DRAFT FOR PUBLIC REVIEW

Municipal Water Efficiency Plan

Town of Basalt, Colorado

ELEMENT Water Consulting & WaterDM

December 16, 2014

MUNICIPAL WATER EFFICIENCY PLAN

Town of Basalt, Colorado

PREPARED BY

DRAFT FOR PUBLIC REVIEW

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December 16, 2014

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LIST OF ABBREVIATIONS

AF	acre-feet
AF/yr	acre-feet per year
Basalt	Town of Basalt
cfs	cubic feet per second
CWCB	Colorado Water Conservation Board
EQR	equivalent residential unit
F	Fahrenheit
gpcd	gallons per capita per day
gpd	gallons per day
gpm	gallons per minute
MG	million gallons
MGD	million gallons per day
Town	Town of Basalt

Front Cover photograph of Town of Basalt provided by Town staff.

ACKNOWLEDGEMENTS

The development of the Town of Basalt Water Efficiency Plan was a collaborative effort funded by a Colorado Water Conservation Board grant as part of the Roaring Fork Watershed Regional Water Efficiency Plan. The project has been supported through the financial and in-kind participation of the following stakeholders:

- City of Aspen;
- Town of Basalt;
- Town of Carbondale;
- City of Glenwood Springs;
- Snowmass Water and Sanitation District;
- Colorado Water Conservation Board;
- Ruedi Water & Power Authority;
- Roaring Fork Conservancy;
- Community Office for Resource Efficiency;
- Colorado River District.

Town of Basalt staff provided access to detailed datasets and system information that facilitated the preparation of this Water Efficiency Plan. The consultant team would like to thank the following staff members for their time and input on this document:

- Boyd Bierbaum, Town of Basalt
- Robi Darcy, Town of Basalt
- Brigitte Ironside, Town of Basalt

EXECUTIVE SUMMARY

PROFILE

The Town of Basalt, Colorado ("Basalt" or "Town") is a municipality that was formally established in 1901, and is located in Pitkin and Eagle Counties at the confluence of the Roaring Fork and Fryingpan Rivers. The Town is located along Colorado State Highway 82 at an elevation of approximately 6,600 feet, and is about midway between Aspen and Glenwood Springs. The Town provides water service to the area within East Basalt while the Mid Valley Metro District serves West Basalt. The Town water service area is approximately 1.9 square miles (CRWA, 2010), and generally follows the same boundaries as the East Basalt town boundary with the exception of a few out-of-town connections.

Basalt owns and operates its own water supply utility; however, wastewater services are provided by the Basalt Sanitation District. The Town's water supply sources include diversions of groundwater under the direct influence of surface water from natural springs as well as groundwater diversions from alluvial wells. The Town also has a contract to use 500 acre-feet (AF) of water in Ruedi Reservoir.

POPULATION

The population of Basalt's water service area was approximately 2,198 people in 2013. Staff have indicated that the Town plans for growth of 2% per year, which matches the average annual rate of growth from 2008 to 2013. This Water Efficiency Plan covers a 36 year forecasting period from 2015 through 2050. Assuming this rate of growth continues, and that recently approved development applications for an additional 206 residential units are constructed, it is forecast that the population of Basalt will increase from 2,317 people in 2015 to 4,936 people in 2050, an overall increase of 113% in the next 36 years.

WATER DEMAND FORECASTS

As part of the water efficiency planning process, three distinct water demand forecasts were prepared. First, a baseline demand forecast starting from 2015 and going out to 2050 was prepared. **This baseline forecast did not include the impact of water conservation of any kind, even passive water savings, and was developed only to assess the adequacy of future supplies under reasonable worst-case conditions and to demonstrate the impact of anticipated efficiency improvements.** Baseline water demand in 2014 was 586 AF (552 AF potable and 34 AF raw water) and under the baseline forecast potable demand is expected to increase by 662 AF while raw water demand remains constant, resulting in a total demand of 1,248 AF in 2050.

A second water demand forecast through 2050 includes the impact of passive efficiencies from Colorado legislation, and federal plumbing codes and standards. This forecast found that Town water demands will increase to 1,113 AF in 2050, or 135 AF less than under the baseline forecast.

A third forecast was prepared that includes the anticipated impact of the Town's planned water efficiency program measures described in this plan. Under this forecast, demand increases to just 1,017 AF in 2050. Compared with the baseline forecast, if the elements of this plan are fully realized, then it is estimated that water demand at 2050 will be reduced by 230 AF as a result of passive and active water conservation measures in Basalt.

These forecasts form the core of the Water Efficiency Plan and are the forecasts upon which estimated water savings from conservation are based. The analysis completed for this Water Efficiency Plan indicates that the likely annual yield of the Town's surface and ground water rights plus their contract water in Ruedi Reservoir is over 1,700 AF; the Town has not observed significant fluctuation in yield from the springs or wells in wet versus dry years. The maximum annual water demand in Basalt over the past 5 years was 586 AF in 2010, and the range of forecast future demands in the year 2050 are from 1,017 AF to a maximum of 1,248 AF. Based on this analysis, it is concluded that the dry-year yield of the Town's water rights is sufficient to meet current and forecasted future demands.[1]

Climate Change Impact on Water Use

Recent climate change forecasts for the Basalt region indicate a warming trend throughout the year, including irrigation season temperatures, with potential for more precipitation to occur as rain versus snow (Lukas et al. 2014). While it is becoming more common to consider potential climate change impacts on water supply planning, the likely impacts on water demands are less understood. However, some impacts on water demands are already included in the forecasts provided in this plan, because recent water demands are utilized to project future water demand patterns and these recent demands reflect actual consumption patterns based on current climate conditions. Regular updates to these projections and this plan can assist in better understanding both demand-side and supply-side impacts from future climate change. Without conducting a more detailed investigation of potential climate change impacts on both supplies and demands, a sensible approach to water demand forecasting in a changing climate is to regularly update and refine demand projections based on actual current conditions. In addition to tracking changes in water use, tracking changes in hydrology (e.g. base flow conditions reached earlier in the year) would support water conservation efforts by focusing attention on the need to reduce water usage during peak water use periods.

[1] The "dry year" is based on an average of historical dry years and is not intended to represent any specific set of drought probabilities or return intervals. Such considerations would be part of a separate drought response plan.

WATER EFFICIENCY PLANNING PROCESS AND GOAL SETTING

The Town carefully developed this Water Efficiency Plan in accordance with the Colorado Water Conservation Act of 2004 so that it meets or exceeds all statutory requirements according to Colorado Revised Statute § 37-60-126. The Town utilized the Colorado Water Conservation Board's *Municipal Water Efficiency Plan Guidance Document* dated July 2012 to inform and guide the development of this conservation plan.

To fulfill Colorado's statutory water efficiency planning requirements, a series of water conservation program scenarios were developed that incorporated a variety of indoor and outdoor efficiency measures that have been cost-effective when implemented in other Colorado utility service areas. For Basalt, it is most cost-effective to continue to pursue water efficiency at current staffing levels relying of strong building codes and ordinances while implementing efficiency programs as opportunities and time permit.

The Town has established a water efficiency goal of 1.1% savings per year compared with a continuation of current demand. Carried through for 36 years to 2050, this water efficiency effort could reduce water demand in Basalt by a total of 230 AF compared with a continuation of current demand patterns.

Based on careful analysis of current demands and expected growth, the Town believes this level of savings to be reasonably achievable. This goal will be re-evaluated on a regular basis, as Basalt intends to update the Water Efficiency Plan every seven years. This means that five or more additional plan updates will be completed before 2050, affording ample opportunity to update and refine the Town's conservation program and goals as needed.

WATER EFFICIENCY PROGRAM

Basalt does not have a dedicated water conservation staff member and their conservation[2] program is implemented by the Public Works Director and the Water System Operator. In addition, the Town hires outside contractors to assist in implementing certain water efficiency program activities such as leak detection. The Town is committed to water use efficiency, and even without a dedicated staff member, has implemented some water conservation measures including metering, a conservation-oriented water rate structure, utility water loss reduction, and public education and information about water efficiency.

WATER EFFICIENCY PLAN APPROVAL

THIS SECTION TO BE COMPLETED AFTER PUBLIC REVIEW

[2] The terms water efficiency and water conservation are used interchangeably throughout this document.

ROARING FORK REGIONAL WATER EFFICIENCY PLAN

The Town's Water Efficiency Plan has the potential to have a direct effect on flows in the Roaring Fork River below the confluence with the Fryingpan River, although Basalt cannot guarantee that water it saves through conservation efforts will benefit the entire downstream reach of the Roaring Fork to the extent that other downstream water users may divert that water out of the river. The Town is interested in regional partnerships to improve water efficiency and is committed to assisting with the implementation of the Roaring Fork Regional Water Efficiency Plan.

1. PROFILE OF EXISTING WATER SUPPLY SYSTEM

1.1 OVERVIEW[3]

The Town of Basalt ("Town" or "Basalt") was originally part of the Ute Indian Reservation and hunting grounds. Basalt is the result of a merger of two communities: Frying Pan Junction and Aspen Junction. Frying Pan Junction was established in 1882 and then the tent town of Aspen Junction came along around 1885. Frying Pan Junction was mainly a tent village although a few cabins were built. There was a tent store and several tent saloons. Though squatters came as early as 1882, the first settlement town, Frying Pan, was built primarily to house and entertain the men working in the nearby charcoal ovens.

When people heard that a railroad was coming to Frying Pan Junction, they quickly moved to the other side of the river to become part of what would be known as Aspen Junction. The Colorado Midland Railroad came to Basalt in 1887. Aspen Junction was a railroad camp with a boarding house, a store, a restaurant, and saloons. The coming of the railroad into Aspen Junction also helped in making the charcoal easier to transport – prior to the railroad, the charcoal was loaded onto the backs of mules and horses to be hauled up to Aspen. The post office at Aspen Junction was established February 13, 1890 but the name did not change to Basalt until June 19, 1895.

The two Junctions merged and the Town was officially incorporated on October 8, 1901. This name was taken from the basaltic rock formation of Black Mountain, which is now known as Basalt Mountain, located to the north of Town.

The Town is located in Pitkin and Eagle Counties at the confluence of the Roaring Fork and Fryingpan Rivers along Colorado State Highway 82 at an elevation of approximately 6,600 feet, and is about midway between Aspen and Glenwood Springs. The Town provides water service to the area within East Basalt while the Mid Valley Metro District serves West Basalt. The boundary of the Town water service area is generally the same as the East Basalt town boundary with the exception of a few out-of-town taps that continue to be served. The Town estimates that the population of the service area was approximately 2,198 residents in 2013, and anticipates that portion of the population to grow at a rate of approximately 2% per year. The Town recently approved development applications for a 56 unit apartment complex and a 150 unit senior care facility. If these two projects are constructed, then there will be approximately 372 additional residents in addition to what is projected using the 2% growth rate by the year 2023. Therefore, it is estimated that the population of the Town's service area will increase to approximately 3,814 by 2035 and 4,936 by 2050.[4]

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[3] Historical information obtained from: http://www.basaltchamber.org/town/basalts-history/.

[4] This assumes a constant growth rate of 2.0% per year from 2023 to 2050 plus development projects currently under review.

1.2 Regional Setting

The Roaring Fork Watershed is located within the Colorado River Basin in central Colorado on the west side of the Continental Divide. The watershed includes the Sawatch, Collegiate and Elk Mountain Ranges and 8 peaks exceeding 14,000 feet in elevation. Snowmelt from the mountainous headwaters contributes to the streamflow in three primary rivers (Roaring Fork, Fryingpan, and Crystal) that eventually contribute to the flow in the Colorado River in the City of Glenwood Springs. The drainage area of the Roaring Fork watershed is approximately 1,450 square miles.

According to the State Water Supply Initiative (SWSI, 2010), the Colorado River Basin has a projected 2050 M&I water supply gap of 40% with respect to projected water demands. The Colorado River Basin supplies water to over 30 million people in the arid southwest, with the Roaring Fork Watershed contributing about 991,100 acre-feet (AF) to the Colorado River per year (USGS, 2013).

The Roaring Fork Watershed experiences a wide range of climatic conditions from year-to-year as well as from season to season. Climatological records provide evidence of recurring major droughts in Colorado of various length and intensities. Water suppliers in the West accommodate this uncertainty through reservoir storage, consideration of "firm yields" in estimates of water availability, raw water supply development, and "demand side" strategies such as voluntary or mandatory restrictions on outdoor water usage. Plans to reduce usage are necessary to stretch the available water supply to help meet future demands and sustain periods of drought.

