Feeder Canal. Stored water in the reservoir can then be released to Steinaker Service Canal and conveyed south 11.6 miles to existing canals and ditches. While water stored in Steinaker Reservoir cannot be directly used at the existing treatment plants, it can be released downstream in exchange for direct flows in Ashley Creek.

  - *Ashley Reservoir Company* – water rights held in reservoirs located upstream from Ashley Valley. The water is stored in Ashley Twin Lake (tributary to South Fork of Ashley Creek), and Oaks Park Reservoir (connected by canal to Ashley Creek). This water can be released into Ashley Creek and treated at either of the treatment plants. These water rights can be reduced in low water years.

- **Red Fleet Reservoir Water via Tyzack Aqueduct -** All of the retail water providers in the District except MWID currently have rights to storage water from Red Fleet Reservoir. All four retail water providers and two additional end-users have requested additional Red Fleet water rights:

  - *Current Red Fleet Water* - current UWCD M&I water rights in Red Fleet Reservoir total 1,800 acre-ft/year. This is delivered to Ashley Valley Water Purification Plant (AVWPP) through the Tyzack Aqueduct Reach 1. The Tyzack pumping plant has a design capacity of 45 cfs. This water is divided between Vernal, Jensen, and AVWSID as shown in Table 5.

- *Additional Red Fleet Requests* - additional District Red Fleet water requested for M&I needs in Ashley Valley total 3,000 acre-ft/year as shown below:

  - Vernal: 1,000 acre-ft
  - AVWSID: 1,000 acre-ft
  - Maeser: 675 acre-ft
  - Jensen: 325 acre-ft. Of this total, 150 acre-ft has been requested specifically to satisfy Uinta County demand for a new recreational vehicle park. This new demand is assumed to be above what is shown in Table 4. This demand is also assumed to be constant pass through demand independent of population growth. As such neither the new demand nor the 150 acre-ft water request are shown in the demand growth projection figures. Only the remaining 175 acre-ft is assumed to be available to meet new demands within the Jensen system.
  - In addition to the water requested by the major retail water providers, Uinta S.F. Phosphate has requested water from Red Fleet Reservoir. This request is for 300 acre-ft and is not included in the 3,000 acre-ft total request. It is assumed to be a new demand above what is shown in Table 4. This demand is also assumed to be independent of population growth and is not shown in any of the demand growth figures.

- **Ground Water –** MWID is the only water provider with ground water rights that are currently being used to satisfy M&I demands:

  - *Hullinger Well* – an artesian well owned by MWID. Water from this well can be released downstream of the water treatment plants into Ashley Creek in exchange for direct flows in Ashley Creek.

- **Secondary Water** - Non-potable water used for residential, commercial, institutional, and industrial purposes (lawns, parks, golf courses etc.) delivered via canals and ditches. This does not include irrigation water used for pastures and farmland purposes. While this water is not used in the potable systems of any provider, it has been estimated in Table 5 for inclusion in the calculation of per capita water demands. Based on discussions with each water provider, there are no plans for any additional secondary water development. Thus, it has been assumed that no additional secondary water will be developed beyond the amount shown in the table.

Included in Table 5 is an estimate of water supplies during both average and dry years. For the purpose of this analysis, average year yields are based on the average recorded yields for the period of September 1999 to August 2006. Dry year yields are based on actual source yields during 2002, the driest year in recent record. The total yield of existing sources during average water years is 8,419 acre-ft. This decreases to 6,337 acre-ft in dry years. While this report presents information for both dry and average years, all supply planning should be based on dry year results since that is when water supply will be most critical.

Projected District demands have been plotted against existing supplies for both dry and average water years in Figures 4 and 5, respectively. From these figures, a number of conclusions can be made:

1. **Current Water Needs** – Although existing supplies are adequate to meet current demands during average water years, they are inadequate in dry years. This was observed in 2002, when some member agencies of the District had to purchase 1,050 acre-ft of additional water from Red Fleet Reservoir to avoid significant supply shortfalls. It should be noted that this purchase was on a one-time basis only, and was made possible only because of excess capacity at Red Fleet at the time. It is not expected that this excess capacity will always be available for single year purchases in the future. Hence, it is important to secure a reliable source to meet the existing dry year shortfall.