Water supply systems in the Roaring Fork Watershed are at risk from possible forest fire, floods, failure of dams/mains/wells, and contamination of all or part of the raw water supply. In order to respond to emergency or drought situations, contingency plans are typically designed for implementation of mandatory measures in stages that minimize impacts to the economy, life-styles, and environment of the community.

1.3 Water Supply and Reliability

The Town owns and operates its own potable water system, which currently includes four water sources with a combined production capacity of just over 2 million gallons per day (MGD). The Town's potable water supply sources include diversions of groundwater under the direct influence of surface water from natural springs as well as groundwater diversions from alluvial wells. Basalt also has one alluvial well that is used solely for irrigation purposes. Wastewater services for East Basalt are provided by the Basalt Sanitation District, which is a separate utility.

The Town's Water Department provides high quality, safe drinking water. Town staff maintain raw water flows to the water treatment facilities in sufficient quantities to meet system

demands. Staff also perform routine operations and maintenance functions for the water utility infrastructure as well as routine laboratory testing and reporting per the Colorado Department of Public Health and Environment (CDPHE) guidelines and requirements.

1.3.1 Potable Water Supply

The Town's potable water system is supplied on a year-round basis by diversions from the Basalt Springs; Lucksinger Springs is a seasonal source available during the non-irrigation months only. Both Springs are located to the north of the Town on Basalt Mountain. The Basalt Springs produces approximately 330 gallons per minute (gpm). Lucksinger Springs produces approximately 350 gpm, however the Town only has the right to use the water as a water supply during the non-irrigation season (it is also used to produce hydropower). The spring flows are concentrated, routed through an in-line 300,000 kilowatt-hour hydroelectric plant, and then piped to the Town's water treatment plant (WTP). The Town's water rights allow the diversion of up to 3,590 gpm (5.2 MGD or 8.0 cfs) from the Basalt Springs and 1,346 gpm (1.9 MGD or 3.0 cfs) from Lucksinger Springs. These legal limits exceed the physical water supply that is currently available from these sources and have not been included as "reliable" yield for this study. The Town prefers to rely on the spring flows as much as possible, and promotes this initiative on their website by saying "*the more we conserve the less we need to use the wells and that means more spring water in the system.*"

The Town's potable water system includes three groundwater wells that are used primarily during the irrigation season to supplement the flows from the springs. The groundwater wells are completed into the Roaring Fork River alluvial aquifer. Well No. 9 produces around 490 gpm, Well No. 11 produces around 240 gpm, and Well No. 13 produces around 390 gpm. Water diverted from the wells is treated at the source, as further described below, and then blended with the spring water. The Town's water rights allow for the diversion of up to 1,234 gpm (1.78 MGD) from the alluvial wells, but not more than 650 AF/yr, and the Town plans to drill and complete additional wells as necessary to meet increased demands and/or to address peaking issues.

The Town stores treated water in 5 storage tanks with a combined capacity of 2.27 million gallons. With this storage, peaking has not historically been an issue.

The Town also has a contract to use 500 AF of water in Ruedi Reservoir and classifies this source of supply as a drought/operational contingency. The Town has not historically observed significant fluctuation in yield from the springs or wells in wet versus dry years. Any future reliability in supply issues are expected to be less drought-related and more impacted by operational issues.

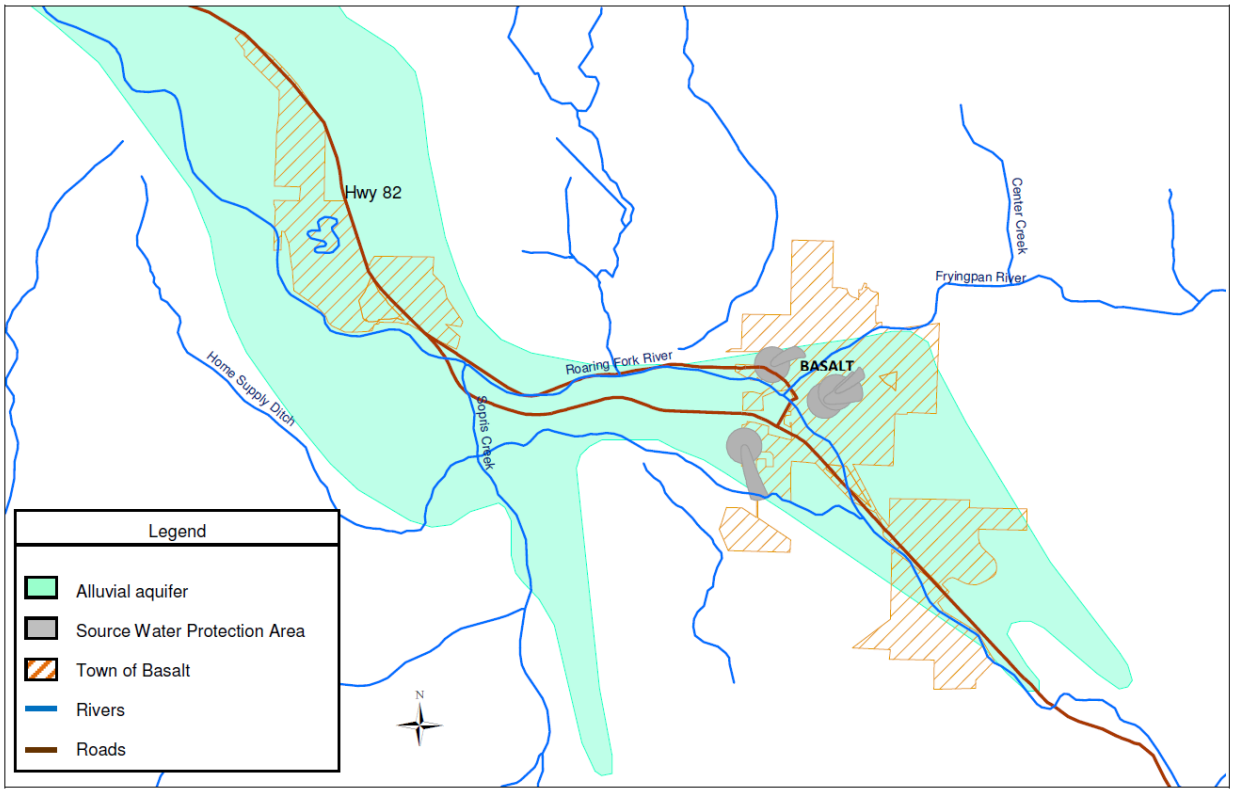

Figure 1. Roaring Fork River Alluvial Aquifer (Colorado Rural Water Association, 2010).

1.3.2 Non-Potable Water Supply

The Town has a fourth groundwater well called the 'Re-1 School Well' that is used for irrigation purposes at the school and in parks. The School Well produces around 250 gpm, but is only available for the Town to use 12 hours per day for park irrigation and on a seasonal basis between April and October (the school uses the well the other 12 hours per day for landscape irrigation at the school). This water is pumped directly to the irrigation system without treatment. The Town supplies approximately 34 AF of raw water per year for irrigation from this source.

1.3.3 Water and Wastewater Treatment

Diversions from the springs are concentrated and then piped to the Town's WTP where they undergo membrane microfiltration and chlorination via chlorine gas. Flows treated at the WTP achieve an adequate chlorine contact time at a "tank farm" consisting of 3 tanks with a total storage volume of 260,000 gallons. The current capacity of the WTP is 0.5 MGD, which provides a margin of safety over the production rate from the springs of 0.475 MGD, based on 330 gpm flowing continuously. The capacity of the WTP can be expanded if necessary. Diversions from the groundwater wells to the potable system are treated at the source with chlorine, either as gas or sodium hypochlorite, and achieve contact time either with clear wells or piping.

The Basalt Sanitation District is a Special District formed to provide sewer service to residents of East Basalt and other areas, and is a separate entity from the Town government. The Basalt Sanitation District's service area covers approximately 942 acres including all of the Town's water service area, Lazy Glen, and other minor developments. The Basalt Sanitation District operates a sewage treatment system with a current capacity of 800,000 gallons per day. A major expansion in 2000 doubled the District's capacity and the District does not plan to expand its facilities in the near future (TG Malloy, 2007).

1.3.4 Capacity and Reliability

As part of the 2007 Basalt Master Plan (TG Malloy, 2007), it was determined that the Town had a total water supply capacity of 2.33 MGD, and a reliable capacity of 1.61 MGD. The reliable water supply capacity was defined as the amount of water that can be produced with the largest individual source (Well No. 9) out of service, which is consistent with a 2006 Water System Report prepared for Basalt (SGM, 2006). The 2006 Water System Report and the 2007 Master Plan attributed a capacity of 350 gpm to the springs; however, the Town has indicated the yield is actually closer to 330 gpm. Similarly, the Town has indicated the well yields are slightly less than capacity. Accordingly, the current yield of Basalt's potable water system is estimated to be around 2.09 MGD with an additional 0.36 MGD non-potable supply, as shown in **Table 1**.

Consistent with the Town's previous planning methodology, the reliable potable water capacity was calculated to reflect the largest potable source being unavailable, which resulted in a value of 1.38 MGD potable supply. While this reflects the instantaneous yield, the annual yield accounts for the wells being decreed for a total of 650 AF/yr, which makes the total potable supply around 1,182 AF/yr.

Peak usage data provided by the Town indicates that the peak daily demand over the last 5 years has averaged approximately 880 gpm, with a maximum of 1,193 gpm in 2012. While the maximum usage exceeded the "reliable" potable supply planning number of 960 gpm, it was still well below the Town's total water supply yield of 1,450 gpm with all wells operational.

The Town water system provides a reliable source of high-quality drinking water for their customers. The Town regularly evaluates its water system supply and demands; however, this is their first water efficiency plan.

Table 1. Water Supply System Yield and Legal Limits.

Water Source	Yield (gpm)	Yield (MGD)	Minimum of Yield and Legal Limit (AF/yr)
POTABLE SUPPLIES			
Basalt Springs	330	0.48	1,097
Lucksinger Springs [a]	350	0.50	
Well No. 9	490	0.71	650
Well No. 11	240	0.35	
Well No. 13 [b]	390	0.56	
Total Potable	1,800	2.59	1,747
Reliable Potable [c]	960	1.38	1,182
NON-POTABLE SUPPLY			
Re-1 School Well [d]	250	0.36	101
CONTRACT			
Ruedi Reservoir			500

Notes:
a Lucksinger Springs can only be used in the non-irrigation season.
b Well No. 13 can only be pumped from April through October.
c Reliable capacity reflects Lucksinger Springs and largest well being unavailable.
d The Town can only pump the Re-1 School Well from April through October and for 12 hours per day; the school uses the well the other 12 hours per day.

1.3.5 Proposed Water Projects

The Town proactively installed a new 1.0 MG storage tank in 2011, and has upgraded approximately 99% of the customer connections to automatic meter reading (AMR) technology. Basalt's water system is reliable and in good condition, so there are no proposed water projects at this time.

2. WATER DEMANDS AND HISTORICAL DEMAND MANAGEMENT

As part of the water efficiency planning process, three distinct water demand forecasts were prepared. The purpose of these forecasts was to present a range of reasonable estimates of water demand for Basalt through the year 2050, given anticipated population growth, and to estimate the impact of the water conservation measures that may occur both "passively" as a result of national and state plumbing codes and standards and "actively" as a result of specific programs and measures to be implemented by the Town. These forecasts were also used for the important purpose of evaluating the adequacy of Basalt's water supply system to meet future demands.

The first step in the forecasting process was to gather data and information on the history of water demands and conservation in Basalt. Through a careful review of these data and information, a baseline demand for Basalt was established. Next, historical population data were used to establish the baseline population, and the Town's planning data were used to forecast population growth out to 2050. This section of Basalt's Water Efficiency Plan describes historical water demands and demand management efforts in the Town.

2.1 Demographics and Service Area Characteristics

The Town provides treated water services to a service area with a 2013 population of approximately 2,198 people. The Town is expanding and anticipates a future growth rate of approximately 2 percent per year through the 2050 planning period. The Town has approved development applications for a 56 unit apartment complex and a 150 unit senior care facility. If these two projects are constructed, then there will be approximately 372 additional residents by the year 2023 in addition to the population projected using the 2% growth rate. Therefore, it is estimated that the population of the Town's service area will increase to approximately 3,814 by 2035 and 4,936 by 2050.[5]

To better understand water use among different categories of customers, Basalt uses the following customer category assignments for its water service accounts. Additionally, the finance department tracks the number of equivalent residential units (EQR[6]) per customer connection as part of the Town's billing system.

- Residential
- Commercial, institutional, and industrial
- Municipal and public
- Mixed commercial and residential
- Irrigation

The town also provides approximately 34 AF per year of water through its non-potable system utilizing the 'Re-1 School Well' described above.

2.2 Historical Water Demands

Annual metered water use in Basalt's service area has ranged from 530 AF/year to 586 AF over the last 5 years (**Table 2**). Water use was slightly above average in 2010 and 2012; however,

[5] Based on a constant growth rate of 2.0% per year from 2023 to 2050 plus development projects approved but not built.
[6] An EQR represents the volume of water consumptively used by a single-family residential unit with 3.5 persons having not more than 2,500 square feet of irrigated lawn or garden. The consumptive use is assumed to be 0.2 AF/yr per EQR.

such slight fluctuations are typical of municipal demand trends across the United States, which have generally declined or held steady in recent years. Fluctuations in Basalt's demand is normal for a municipality of this size and character. The Town reads meters and bills customers on a quarterly basis, however quarterly data were only available from July (3rd Quarter) 2012 through June (2nd Quarter) 2014. These data are summarized in Table 2 below.

The baseline population and demand data shown in Table 2 were selected based on recent demands and the best available understanding of water use in Basalt moving forward into the future. The baseline demands are an important element of the three demand forecasts developed in this plan. To assess the adequacy of water supplies in the future, it is essential to include a full level of potential future demands that are not biased by the normal fluctuations in demand observed in 2013 (or any individual year). While demands in Basalt have been relatively consistent over the 2009 through 2013 time period, the maximum annual values from the July 2012 to June 2014 period for each customer class were conservatively selected as the baseline.

Table 2. Population and Annual Water Deliveries (AF/yr) from 2009 through 2013.

Year	Population	Residential	Commercial	Municipal	Mixed	Non-Potable	Water Loss	Total
2009	2,016	-	-	-	-			533*
2010	2,124	-	-	-	-			586*
2011	2,145	-	-	-	-			530*
2012	2,164	-	-	-	-			547*
2013	2,181	273	88	29	30	34	84	538
2012-13**	2,198	244	92	39	31	34	92	532
2013-14**	2,242	266	115	48	30	34	92	585
Baseline	**2,242**	**266**	**115**	**48**	**31**	**34**	**92**	**586**

*Totals for 2009 through 2012 do not include non-potable irrigation.
**Quarterly data were only available by customer class from July 2012 to June 2014 and therefore 2013 is the only full calendar year with data by customer class.

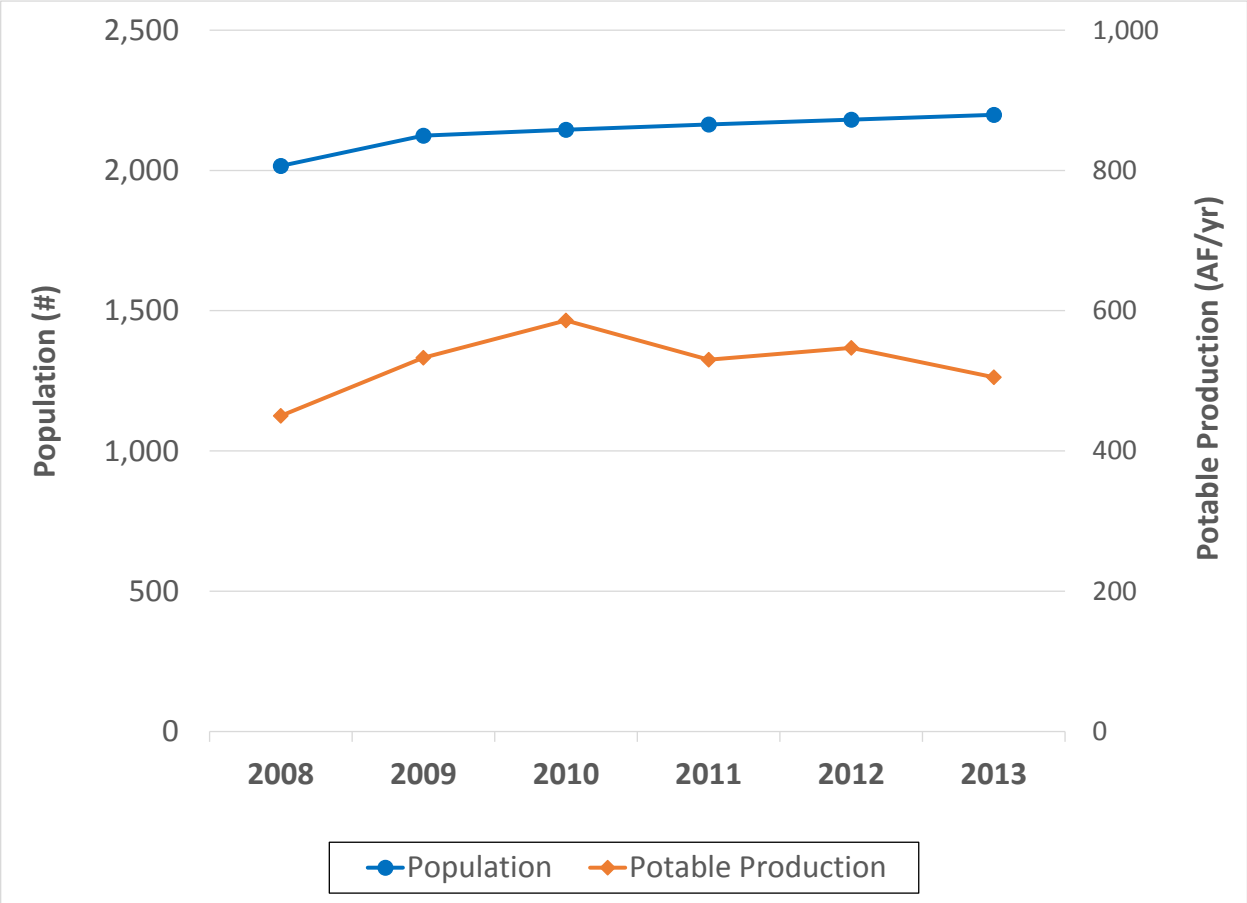

Figure 2. Changes in Population and Annual Potable Production from 2008 through 2013.

An estimated breakdown of indoor and outdoor historical metered potable demands[7] in Basalt based on periodic consumption data provided by Town staff are shown in **Table 3**. Typically about 62% of the annual potable water demand in Basalt is for indoor purposes and 38% is for outdoor irrigation.

Table 3. Total Indoor and Total Outdoor Potable Deliveries from July 2012 through June 2014.

Year	Indoor (AF/yr)	Outdoor (AF/yr)	% Indoor	% Outdoor	Apr to Oct Temp (deg F)*
2012-13	250	156	61.7%	38.3%	60.5
2013-14	278	165	62.7%	37.3%	60.0
Baseline			**62%**	**38%**	**60.3**

*Based on Glenwood Springs #2 Weather Station (No. 53359).

[7] Metered potable demands are the focus of this Water Efficiency Plan. Unless specifically noted, the demands shown do not include the Town's non-potable system.

Basalt's consumption data was further disaggregated by water use sector as shown in **Table 4.** Indoor and outdoor demands for each category were estimated using a standard average winter consumption (AWC) approach where indoor use from the winter months (January, February, and December), when there is typically no outdoor irrigation occurring, is used to estimate indoor use for the entire year. Indoor use is then deducted from the total to estimate outdoor use.

Table 4: Sectoral and Seasonal Metered Potable Deliveries from July 2012 through June 2014 (AF).

	Residential		Commercial		Municipal		Mixed		
Year	Indoor	Outdoor	Indoor	Outdoor	Indoor	Outdoor	Indoor	Outdoor	Total
2012-13	172	72	52	40	5	35	22	9	406
2013-14	142	124	111	4	20	27	20	10	444
Baseline	**142**	**124**	**111**	**4**	**20**	**27**	**22**	**9**	**460**

As with most municipalities in Colorado, the Basalt's demands are higher during summer months due to outdoor water use. **Figure 3** shows the average monthly potable demands over the past 2 years from July 2012 through June 2014, by water use sector. As expected due to outdoor water use, most water use sector demands increase during the second and third quarters that include summer months and the residential pattern correlates particularly well with temperature. Peak usage occurs in the third quarter that includes the months of July, August, and September, as each of these months is affected by irrigation. The usage in the third quarter was 2.9 to 3.6 times higher than during winter months of the years with quarterly data. The distribution of sectoral demands in Basalt are also very consistent between years, as shown in **Figure 4**.

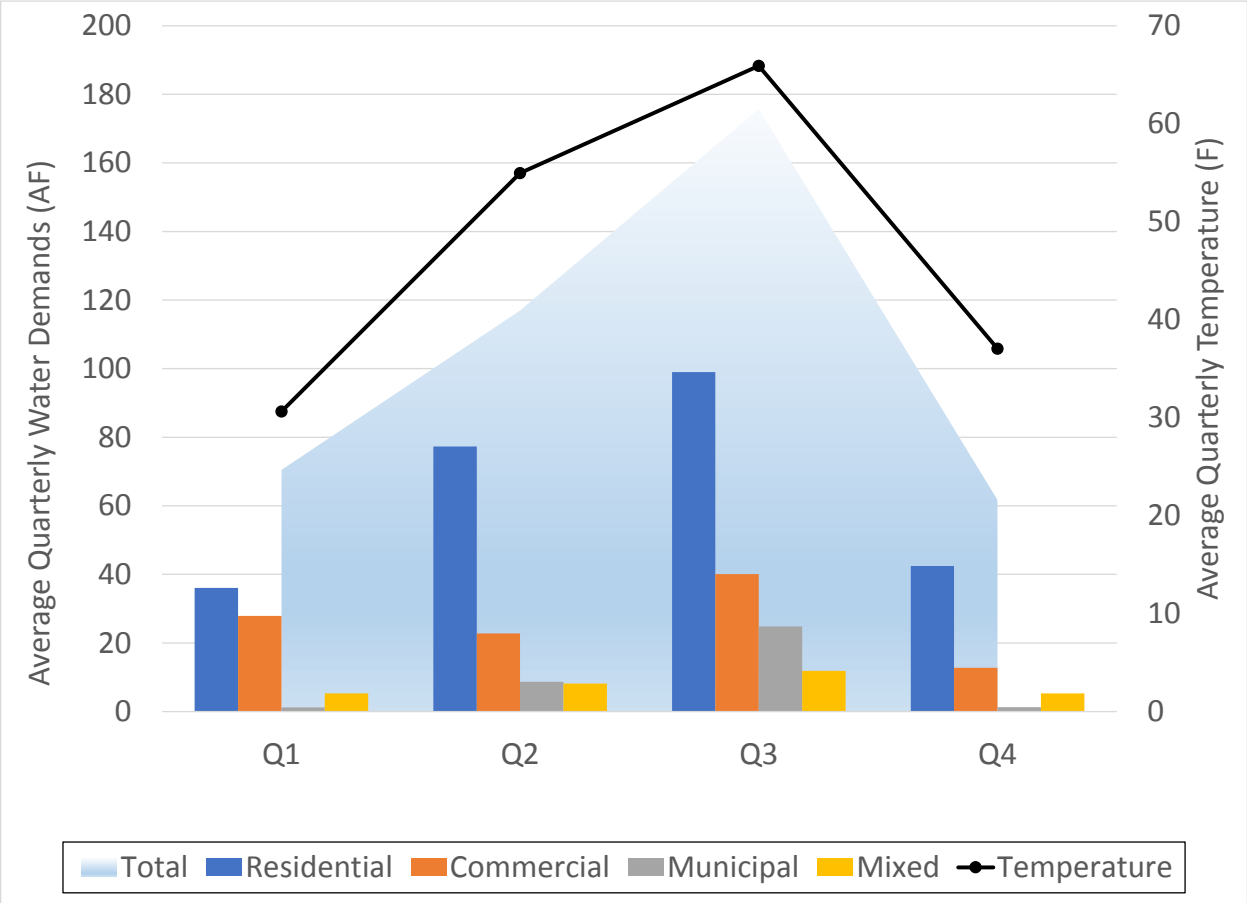

Figure 3. Average Quarterly Potable Demands by Water Use Sector from July 2012 through June 2014.