2. **Long-term Water Needs** – As growth occurs within the District's service area, the District's current supply shortfall will increase. The magnitude of this increased shortfall will depend on the amount of growth that occurs within the District. For the "Minimal Growth" scenario considered in this report, the shortfall during a dry year remains approximately constant over the next 50 years. For the "Aggressive Growth" scenario, the shortfall in a dry year increases to over 8,617 acre-ft/year by 2050.

3. **Conservation** – The conclusions above will only apply if the District is successful in meeting the State's conservation goal of a 25 percent reduction in per capita water demand by the year 2050. If the District fails to meet the conservation goal, projected supply shortfalls will be significantly larger and occur sooner than described above.

4. **Additional Red Fleet Water** – The additional 3,000 acre-ft/year of water requested from Red Fleet Reservoir would be more than adequate to meet current demands during dry years. The additional water would be adequate to meet projected demands during dry years until about 2017 under aggressive growth, until about 2039 under moderate growth, and past 2050 under minimal growth.

PEAK DAY PRODUCTION CAPACITY

To evaluate UWCD sources in meeting projected peak daily water demand, existing water treatment plant capacities were considered. Ashley Valley has two water treatment plants:

- Ashley Valley Water Treatment Plant (AVWTP) is situated near Ashley Creek about 10 miles northwest of Vernal and is owned and operated by AVWSID. The AVWTP has a design capacity of 8 mgd and receives and distributes water as described below.

    - Physical Source: Ashley Creek is the only physical water source to the plant. Ashley Reservoir Company Stock can be released into Ashley Creek upstream of the plant.

  - Exchange Sources: Red Fleet, Steinaker M&I, and Hullinger Well can be released at points below the plant in exchange for direct flows in Ashley Creek water.

  - Distribution: Treated water from AVWTP is currently distributed to AVWSID, Maeser WID, Jensen WID, with a small amount going to Uintah County and Vernal.

- Ashley Valley Water Purification Plant (AVWPP) is owned and operated by the Central Utah Water Conservancy District (CUWCD). It is located north of Vernal and has a current capacity of 15 mgd with an ultimate design capacity of 30 mgd. The AVWPP receives and distributes water as described below:

  - Physical Sources: Water piped from Ashley Creek/Springs in a raw water pipeline or pumped from Red Fleet Reservoir via the Tyzack Aqueduct Reach No. 1. Ashley Reservoir Company Stock can be released into Ashley Creek upstream of the intake for the plant raw water pipeline.

  - Exchange Sources: Steinaker M&I, and Hullinger Well can be released at points below the plant in exchange for direct flows in Ashley Creek water.

  - Distribution: Treated water from AVWPP is currently distributed primarily to Vernal with lesser amounts going to JWID, MWID, and AVWSID.

Based on input from the water providers, it has been assumed that demands will be distributed between the two plants as follows:

- AVWSID, MWID, and JWID water will be treated at AVWTP unless total demand exceeds plant capacity (8 mgd). Any excess demand from these entities above AVWTP capacity will be treated at AVWPP.

- All Vernal water will be treated at AVWPP.

Projected District PDD has been plotted against existing treatment plant capacities for both AVWTP and AVWPP in Figures 6 and 7, respectively. A peaking factor of 2.8 was multiplied by the projected average daily demand as described in the PDD section. Estimated secondary water demand was not included because this water does not flow through the water treatment plants and therefore does not affect treatment plant capacity. From Figures 6 and 7, a number of conclusions can be made:

1. **Current Water Needs** – The figures show that the existing combined treatment plant capacity of 23 mgd is more than sufficient to meet current PDD in Ashley Valley. As depicted in Figure 6, PDD of AVWSID, Maeser, and Jensen has slightly exceeded the AVWTP capacity of 8 mgd in recent years. This PDD has typically occurred towards the end of July or early August. During these times, the PDD above AVWTP capacity has been treated at AVWPP for distribution to MWID, JWID, and AVWSID. Even with these additional demands, however, the AVWPP is only at half of its existing capacity.

2. **Long-term Water Needs** – Figure 7 shows that the current treatment plants will be sufficient to meet PDD until about 2025 under the aggressive growth scenario, and sufficient to meet PDD under moderate and minimal growth scenarios through 2050. If the AVWPP is expanded to 30 mgd capacity, the combined plant capacities will be sufficient to meet PDD through 2050, even under Aggressive growth conditions.