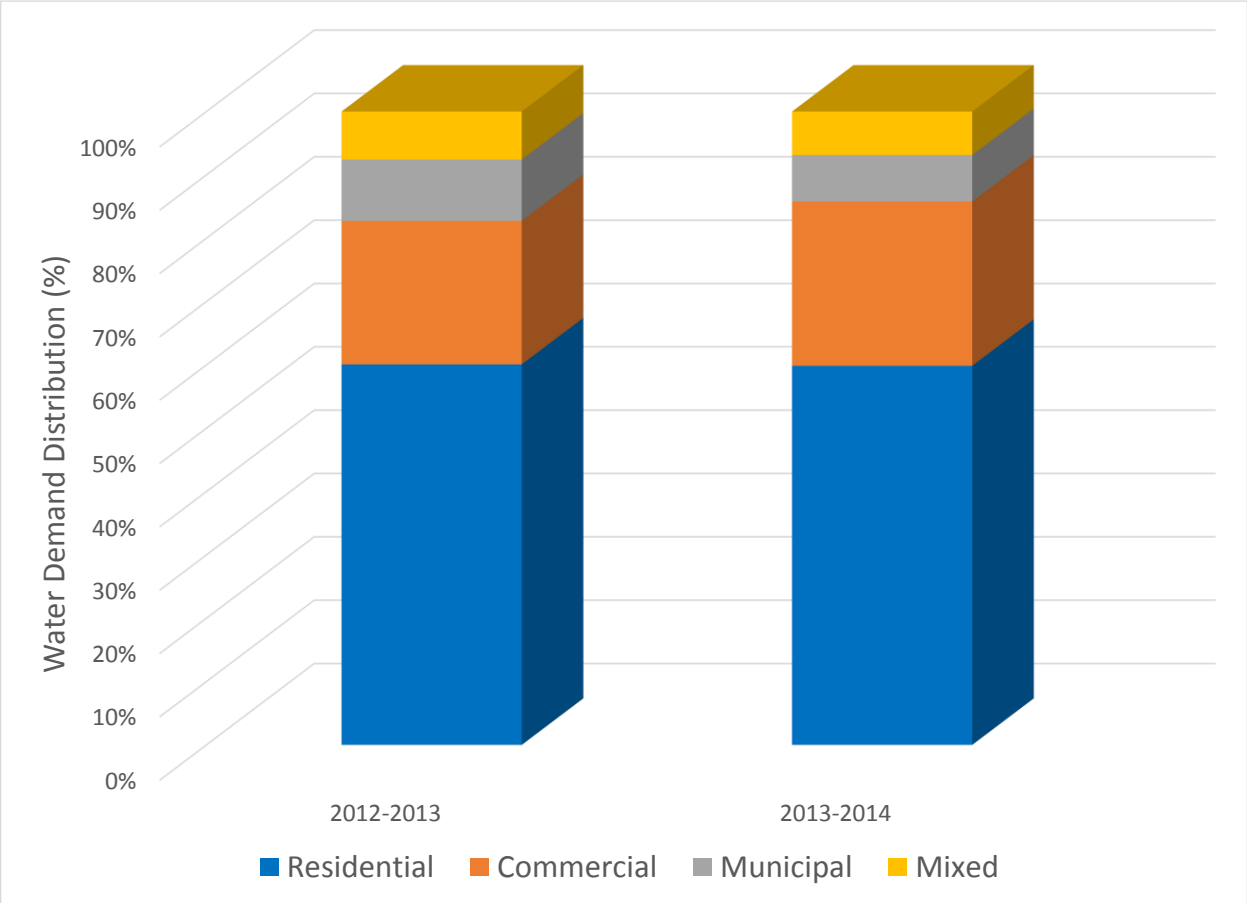

Figure 4. Distribution of Sectoral Potable Demands from July 2012 through June 2014.

In 2013, residential demand accounted for 58% of the total potable demand in Basalt, commercial accounted for 29%, and municipal and mixed categories each accounted for 7% of the annual potable demand. A pie chart showing the components of the 2013 water usage in Basalt is presented in **Figure 5.**

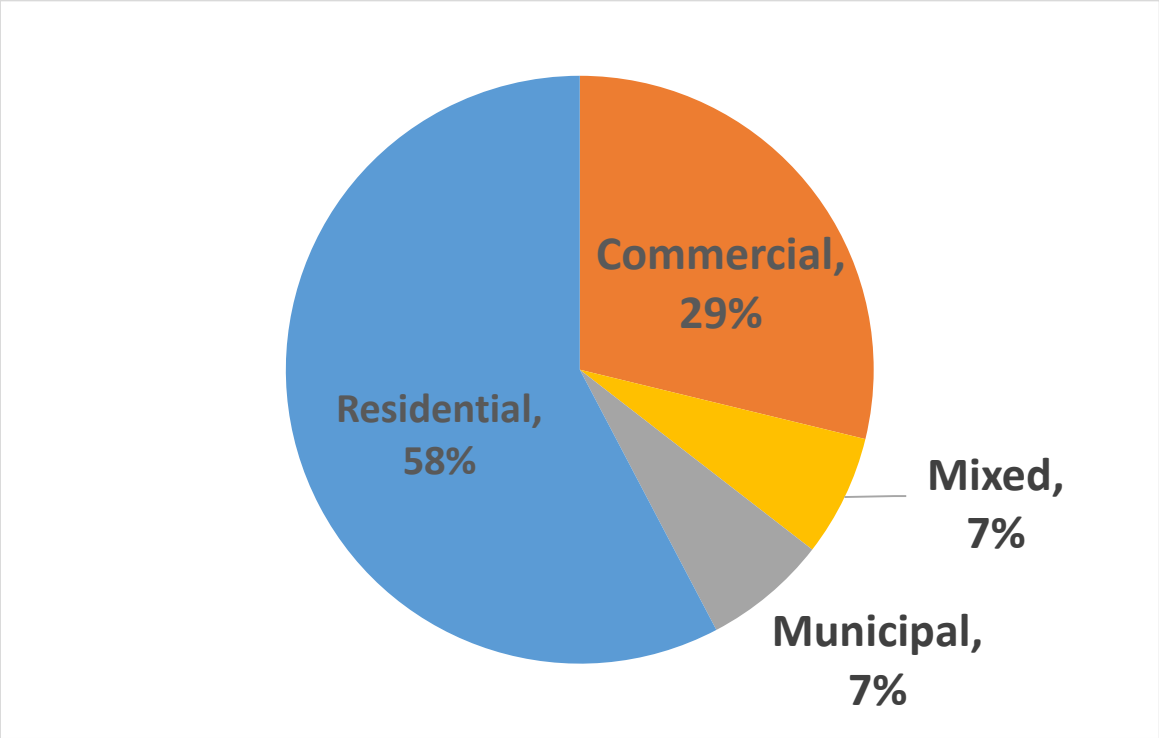

Figure 5: Distribution of Annual Potable Water Use by Sector in 2013.

A pie chart showing the percentage of customer connections in 2013 by water use sector is provided in **Figure 6**. Residential customers are most prevalent in Basalt, accounting for 83.3% of all service connections. Commercial/institutional/industrial customers account for 8.5% of connections, public/municipal customers account for 3.8% of connections, and irrigation and commercial/residential customer connections account for the remaining 4.4%.

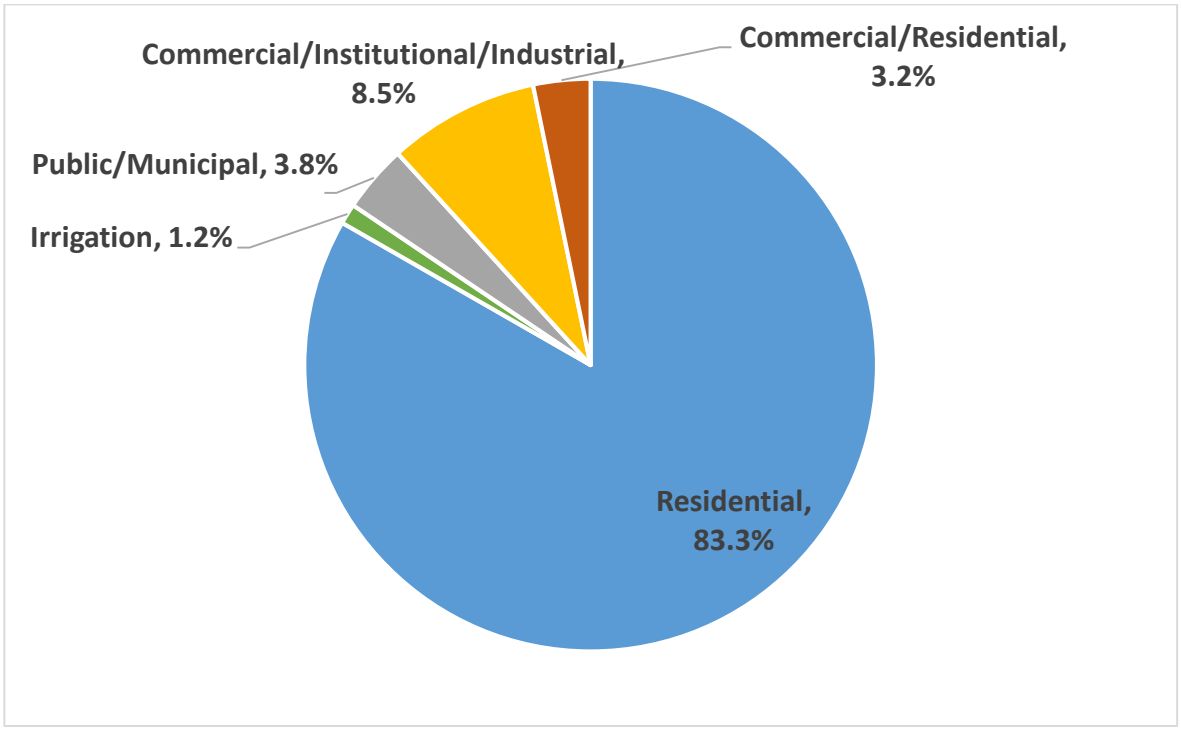

Figure 6. Customer Connections in 2013.

Although residential customers make up approximately 83.3% of customer connections, they comprise only 58% of the total annual demand. Commercial/institutional/industrial customers (8.5% of connections) account for 29% of annual demand.

2.3 Seasonal and Peak Day Demands

A summary of average day and peak potable water production is provided in **Table 5**. Over the last five years, the average day water production has averaged 0.48 MGD and the peak day demand has averaged 1.27 MGD. This indicates that the Town experiences an average peaking factor of approximately 2.6. Additionally, the maximum peak day demand from 2009 to 2013 was 1.72 MGD. The Town's potable system is capable of yielding around 2.09 MGD, so there are no problems meeting current peak demands when all sources are operational.

Table 5: Annual and Daily Potable Production and Demand Characteristics from 2009 through 2013.*

Year	Annual Production (AF)	Annual Production (MG)	Average Daily Production (MGD)	Maximum Daily Demand (MGD)	Peaking Factor
2009	533	174	0.476	1.102	2.3
2010	586	191	0.523	1.056	2.0
2011	530	173	0.473	0.976	2.1
2012	547	178	0.488	1.717	3.5
2013	505	165	0.451	1.474	3.3
5-YR AVG	540	176	0.482	1.265	2.6

*Does not include non-potable water system.

2.4 System Water Losses

The Town annually contracts with a professional leak detection firm that utilizes sophisticated listening equipment to locate leaks. Town staff also compare production data to meter readings on a quarterly basis. Repairs are then made based on these analysis. Town staff also provide audits to customers with a suspected leak. A comparison of annual water production and metered use over the last 7 years indicates an average loss of approximately 20%. However, Town staff have indicated that the water system is in good shape and relatively free of leaks and believe this value is more attributable to metering and billing issues than it is representative of actual leaks. Approximately 99% of the Town's residential connections have been replaced in recent years and have automated metering reading (AMR); however, the Town is not using this technology to identify potential leak at this time. A baseline water loss level of 20% was included in the demand forecasts. To better understand the nature of this level of water loss, it is strongly recommended that Basalt implement an IWA/AWWA water loss control audit annually.

Table 6. Comparison of Potable Production and Metered Water Use Data from 2007 through 2013.*

Year	Production (AF/yr)	Metered Use (AF/yr)	Loss (AF/yr)	Loss (%)
2007	504	425	79	15.7%
2008	542	450	92	17.0%
2009	533	414	119	22.3%
2010	586	432	154	26.3%
2011	530	405	125	23.5%
2012	547	432	115	21.1%
2013	505	421	84	16.6%
Average	**535**	**426**	**110**	**20.4%**

*Does not include non-potable water system.

2.5 Past and Current Demand Management Activities

The Basalt water department currently employs 1.5 people including the Director of Public Works. Basalt does not have a dedicated conservation staff member and their conservation program is implemented by the Town's Water System Operator with assistance from the Public Works Director. The Town has demonstrated a commitment to water use efficiency, and even without a staff member dedicated to water conservation, has implemented some of the most essential water efficiency and conservation program measures.

While this is Basalt's first water efficiency plan, they have already implemented the following initiatives to reduce water use:

- Water loss reduction and infrastructure upgrade program.
- Tiered water rate structure.
- On-site water audits upon request.
- Public outreach and education regarding outdoor water use, including:
    - Water conservation pamphlet distributed to customers.
    - Recommended watering schedules.
    - Recommended landscaping maintenance practices to conserve water.
    - Promoting the use of rain shutoff devices with automatic irrigation systems.

2.6 Demand Forecast

As part of the preparation of the Water Efficiency Plan, three separate demand forecasts were prepared:

1. Baseline Forecast (without conservation)
2. Passive Savings Forecast
3. Passive and Active Savings Forecast

The baseline forecasting method used historical demand patterns to establish baseline per capita demand and then to increase these demands with population out to 2050 as if the 2014 per capita water use patterns continue without change to 2050. This is a standard approach to demand forecasting, but it does not take into consideration the expected impacts of water efficiency.

The second and third forecasts were developed using a more robust approach, where demands were separated out by water use sector or customer category (e.g. residential, commercial, irrigation, schools, etc.), with seasonal and non-seasonal demands (outdoor and indoor) disaggregated for each category. Then a separate demand forecast out to 2050 was prepared for indoor and outdoor demand in each of Basalt's customer sectors. This allowed the impacts of specific water efficiency measures like high-efficiency toilets and clothes washers to be considered.

2.6.1 Population Planning Projections

For water demand forecasting, it is important to consider a reasonably high-growth population forecast to ensure that sufficient water supply and infrastructure are in place when needed by the local citizens. The population forecast used in this conservation plan is intended to represent a reasonable "high growth" scenario for Basalt in which the currently proposed large development applications are approved and population growth continues at an annual 2% rate over the next 36 years.

The Town estimates that the population of the service area was approximately 2,198 residents in 2013, and anticipates that portion of the population to grow at a rate of approximately 2% per year. The Town is currently reviewing development applications for a 56 unit apartment complex and a 150 unit senior care facility. If these two projects are constructed, then there will be approximately 372 additional residents as compared to what is projected using the 2% growth rate by the year 2023.

Table 7 shows the population forecast from 2015 to 2050. These data are shown as a graph in **Figure 7**. Under this forecast, it is estimated that the population of the Town's service area will increase to approximately 3,814 by 2035 and 4,936 by 2050.[8]

[8] This assumes a constant growth rate of 2.0% per year from 2023 to 2050 plus development projects currently under review.

Table 7: Population Growth Projections from 2015 through 2050.

Year	Population
2015	2,317
2016	2,392
2017	2,467
2018	2,541
2019	2,616
2020	2,691
2025	3,065
2030	3,439
2035	3,814
2040	4,188
2045	4,562
2050	4,936

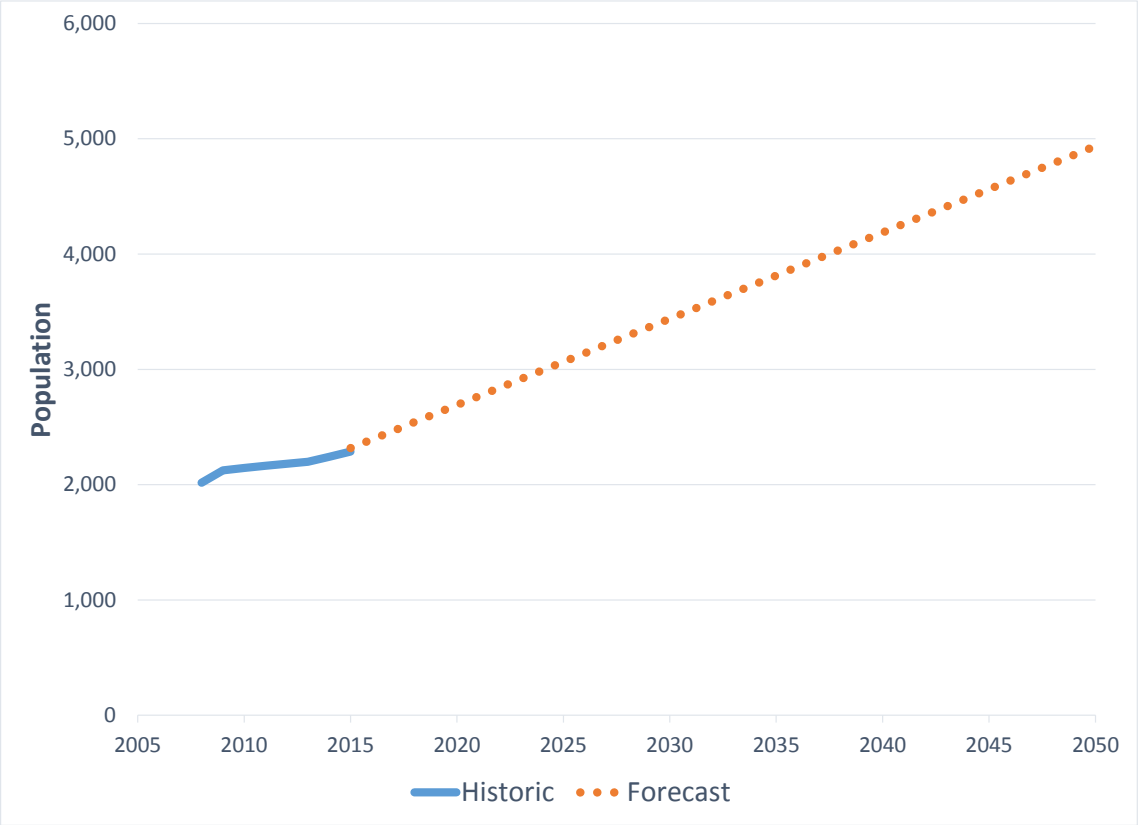

Figure 7: Actual and Forecast Population from 2000 through 2050.

The Town does not currently have a build-out population planning projection. In the forecasts shown here, a 2.0% annual growth rate is anticipated, in addition to several significant approved projects. The actual growth rate (pre-recession) over the past few years has been closer to 1.0% per year. For water and conservation planning purposes, the projections used by the Town and presented here are responsible and appropriate for assessing water supply adequacy. Furthermore, since this plan is scheduled to be updated every seven years, there is ample opportunity to refine these forecasts to better match actual growth trends in Basalt.

2.6.2 Demand Forecasts

As part of the water efficiency planning process, three distinct water demand forecasts were prepared. A description of each scenario and the forecasting methodology is presented below. The costs and benefits associated with these scenarios are considered in the next section of this plan document.

2.6.2.1 Forecast Methodology

First, a baseline demand forecast starting from 2015 and going out to 2050 was prepared. This baseline forecast did not include the impact of water conservation of any kind, even future passive water savings, and was developed only to assess the adequacy of future supplies under reasonable worst-case conditions, and to demonstrate the impact of anticipated efficiency improvements. The baseline forecast in based on a combination of anticipated demographic and land use changes in Basalt. In the baseline forecast, all demands (indoor and outdoor) increase proportionally with the population at the current rate of usage. An annual demand for non-potable water of 34 AF is included in each year of all forecasts. A second water demand forecast to 2050 was developed that includes the impact of passive efficiencies from Colorado legislation, and federal plumbing codes and standards. A third forecast was prepared that includes the anticipated impact of the Town's planned water efficiency program measures described in this plan.

The second and third forecasts include the impacts of water efficiency and were developed using a more robust approach that considers anticipated changes in each customer sector in Basalt. To develop these forecasts, demands were separated out by water use sector (e.g. residential, commercial, irrigation, schools, etc.), with seasonal and non-seasonal demands (outdoor and indoor) disaggregated for each category as shown in Table 4. Then a separate demand forecast out to 2050 was prepared for indoor and outdoor demand in each of Basalt's customer sectors. This allowed the impacts of specific water efficiency measures like high-efficiency toilets and clothes washers to be considered.

These three forecasts form the core of the water efficiency plan and are the forecasts upon which estimated conservation savings are based. Each forecast shows demand starting in 2015 and going through the planning horizon of 2050 (36 years). The results are provided in **Figure 8** and further described below.

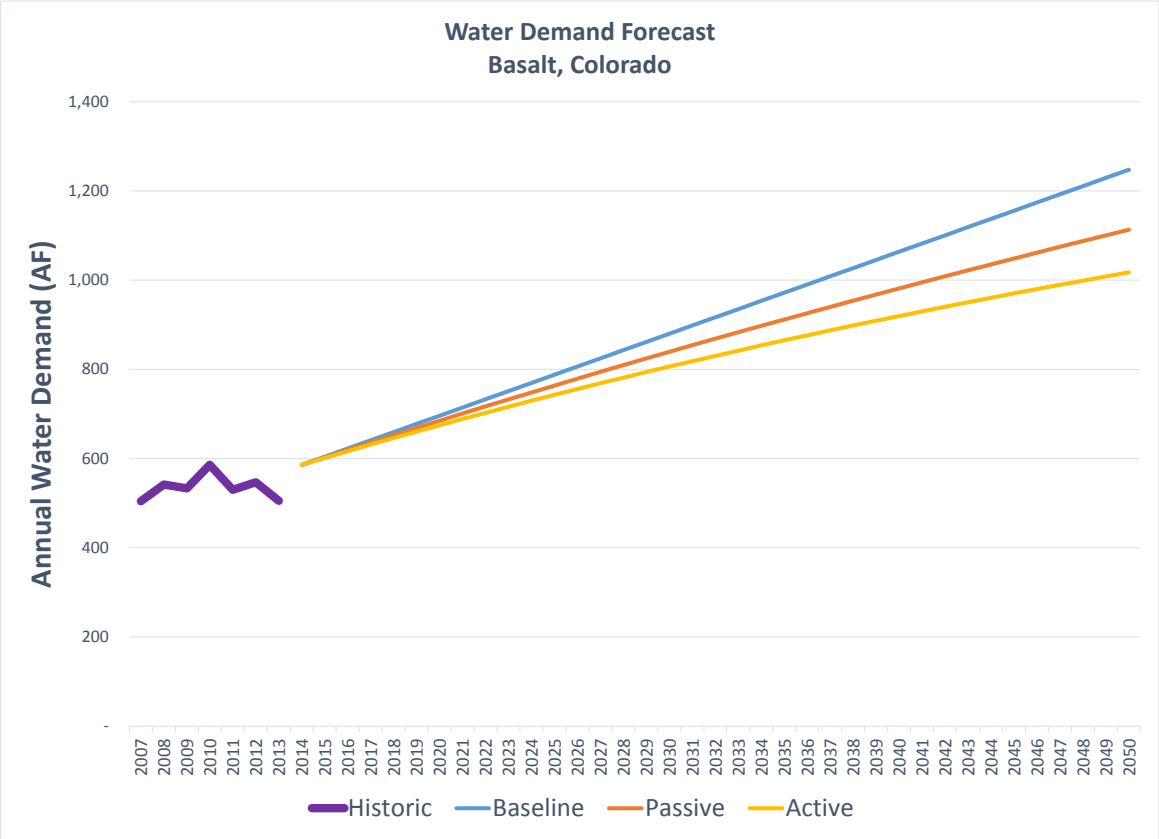

Figure 8: Baseline, Passive, and Active Demand Forecasts through 2050 (includes raw water).

Baseline Forecast

The concept of the baseline forecast is to exclude conservation of any kind and to simply assume that typical baseline demand patterns (i.e. the water use patterns of 2009-2013) are continued into the future without change. It is also assumed that typical water demands for the Town will change proportionally with increases in population. This assumes new customers joining the system use water identically to the current customer base. The fundamental purposes of the baseline forecast are to assess the adequacy of future supplies under reasonable "worst case" conditions (i.e. no water efficiency gains), and do demonstrate the anticipated impact of water efficiency in Basalt from both passive and active conservation programs. The baseline forecast is presented in Figure 8.

Key assumptions in the baseline forecast include:

- Baseline water use patterns for Basalt (Table 2).
- Population forecast for Basalt (Table 7).
- Water use in all sectors, both seasonal and non-seasonal, changes proportionally with the population.

- Outdoor water use impacts from temperature and precipitation in 2050 are similar to 2015.

Baseline water demand in 2014 (including non-potable) was 586 acre-feet (AF) and under the baseline forecast is expected to increase by 662 AF to 1,248 AF in 2050. This represents a 113% increase in water demand over the next 36 years.