3. **Conservation** – The conclusions above will only apply if the District is successful in meeting the State's conservation goal of a 25 percent reduction in per capita water demand by the year 2050. If the District fails to meet the conservation goal, projected PDD will be significantly larger and exceed plant capacities sooner than described above.

SOURCE TIMING – PEAK SEASONAL WATER DEMAND

In addition to considering the District's ability to satisfy annual and peak demands, it is important to consider seasonal water availability. After discussing seasonal source availability with District personnel, it was determined that there are two critical supply periods for the District: spring runoff and late summer.

Critical Demands During Spring Runoff

Spring runoff flows in Ashley Creek produce increased turbidity and decreased alkalinity making it difficult for AVWTP to treat the raw water. During these times, the AVWTP operation uses more water for plant backwashes and flushes, thus treated water capacity is reduced and excess demands on this plant are shifted to AVWPP. As discussed previously, AVWPP currently has significant excess capacity and is therefore able to handle the increased flushing operations and still provide the required water. AVWPP is also able to use Red Fleet water if necessary to meet demands. As demand increases in the District and excess capacity at the AVWPP decreases, it is important to consider the District's ability to continue to treat water during spring runoff in the future.

Figure 8 shows daily raw water flows at AVWTP and AVWPP during May 2006 (peak runoff period for Ashley Creek). From the figure, we see that about 12 mgd of the 23 mgd combined plant capacities was used on May 21st, the peak raw water flow day for the month. However, average daily demand for processed water through the plants was only 7 mgd during May. The difference in raw water used and processed water delivered is primarily due to water

required for flushing and backwashing operations. Historically, AVWTP has required up to 3 mgd of plant capacity (roughly one-third) for flushing operations during spring runoff. If it is assumed that the effective treatment capacity of both plants will be reduced by up to one-third during spring runoff, the existing and ultimate capacity of the plants during this period will be as summarized in Table 6. This effective capacity is applicable only during spring runoff when Ashley Creek water is the sole source treated. The effective capacity of AVWPP will increase if Red Fleet water is used to supplement or replace Ashley Creek during this period.

Table 6
Water Treatment Plant Design and Effective Capacities During Spring Runoff

Plant	Current Capacity (mgd)	Effective Current Capacity (mgd)	Ultimate Capacity (mgd)	Effective Ultimate Capacity (mgd)
AVWTP	8	5.33	8	5.33
AVWPP	15	10	30	20
Combined	23	15.33	38	25.33

Based on historic records, peak raw water use during the springtime runoff period is approximately two times average day demands. Using this historic ratio, peak spring demands have been projected through 2050 for comparison against the effective combined capacity of the treatment plants. This is shown in Figure 9. From the figure, we can make the following conclusions:

1. **Current Water Needs** – The current combined effective capacity of 15.33 mgd is more than sufficient to meet current peak demands during spring runoff in Ashley Valley.

2. **Long-term Water Needs** – Under aggressive growth conditions, the combined effective capacity of 15.33 mgd will be sufficient to meet projected peak demand during spring runoff (treating only Ashley Creek water) until approximately 2025. If Red Fleet water is used to supplement or replace Ashley Creek water during spring runoff, the effective combined plant capacity will increase and will be sufficient for a longer period of time. If the AVWPP plant is expanded to 30 mgd, the combined effective plant capacity (25.33 mgd) will be more than sufficient for the next 45 years to treat spring runoff peak demand (treating only Ashley Creek water).

3. **Comparison to Overall Capacity Needs** – In the analysis of overall treatment plant capacity (see Figure 7), it was determined that plant expansion would be required in 2025 for the aggressive growth scenario. For spring runoff conditions, it was also determined that plant expansion would also be required around 2025 for the aggressive growth scenario. Thus, it can be concluded that capacity needs during spring runoff will not be any more restrictive than overall capacity needs.

While spring runoff capacity does not appear to be a concern for several years, it is recommended that UWCD continue monitoring spring runoff in Ashley Creek to determine whether it is more efficient or cost effective to:

- Treat Ashley Creek water and require additional quantities of water for treatment plant flushing operations, or;
- Pay for pumping costs and treat higher quality Red Fleet water.

Summer Peak Day Demands

The summer is a critical period for seasonal source availability because it is not only the period with maximum system demands, but also a period with minimal direct flows from Ashley Creek. As flow diminishes in Ashley Creek during the late summer months, the District must rely on water from other sources. In average years, water from Steinaker M&I, Ashley Reservoir Company Stock, and Red Fleet Reservoir may be available. During drought years, only Red Fleet water has historically been available because the other storage sources have been used earlier in the year.