Passive Conservation Forecast

A second water demand forecast to 2050 that includes the impact of anticipated passive efficiencies from Colorado legislation, and federal plumbing codes and standards on a sector-by-sector basis for both indoor and outdoor use was prepared. Colorado Senate Bill 2014-103, which was passed in 2014 and phases out the sale of low-efficiency lavatory faucets, showerheads, flushing urinals, and tank-type toilets, is an example of local legislation that is accounted for in the forecast of passive conservation between 2015 and 2050. This forecast found that Town water demands will increase to 1,113 AF in 2050. The passive forecast is presented in Figure 8.

Key assumptions in the passive conservation forecast include:

- Baseline water use patterns for Basalt (Table 2).
- Population forecast for Basalt (Table 7).
- Outdoor water use in all sectors increases proportionally with the population.
- Outdoor water use impacts from temperature and precipitation in 2050 are similar to 2015.
- 1% per year decrease in residential indoor per capita water use (from 56.4 gallons per capita per day (gpcd) in 2014 to 39.3 gpcd in 2050) continuing trends of the past 15 years9.
- 0.5% per year decrease in per capita commercial indoor use from ongoing replacement of fixtures, appliances and equipment and new Colorado legislation (Senate Bill 14-103) assuring high-efficiency plumbing in new construction.
- 0.5% per year decrease in per capita mixed indoor use in the mixed use customer category from ongoing replacement of fixtures, appliances, and equipment and new Colorado legislation assuring high-efficiency plumbing in new construction.
- 0.5% per year decrease in per capita municipal indoor use from ongoing replacement of fixtures and appliances and new Colorado legislation assuring high-efficiency plumbing in new construction.

[9] Based on results from the Water Research Foundation *Residential End Uses of Water Update* (to be published in 2014).

The passive conservation forecast hypothesizes a 90.1% increase in water demand over the next 36 years and suggest that more efficient fixtures and appliances could help reduce future demands in Basalt by 135 AF in 2050 compared with the baseline.

Active Conservation Forecast

A third forecast was prepared that includes the anticipated impact the Town's planned water efficiency program measures described in this plan. Under this forecast, demand increases to just 1,017 AF in 2050. Compared with the original baseline forecast, if the elements of this plan are fully realized, then it is estimated that water demand at 2050 will be reduced by 230 AF as result of passive and active water conservation measures in Basalt. The active conservation forecast is presented in Figure 8.

Key assumptions in the active conservation forecast include:

- Baseline water use patterns for Basalt (Table 2).
- Population forecast for Basalt (Table 7).
- Outdoor water use in all sectors increases proportionally with the population, but is reduced by 0.25% per year due to a combination of factors including: Basalt's conservation-oriented rate structure which charges higher rates for outdoor use, densification as the Town grows, anticipated smaller lot sizes in future developments, irrigation efficiency improvements, ongoing landscape transformation from traditional turf to water-wise plants, and the Town's ongoing education and information efforts.
- Outdoor water use impacts from temperature and precipitation in 2050 are similar to 2015.
- 1.1% per year decrease in residential indoor per capita water use (from 56.4 gpcd in 2014 to 37.9 gpcd in 2050), continuing trends of the past 15 years and reflecting recent changes to Colorado law under (Senate Bill 14-103), that phases in the sale of only high-efficiency WaterSense labeled fixtures starting in 2016.
- 0.75% per year decrease in per capita commercial indoor use from ongoing replacement of fixtures, appliances and equipment and new Colorado legislation assuring high-efficiency plumbing in new construction.
- 0.5% per year decrease in per capita municipal indoor use from ongoing replacement of fixtures, appliances, and equipment and new Colorado legislation assuring high-efficiency plumbing in new construction.

The active conservation forecast hypothesizes a 73.7% increase in water demand over the next 36 years and suggests that more efficient fixtures and appliances could help reduce future demands in Basalt by 230 AF compared with the baseline.

The Town has an ample raw water supply to meet current demands, and has the water rights available to address projected future demands over the next 36 years. Basalt currently has a

reliable peak water treatment capacity of 1.38 MGD. Under the baseline forecast, this peak will be exceeded by 2032. Under the active conservation forecast, Basalt's peak capacity will not be exceeded until 2044, providing the Town an additional 12 years to expand capacity.

Climate Change Impact on Water Use

Recent climate change forecasts indicate a warming trend in irrigation season temperatures in the Roaring Fork region. For example, one report indicates temperatures for the 2035 to 2064 time period are forecast to increase by an average of approximately *4 degrees F* as compared to 1971 to 2000 (Lukas et al., 2014). More frequent and severe heat waves, droughts, and wildfires are projected. While this may increase the uncertainty in outdoor water demand projections, the net effect depends on numerous factors such as the amount and type of landscaping material, irrigation management practices, etc. Furthermore, some of the impacts on water demands are already included in the forecasts provided in this plan, because recent water demand are utilized to project future water demand patterns. It is important to consider both demand-side, as well as supply-side, impacts of future climate change on overall water supply conditions. The forecast methodology provided in this plan, along with regular updates to the demand data projections, will assist in this process.

3. SELECTION OF WATER EFFICIENCY ACTIVITIES

The Town considered a wide variety of water efficiency programs and measures before selecting the final components for inclusion in this plan. Efficiency measures were screened using a variety of criteria including:

- Applicability
- Effectiveness
- Feasibility and practicality for a small utility
- Estimated water savings and cost per AF

The Town utilized the CWCB's *Municipal Water Efficiency Plan Guidance Document* (CWCB 2012) to inform and guide the development of this conservation plan.

3.1 SUMMARY OF THE SELECTION PROCESS

The Town implemented a tiered screening and selection process for evaluating potential water efficiency activities. Existing activities were included in the list of measures and unless duplicative, existing activities are expected to continue as part of the ongoing water efficiency program.

Initial Screening. An initial screening was conducted by the consultant team, using the CWCB screening and evaluation worksheets (CWCB, 2012) and the *Guidebook of Best Practices*

Guidebook for Municipal Water Conservation in Colorado (CWW, 2010) as the key technical resources, along with professional experience. Activities that made it through the initial screening were assembled and passed along to the staff for screening.

Final Screening. The final level of screening and selection of water efficiency activities was made by the Town's Public Works Director and Water System Operator. During the final screening, care was taken to select a suite of activities capable of achieving the level of water savings needed by Basalt to achieve the stated water efficiency goals.

3.2 Demand Management Activities

Table 8 presents the new and updated water efficiency activities selected for inclusion in this plan. Each measure is described in more detail in the sections below.

Table 8. New and Updated Water Efficiency Activities and Water Savings Estimates.

Water Efficiency Activities	Sectors Impacted	Ongoing Activity?	Implementation Period of New Activities	Projected Annual Water Savings 2015 - 2050 (AF/yr)
FOUNDATIONAL ACTIVITIES				
Automatic Meter Reading Installation and Operation	All	YES		15
Enhanced Water Loss Control	All	YES	annual	60
Conservation-Oriented Rates	All	YES		50
TARGETED TECHNICAL ASSISTANCE AND INCENTIVES, AND NATURAL REPLACEMENT OF FIXTURES AND APPLIANCES				
Fixtures, Appliances, and Incentives	All, indoor	YES	ongoing/as needed	30
Outdoor Water Efficiency	All, outdoor	YES	ongoing/as needed	30
Commercial, Institutional, and Industrial Water Efficiency	CII	YES	ongoing/as needed	10
ORDINANCES AND REGULATIONS				
Regulatory Measures	All	YES	Ongoing	15
Waste of Water Ordinance Update	All	YES	Ongoing	
EDUCATIONAL ACTIVITIES				
Public Information and Education	All	YES	ongoing/as needed	10
K-12 Education	All	Proposed	ongoing/as needed	10
TOTAL SAVINGS THROUGH 2050 (AF/yr)				**230**

3.2.1 Foundational Activities

3.2.1.1 Metering

A good metering program is fundamental to the success of water conservation efforts. Colorado statute requires all water providers to meter the water use of their customers and to bill based on metered consumption.

In Basalt, 100% of the customers (including all municipal facilities) are metered. All customers are billed quarterly based on metered consumption. The Town has upgraded approximately 99% of the residential metered connections to AMR technology.

The *Guidebook of Best Practices for Municipal Water Conservation in Colorado* notes, "bimonthly or quarterly billing cycles are far less successful at influencing customer behavior than monthly billing… Monthly billing with understandable billing documents that clearly show the volume consumed and, if possible, comparisons with previous usage and usage by other similar customers is ideal." Basalt has taken important steps to ensure full metering and accurate water measurement, yet improvements could be made in the Town's billing practices. In the future, the Town should consider billing customers more frequently and providing normative information on usage as part of the bill. Moving from quarterly to monthly (or bi-monthly) billing provides customers with more regular communication and feedback on their water consumption.

3.2.1.2 Enhanced Water Loss Control

Water loss control is the practice of system auditing, loss tracking, infrastructure maintenance, leak detection and leak repair for water utilities. Leak detection and repair are familiar water agency practices, but true water loss control is more pragmatic than simply finding and fixing leaks. The American Water Works Association water loss methodology detailed in the M36 Water Audits and Loss Control Programs manual of practice is considered the industry standard, but has not yet been widely adopted in Colorado or the Roaring Fork region.

Auditing a water distribution system for real and apparent losses and evaluating the costs of those losses is the foundation of water loss control. Real losses are actual physical losses of water due to leaks or other problems with the system. Apparent losses are due to meter inaccuracy, unauthorized consumption, and data handling errors. Cost and benefit considerations drive implementation actions in the recommended methodology, described in detail in the AWWA Manual M36.

Leak detection and water loss control are also fundamental water efficiency practices for all water utilities. As discussed above in Section 2.4, system leakage in Basalt is currently estimated to be around 20%, which exceeds the 10% threshold that is often estimated as the national average. However, Town staff have indicated that the water system is in good shape and relatively free of leaks and staff believe this value is more attributable to metering and billing issues than it is representative of actual leaks.

Conducting an annual system water audit, using the free AWWA Water Audits and Loss Control Programs software, will assist the Town in understanding the nature of water loss in the Basalt system and in determining the most appropriate and cost effective measures to reduce water loss. The M36 water loss audit methodology helps improve utility water management by categorizing all water uses and identifying and quantifying non-revenue water and real and apparent losses that directly impact Basalt's bottom line, as shown in **Table 9** below.

CWCB grant funding may be available for implementing an M36 water audit and Basalt could team with other utilities in the Roaring Fork region to obtain technical assistance for completing the first annual audits.

Table 9: AWWA Water Audits and Loss Control Programs.

Billed Authorized Consumption	Billed Water Exported	Revenue Water
	Billed Metered Consumption (including water exported)	
	Billed Unmetered Consumption	
Unbilled Authorized Consumption	Unbilled Metered Consumption	Non-Revenue Water
	Unbilled Unmetered Consumption	
Real Losses	Unauthorized Consumption	
	Systematic Data Handling Errors	
	Leakage and Overflows at Utility's Storage Tanks	
	Leakage on Service Connections	

3.2.1.3 Conservation Oriented Water Rate Structure and Billing System

The Town is a fully metered municipality and currently bills their customers on a quarterly basis on January 1, April 1, July 1, and October 1. The Town utilizes a computerized billing system, and as previously discussed, approximately 99% of meters utilize AMR technology.

The Town uses a four tier inclining block rate structure that is modified for different customers by the calculated number of EQRs (equivalent residential units) established for the customer category.[10] The standard schedule of rates and charges for water customers is shown in **Table 10**. In this rate structure, tier 2 represents a 37% increase over tier 1, tier 3 is a 105% increase over tier 2, and tier 4 represents a 22% increase over tier 3. The 31,500 gallon/quarter/EQR

[10] Basalt Municipal Code Sec. 13-47 specifies local water rates. Section 2-381 defines an EQR. In Basalt, an EQR represents the volume of water consumptively used by a single-family residential unit with 3.5 persons having not more than 2,500 square feet of irrigated lawn or garden. The consumptive use is assumed to be 0.2 AF/yr per EQR.

could be generous amount of indoor water use (7,875 gallons per month compared with the national residential average of ~ 5,000 gallons per month[11]) for the residential sector which is the largest customer class in the Town.

Table 10: Treated Water Rates and Rate Structure for 2014.