If it is assumed that only direct flows in Ashley Creek and Red Fleet water are available to meet peak demands, one could expect the following reliable source production (based on historic production, August 2002):

- Ashley Creek Direct Flows: 1.05 mgd (100.3 acre-ft/month)

- Red Fleet Reservoir: 29.08 mgd (45 cfs) via the Tyzack Pumping Plant and Aqueduct Reach No. 1. This assumes that annual water rights are sufficient to supply the needed water at this capacity late in the water year.

Figure 10 compares projected reliable summer source capacity with projected PDD. A number of conclusions can be made from the figure:

1. **Current Water Needs** – Existing source production (predominantly Red Fleet water through the Tyzack Aqueduct) is more than sufficient to meet current summer PDD in Ashley Valley.

2. **Long-term Water Needs** – It appears that the conveyance capacity of the Tyzack Aqueduct will allow Red Fleet to be the primary water source during summer months and be capable of meeting PDD even with low summer Ashley Creek flows through 2050 for all but the most aggressive growth scenario. For the aggressive growth scenario, existing capacity is adequate through 2046. When the PDD exceeds the available capacity of the Tyzack Aqueduct, additional source capacity will be required. This easiest way to create this additional capacity is to hold water in Steinaker or Ashley Reservoirs for exchange later in the season (assuming water is physically available in Ashley Creek).

RECOMMENDATIONS

From the conclusions in this report, the following actions are recommended:

1. **Secure at least 3,000 acre-ft of additional supply from Red Fleet Reservoir.** While the District has enough supply to meet current demands during average years, it will experience significant shortfalls during dry years until it can secure additional water. This is true regardless of the amount of growth that ultimately occurs within the District. It is recommended that the District secure additional water in Red Fleet to meet this demand. How long this additional 3,000 acre-ft of water will satisfy District demands will depend on how quickly future growth occurs:

    a. Minimal Growth Scenario – The 3,000 acre-ft will satisfy all District demands for the foreseeable future (past 2050).

    b. Moderate Growth – The 3,000 acre-ft will satisfy District demands for approximately 32 years.

    c. Aggressive Growth – The 3,000 acre-ft will satisfy District demands for approximately 10 years.

2. **Monitor development and conservation patterns.** These conclusions are based on current development trends and the State's current conservation goal. It is recommended that the District periodically review the assumptions contained in this report to check their accuracy. Any significant changes in development patterns or conservation habits could seriously affect the conclusions of this report. UWCD should re-evaluate water supply and demand in Ashley Valley in 5 to 7 years. This time frame will allow sufficient time to develop additional water and/or facilities, even if growth in Ashley Valley follows the aggressive scenario.

3. **Analyze Water Use During Spring Runoff.** During Spring runoff in Ashley Creek, it is recommended that the District determine whether it is more cost effective to treat Ashley Creek water, or to pump water from Red Fleet for treatment at AVWPP.

4. **Plan seasonal water usage.** As peak daily demands approach summer source water limits, UWCD will need to carefully monitor usage from the various sources to ensure water rights by exchange for Ashley Creek are available towards the end of the water year. This however is not expected to occur until around 2046. The District will also need some flexibility to shift water right allocations between water service providers late in the water year to meet demands throughout the valley.

5. **Evaluate treatment plant capacity**. Based on spring and summer PDD projections, the current treatment plants have sufficient capacity to meet demands.

The capacity may need to be expanded as early as 2025 under aggressive growth conditions. If aggressive growth does continue, it is recommended that AVWPP be evaluated for expansion to ultimate design capacity of 30 mgd.

6. **Develop plan for long-term water development**. The additional requested 3,000 acre-ft/year of Red Fleet water will only be sufficient for the next 10 years if aggressive growth continues. By 2050, up to 5,770 acre-ft of additional supply could be required. It is recommended that UWCD consider Red Fleet Reservoir and additional Ashley Creek water rights for potential future water development. If more water from Red Fleet is not available, Steinaker Reservoir would be a possible, though less desirable, raw water source. These options should be re-evaluated in 5 to 7 years as discussed above.

7. **Encourage conservation.** Even with the acquisition of additional Red Fleet water, future growth could strain District supplies. To minimize the cost of new water that must be developed in the future, it is recommended that the District pursue the state's long-term conservation goal.