Rate Tier	Water Rate Per 1,000 gallons
Tier 1 – up to 31,500 gallons/quarter/EQR	$1.66
Tier 2 – from 31,501 – 80,325 gallons/quarter/EQR	$2.28
Tier 3 – from 80,326 to 111,600 gallons/quarter/EQR	$4.68
Tier 4 – over 111,601 gallons/quarter/EQR	$5.72
Fixed quarterly base charge (in Town)	$54.00/EQR
Fixed quarterly base charge (outside Town)	$81.00/EQR

Moving from quarterly to monthly billing, as discussed above, would be a significant improvement for Basalt and would provide water customers with substantially more feedback on their water consumption. To further incent water efficiency, the Basalt water rate structure could be refined to send a more effective price signal that better differentiates between indoor and outdoor use for many customers. Establishing landscape water budgets to provide customers with a normative comparison of actual use to a reasonable theoretical requirement would be another significant step towards incenting water efficiency.

Given the cost and effort associated with these changes, it was determined that it would not be possible to make these changes or to modify the rate structure at this time. The Town may consider modifications that provide a stronger price signal, including landscape water budgets, in the future.

The schedule of rates for bulk water customers is shown in **Table 11**. Water may be purchased in bulk from the Town, provided that a permit has been secured from the Water Superintendent and it is in the possession of the user. The permit for bulk water usage is $6.00 per 1,000 gallons plus a $400.00 deposit to cover plant damages (including fire hydrants). The Town requires that the Water Superintendent must be notified each time water is purchased in bulk.

Table 11: Bulk Water Rates for 2014.

Rate Tier	Water Rate Per 1,000 gallons
Per 1,000 gallons	$6.00

[11] (Mayer, P. et. al. 1999. Residential End Uses of Water. Water Research Foundation)

3.2.2 Targeted Technical Assistance and Incentives

3.2.2.1 Fixtures, Appliances, and Incentives

As water demands increase, Basalt will continue to face the combination of water supply limitations that occur during periods of peak demand. This means that for Basalt, there is a substantial value in reducing its non-seasonal (indoor) water demand. The gradual replacement of inefficient fixtures and appliances and other water using devices is an excellent way to accomplish this objective.

Building Codes

Ensuring new buildings are built to be water efficient is important in Basalt. In 2009, the Town adopted Sustainable Building Regulations that apply to all new single family, duplex, and townhouse (attached single family) construction per the currently adopted building code. These regulations incentivize the use of ultra-low and dual-flow toilets (1.28 gallons per flush or less), low-flow showerheads (2.0 gallons per minute or less), low-flow bathroom faucets (WaterSense labeled), water efficient clothes washers and dishwashers (ACEEE or EnergyStar labeled), and stormwater recycling for landscape.

The Sustainable Building Regulations will soon be bolstered by a new Colorado state law that phases in the sale of WaterSense labeled fixtures starting by 2016. Joining Texas, Georgia, and California, starting in 2016 all toilets, showerheads, and faucets sold in Colorado must have earned the EPA WaterSense certification.

Non-Residential Water Audits and PRSV Incentive

The Town plans to implement a non-residential water audit and efficiency assistance program targeted at some of highest non-residential water users in the town such as restaurants, hotels, and customers with large landscapes.

The Town hopes to engage local plumbers, tradespeople, non-profit, or student organizations for this project. Water auditors will meet with customers with historically high water use, evaluate equipment and fixtures at the site, and make recommendations for cost-effective water efficiency improvements.

One of the efficiency improvements that makes sense for Basalt is to replace old, high-flow dish rack pre-rinse spray valves with water efficient, but still effective WaterSense labeled pre-rinse spray valves (PRSVs). PRSVs are used in most commercial kitchens, can be offered for free or at reduced cost as an incentive for some customers to participate in the audit program. A WaterSense labeled PRSV costs from $40 - $80.

Using this simple, but effective spray valve can save a commercial or institutional kitchen a significant amount in energy and water costs. Replacing one PRSV with a WaterSense labeled model can save a typical commercial kitchen more than 7,000 gallons of water per year according to the EPA. Useful analysis and information on water efficient products is available for free from the Food Service Technology Center (http://www.fishnick.com/equipment/sprayvalves/).

3.2.2.2 Outdoor Water Efficiency

Basalt experiences high summer peak water demands due in part to the tourism industry, but largely due to irrigation demands from customers. The Town has taken a number of steps to help reduce irrigation demands, focused on customer education.

The Town actively promotes efficient irrigation and landscape maintenance practices on their website including information on efficiency irrigation practices, irrigation system maintenance, and recommendations for installation of rain sensors on automatic irrigation systems. The Town provides guidelines on recommended watering days based on addresses, which also helps reduce peaking impacts.

Basalt's staff work to set an example through the efficient irrigation of parks and public lands. Staff have created beautiful gardens throughout the town, demonstrating proper landscaping techniques with spectacular results. All Town parks, medians, and other irrigated areas are metered and billed based on their actual consumption.

The Town's billing rate structure is meant to encourage outdoor water efficiency by setting the tier 2 break point at 31,500 gallons per quarter. The Town has also considered developing and implementing an irrigation efficiency program targeted at high volume water users. The lack of staff resources and the sufficiency of the current water supply have deferred this effort for the time being.

While not a long-term water efficiency measure, in the event of a climatological drought that affects the Town's supply, Basalt is prepared to implement outdoor watering restrictions to reduce demands pursuant Stage 1 and Stage 2 designations as defined in Chapter 13 of the Town Code.

Landscape Professionals and Second Homeowners
There are many Basalt residents who spend only part of their time living in town and may not attend to their landscape regularly. This can particularly be a problem for automatic irrigation systems during rain storms that occur while people are away. Rain sensors (described above) are one potential solution to this problem, but a broad approach focused on landscape professionals as well as homeowners and residents is recommended.

Landscaper Training and Certification
Proper installation and maintenance are needed to create and maintain water-efficient landscapes and irrigation systems, particularly in a community with significant seasonal resident population. Establishing minimum training requirements and certification for landscape professionals is an important step toward improved landscape management. Trained and certified professionals are in the best position to design and install water efficient landscapes and irrigation systems that meet mandated standards.

Mandating certification of landscape professionals is greatly simplified by the WaterSense Certification offered by the US EPA which accredits programs such as the Irrigation Association's training courses. An entity such as a town/city, county, or state can specify that all landscapes must be designed and installed by a WaterSense certified professional.

Additional landscape certification programs that may be considered by Basalt are listed in the *Guidebook of Best Practices for Municipal Water Conservation*, along with the sponsoring organization and link to access addition information.

Customer outreach is also an important component to implementing this type of program. The Town should communicate with customers about the value of quality landscape service. Customers should know who they are hiring and what their certifications and accreditations mean. This certification program could be established as part of the regional water efficiency program, or implemented by Basalt alone or in conjunction with other entities in the area.

Rain Sensors and Shutoff Devices
Shutting off automatic irrigation systems during a rain storm is a simple and effective way to conserve water and rain sensors and shutoff devices are inexpensive add-ons for an automatic irrigation system. Products like the Hunter Mini Clik can be purchased for under $50 and installed on just about any automatic irrigation system. During summer months when rain occurs, these devices have the potential to substantially reduce irrigation use. Recent research in Florida found that the combination of a rain switch and rain pause reduced irrigation by 41% compared with the use of no

rain features, whereas the rain pause feature alone saved 25% (Rutland, D.C. and M.D. Dukes. 2012).

Installation of a rain sensor is not overly complex, but does require a basic understanding of irrigation systems, wiring, and some carpentry skills. Basalt could purchase rain sensors in bulk and then offer them at free or reduced rates to water customers who agree to pay for installation or to do it themselves. To ensure success, Basalt should require proof of installation of the sensor. Local irrigation technicians could be contracted to assist with installation or student or non-profit groups could be trained for the job. Rain sensors could be installed as part of an irrigation audit program.

Landscape Transformation

A proven method for reducing water use is to replace heavily irrigated landscapes with native and locally adapted landscapes that thrive on available precipitation and reduce supplemental irrigation. Some commercial properties have large irrigated landscapes, the result of zoning policies that could be re-landscaped to lower both water demand and maintenance requirements. The Town can identify potential properties and explore opportunities to partner with property owners to reduce irrigation demands.

A traditional "landscape rebate" program is not recommended for Basalt because of the staff time and effort required with implementation and follow-up. Instead, the Town should opportunistically work with commercial property owners to re-landscape from a water demand sensitive perspective.

3.2.2.3 Commercial, Institutional, and Industrial Water Efficiency

Without a formal water conservation program and accompanying staff, Basalt seeks to encourage commercial, institutional, and industrial (CII) water efficiency through education and pricing mechanisms.

Pricing water services appropriately has been shown to be an effective method for reducing water demands (Mayer et. al. 2008), (Mayer et. al. 2004), (Howe, 1982). In Basalt, CII customers are billed for water using the same rate structure as residential customers, which means that large users pay for most of their water at the tier 2 to tier 4 rates. However, unless the person handling the water bill at the business is paying attention to the consumption and rates each quarter, this price signal provided by the increasing block rate structure may not have an impact.

An effective method for addressing high water using customers in the CII sector is to implement an efficiency audit program, targeted at high demand customers. As described above, the Town plans to implement a non-residential water audit and efficiency assistance program targeted at some of the highest non-residential water users in the town such as restaurants, hotels, and customers with large landscapes.

The Town hopes to engage local plumbers, tradesmen, non-profit, or student organizations for this project. Water auditors will meet with customers with historically high water use, evaluate equipment and fixtures at the site, and make recommendations for cost-effective water efficiency improvements.

3.2.3 Ordinances and Regulations

3.2.3.1 Regulatory Measures

The Town regularly reviews local codes and regulations for opportunities to specify water conservation requirements. The Town has enacted a number of water conservation-oriented regulatory measures.

In 2009, the Town adopted Sustainable Building Regulations that apply to all new single family, duplex, and townhouse (attached single family) construction per the currently adopted building code. These regulations incentivize the use of ultra-low and dual-flow toilets (1.28 gallons per flush or less), low-flow showerheads (2.0 gallons per minute or less), low-flow bathroom faucets (WaterSense labeled), and water efficient clothes washers and dishwashers (ACEEE or EnergyStar labeled). These rules are bolstered by Colorado state law that phases in the sale of WaterSense labeled fixtures starting by 2016.

Basalt's municipal code requires that swimming pools and spas be covered with an insulating cover that prevents evaporation and heat loss when not in use.[12] Waste of water and water use restrictions are outlined in Chapter 13 of the Basalt Municipal Code. The waste of water regulation requires that all water outlets be closed when not in use, and that irrigation systems be operated to prevent the spray of water onto impervious surfaces. The Town Code provides mechanisms for assessing monetary penalties and the discontinuance of service for premises where water is being wasted.

Chapter 13 of the Municipal Code also outlines the procedure for implementing Stage 1 and Stage 2 water use restrictions. Stage 1 restrictions limit the number of irrigation days and other outdoor water use such as car washing based on odd or even address numbers and also requires that hoses be equipped with nozzles that shut off completely. Stage 2 restrictions may be implemented when the Town determines that water supplies may be insufficient to meet demands, including those for fire suppression purposes. Stage 2 restrictions prohibit all outdoor sprinkler irrigation except drip, but residents may irrigate using hand held devices pursuant to the watering days outlined under Stage 1.

The International Plumbing Code (2003) edition as currently adopted by the State of Colorado has also been adopted by the Town in 2012, including Chapter 1 in its entirety and Appendix Chapters B, D, E, F and G.

[12] Basalt Municipal Code Chapter 18, Sec. 1303.2.

3.2.3.2 Raw Water, Water Reuse, and Recycling

The Town uses non-potable water for irrigation of parks. Raw water is withdrawn from a well called the 'Re-1 School Well' which produces around 250 gpm, but is only available to the Town for 12 hours per day and on a seasonal basis from April through October.

Water reuse and recycling are not currently part of the Town's water supply portfolio. In the future, water reuse and recycling may be further considered, but these approaches are currently not financially viable on a municipal scale for Basalt.

3.2.4 Public Education and Information

Since the Town is built next to a river, water appears plentiful and abundant at first glance. Basalt plans to implement an education and information campaign to inform and educate residents, school children, and visitors about the water supply challenges confronting the Town.

The Town regularly provides information to customers about ways to conserve water and avoid water waste through door hangers and other communication mechanisms. Basalt maintains water conservation materials and information that are available upon request, and education efforts focus on both indoor and outdoor water demands.

Basalt hopes to extend water education efforts into the local schools through an established water curriculum such as Project WET (www.projectwet.org), MY H2O (used by Boulder and St. Vrain Valley School districts), or the Living Wise Resource Action Program (www.resourceaction.com). Excellent school curriculum and materials focused on water supply and water efficiency are available from these and other sources. Since developing curriculum can be expensive, it is almost always cheaper to use an existing program. An option under the regional efficiency plan would be to provide free water conservation curriculum to local schools or to pool resources to significantly reduce the cost.

In conjunction with the school education efforts, Basalt hopes to offer regular field trip tours of utility facilities including treatment plants, storage facilities, and well sites to K-12 students and teachers. These tours offer an excellent opportunity for discussion of water efficient behaviors and practices.

4. IMPLEMENTATION AND MONITORING PLAN

The Town does not have a dedicated conservation staff member or a formal, stand-alone water conservation program. However, the Town is commitment to water use efficiency and even without a formal program has implemented many of the most essential water conservation program measures. The elements of this program are described in detail in this plan document.

4.1.1 Monitoring and Evaluation

Basalt plans to review and update this water conservation plan at least every seven years, or as needed. The Town monitors water use on a regular basis and will maintain consumption records. Progress towards meeting the conservation goal can be evaluated when the conservation plan is next updated and into the future using empirical data. This tracking analysis will help determine what (if any) additional conservation program measures are necessary to help Basalt meet their stated goal by 2050. As the plan is updated, new forecasts will be developed and the adequacy of the Town's water supplies will be compared against forecasted future demand. If necessary, the Town will adopt additional demand management measures. As part of this Water Efficiency Plan, the Town is considering conducting annual water loss audits using the AWWA M36 method.

4.1.2 Revenue Stability

Basalt's water rate structure is designed to promote revenue stability and water efficiency. It includes a substantial fixed charge component for revenue stability and increasing rate tier sizes designed to promote efficiency. The Town does anticipate a growth in water demand over time as the population grows. Water efficiency as practiced in the Town helps ensure water rates remain as low as practical for customers, because efficiency is being achieved at a lower cost than procuring new supplies or constructing new infrastructure.

5. ADOPTION, PUBLIC REVIEW, AND APPROVAL OF WATER EFFICIENCY PLAN

THIS SECTION TO BE COMPLETED AFTER PUBLIC REVIEW

6. COMPLIANCE WITH STATE PLANNING REQUIREMENTS

Colorado Revised Statute § 37-60-126 requires a covered entity to develop, adopt, make publicly available, and implement a water conservation (efficiency) plan that will encourage its domestic, commercial, industrial, and public facility customers to use water more efficiently. According to the statute, a "covered entity" means a municipality, agency, utility, or other publicly owned entity with a legal obligation to supply, distribute, or otherwise provide water at retail to domestic, commercial, industrial, or public facility customers, and that has a total annual demand for such customers of two thousand acre-feet or more. Even though the water demand forecasting provided under this plan shows that the Town will not reach the covered entity threshold until sometime after 2050, the Town is committed to implementing a water efficiency plan that meets the statutory plan requirements.

Key elements that must be fully evaluated in development of the plan are listed as follows:

A. Water-saving measures and programs including:
   I. water-efficient fixtures and appliances;
   II. low water use landscapes, drought-resistant vegetation, removal of phreatophytes, and efficient irrigation;
   III. water-efficient industrial and commercial water-using processes;
   IV. water reuse systems;
   V. distribution system leak identification and repair;
   VI. information and education;
   VII. conservation-oriented rate structures and billing systems;
   VIII. regulatory measures designed to encourage water conservation;
   IX. incentives to implement water conservation techniques including rebates.
B. Role of conservation in the entity's supply planning.
C. Plan implementation, monitoring, review, and revision.
D. Future review of plan within seven years.
E. Estimated savings from previous conservation efforts as well as estimates from implementation of current plan and new plan.
F. A 60-day minimum public comment period (or other time period based on local ordinance).

The following section of the plan details Basalt's compliance with this statute.

6.1.1 Town of Basalt Compliance

The Town developed this water efficiency plan to meet the elements required under C.R.S. § 37-60-126 even though it falls below the threshold that would obligate it to comply with this statute. Each element of compliance is documented below.

A. Consideration of specific conservation measures.

(I) *Fixture and appliances* – The Town actively promotes the installation of water efficient fixtures and appliances through its regular conservation education efforts and through their Sustainable Building regulations. The Town also plans to implement a pre-rinse spray valve program.

(II) *Low water use landscaping* – The Town actively promotes water wise landscaping practices through its regular conservation education efforts and its conservation-oriented rate structure. A Town horticulturalist and other staff have has created beautiful demonstration gardens throughout the Town. The Town encourages the installation of water wise landscapes through landscape development ordinances. In the future, the Town hopes to increase installation of rain sensors and shutoff devices and the Town plans to encourage certification and training for landscapers.

(III) *Commercial, Industrial and Institutional (CII) measures* – The Town hopes to engage local plumbers, tradesmen, non-profit, or student organizations to conduct efficiency audits of high-demand CII customer. Water auditors will meet with customers with historically high water use, evaluate equipment and fixtures at the site, and make recommendations for cost-effective water efficiency improvements. WaterSense pre-rinse spray valves will be provided at locations where appropriate.

(IV) *Water reuse systems* – Basalt uses non-potable water for irrigation at parks on a seasonal basis from April through October. Water reuse and recycling are not currently part of the Town's water supply portfolio. In the future, water reuse and recycling may be further considered, but these approaches are currently not financially viable on a municipal scale for Basalt.

(V) *Water loss and system leakage reduction* – The Town plans to begin annual implementation of the AWWA M36 water audit and may seek CWCB support for this effort.

(VI) *Information and public education* – Basalt plans to implement an education and information campaign to inform and educate residents, school children, and visitors about the water supply challenges confronting the Town. The Town regularly provides information to customers about ways to conserve water and avoid water waste through door hangers and other communication mechanisms. Basalt maintains conservation materials and information that are available upon request. Education efforts focus on both indoor and outdoor water demands.

(VII) *Water rate structure* – Basalt currently bills its customers on a quarterly basis using a four-tier inclining block rate structure.

(IX) *Regulatory measures* – The Town has enacted a number of water conservation-oriented regulatory measures. In 2009, the Town adopted Sustainable Building Regulations that apply to all new single family, duplex, and townhouse (attached single family) construction per the currently adopted building code. These regulations incentivize the use of ultra-low and dual-flow toilets (1.28 gallons per flush or less), low-flow showerheads (2.0 gallons per minute or less), low-flow bathroom faucets (WaterSense labeled), and water efficient clothes washers and dishwashers (ACEEE or EnergyStar labeled). These rules are bolstered by Colorado state law that phases in the sale of WaterSense labeled fixtures starting by 2016.
Basalt municipal code requires that swimming pools and spas be covered with an insulating cover that prevents evaporation and heat loss when not in use. Waste of water and water use restrictions are outlined in Chapter 13 of the Basalt Municipal Code.

(X) *Incentives* – Incentives such as pre-rinse spray valves and rain sensors are under consideration. Efficient fixtures are required in new residential construction and substantial remodels through the Sustainable Building Regulations.

B. Role of conservation in Basalt's supply planning. This Water Efficiency Plan represents the Basalt's most comprehensive effort to date to integrate water conservation into water supply planning. Through this plan, the Town has established that their raw water supply is sufficient to meet future growth under current planning scenarios.

C. Plan implementation, monitoring, review, and revision. The Town monitors water use on a regular basis and will continue to do so. Basalt plans to review and update this Water Efficiency Plan every seven years or as needed. During this review, progress towards achieving the stated conservation goal will be evaluated.

D. Future review of plan within seven years. Basalt plans to review and update this water conservation plan every seven years or as needed.

E. Estimated savings from previous conservation efforts and current plan. Since 2008, it is estimated that the Town of Basalt has conserved 55 AF of water relative to what the usage would have been if Basalt's level of water use, in gpcd, had continued. The active conservation forecast prepared for this 2014 plan includes the anticipated impact the Town's planned water efficiency program measures. Under this forecast, demand increases to 941 AF in 2050. Compared with the original baseline forecast, if the elements of this plan are fully realized, then it is estimated that water demand at 2050 will be reduced by 272 AF as a result of passive and active water conservation measures in Basalt.

F. Public comment period. **THIS SECTION TO BE COMPLETED AFTER PUBLIC REVIEW.**

7. ROARING FORK REGIONAL WATER EFFICIENCY PLAN

The development of the Town of Basalt Water Efficiency Plan was a collaborative effort funded by a Colorado Water Conservation Board grant as part of the Roaring Fork Watershed Regional Water Efficiency Plan. The Regional Water Efficiency Plan is published under separate cover and focuses on regional opportunities to increase municipal water efficiency. The Town's Water Efficiency Plan has the potential to have a direct effect on flows in the Roaring Fork River below the confluence with the Fryingpan River, although Basalt cannot guarantee that water it saves through conservation efforts will benefit the entire downstream reach of the Roaring Fork to the extent that other downstream water users may divert that water out of the river. The Town is interested in regional partnerships to improve water efficiency and is committed to assisting with the implementation of the Roaring Fork Regional Water Efficiency Plan.

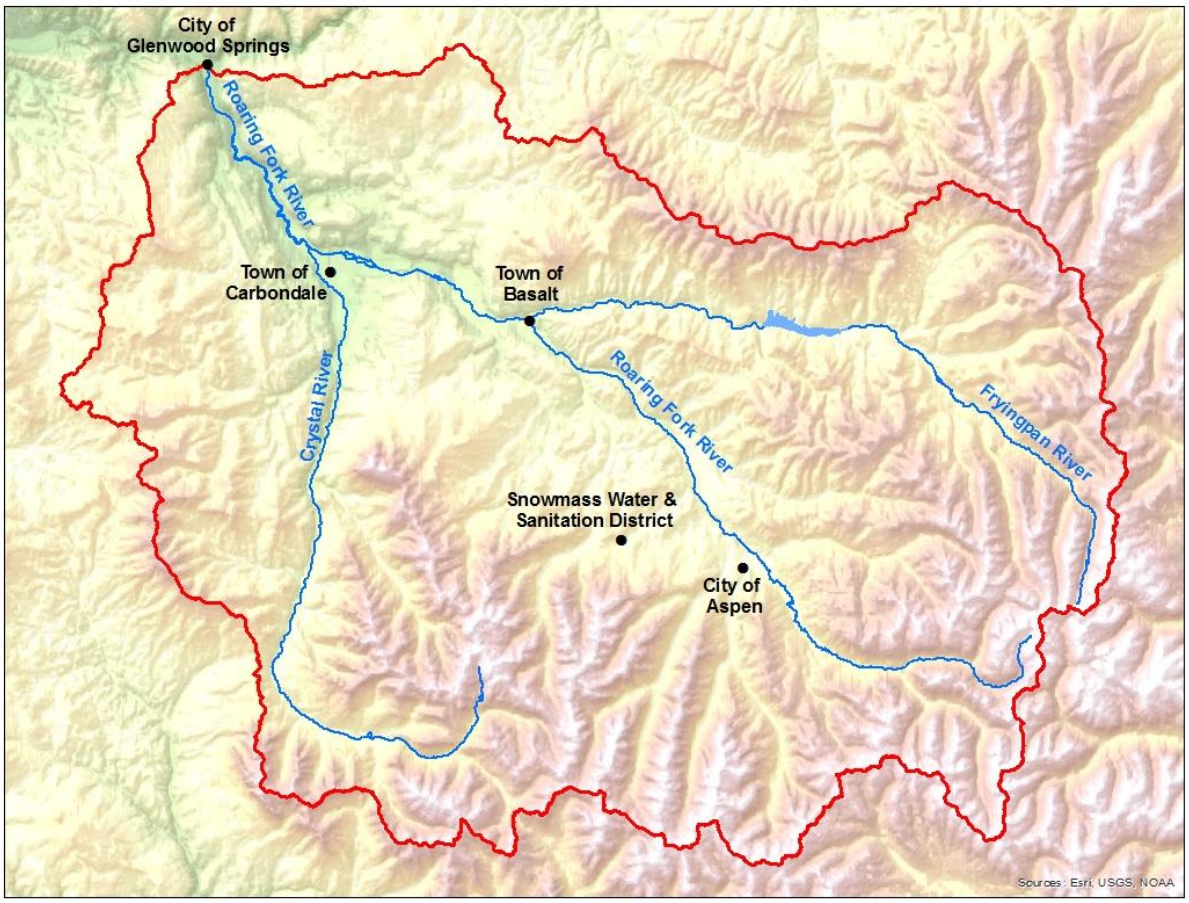

Figure 9. Water Providers Participating in the Roaring Fork Regional Water Efficiency Plan.

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