August 11, 2015

Mr. Kevin Reidy
State Water Conservation Technical Specialist
1313 Sherman St., Rm. 721
Denver, CO 80203

Re: City of Glenwood Springs Water Efficiency Plan

Dear Mr. Reidy

Attached is the draft Water Efficiency Plan for the City of Glenwood Springs, developed per Colorado Revised Statute § 37-60-126(4). City staff contacts regarding the Water Conservation Plan include Mr. Robin Millyard, Public Works Director, 970-384-6409 or via email at robin.millyard@cogs.us and Mr. Jerry Wade, Assistant Water & Wastewater Superintendent, 970-384-6345 or via email at jerry.wade@cogs.us

This plan was developed for the City of Glenwood Springs with the assistance of Ms. Beorn Courtney of Element Water Consulting, P.O. Box 140785, Denver, CO 80214, (303) 786-9691 and Peter Mayer with Water Demand Management, 1339 Hawthorn Avenue, Boulder, CO 80304, (720) 318-4232.

Comments received from public review, from CWCB and from City Council have been incorporated into the 2015 Water Efficiency Plan update. The Glenwood Springs City Council adopted the Plan at their August 6, 2015 regular City Council meeting via Resolution 2015-20, a copy of which has been incorporated into the Plan.

The City looks forward to implementing the Plan and the opportunity to work regionally with other stakeholders involved in developing Regional Water Efficiency Plan for the Roaring Fork Watershed.

I want to genuinely thank you and the Colorado Water Conservation Board for their technical and financial assistance regarding the update of our Water Efficiency Plan and the Regional Water Efficiency Plan. We respectfully request your final review and approval of the City's plan.

Sincerely,

Robin Millyard
Public Works Director

XC: Brad Zachman, Water & Wastewater Superintendent
Jerry Wade, Assistant Water & Wastewater Superintendent

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Municipal Water Efficiency Plan

City of Glenwood Springs, Colorado

ELEMENT Water Consulting & WaterDM

August 14, 2015

MUNICIPAL WATER EFFICIENCY PLAN

City of Glenwood Springs, Colorado

PREPARED BY

ELEMENT
Water Consulting

P.O. BOX 140785
DENVER, CO 80214

AND

WaterDM
DEMAND MANAGEMENT

1339 HAWTHORN AVENUE
BOULDER, CO 80304

August 14, 2015

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AF	acre-feet
AF/yr	acre-feet per year
AMR	automated meter reading
AWC	average winter consumption
cfs	cubic feet per second
CII	commercial, institutional, and industrial
City	City of Glenwood Springs
CWCB	Colorado Water Conservation Board
F	Fahrenheit
gpcd	gallons per capita per day
gpd	gallons per day
gpm	gallons per minute
IPC	International Plumbing Code
MG	million gallons
MGD	million gallons per day
PRV	pressure reducing valve

Front Cover photograph of City of Glenwood Springs obtained from Wikipedia:
http://en.wikipedia.org/wiki/Glenwood_Springs,_Colorado#mediaviewer/File:Glenwood_springs_co.jpg

ACKNOWLEDGEMENTS

The development of the City of Glenwood Springs 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

This Water Efficiency Plan updates and builds upon, rather than duplicating, the previous plan which was completed in 2009. City of Glenwood Springs 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:

- Buddy Burns, City of Glenwood Springs
- Robin Millyard, City of Glenwood Springs
- Jerry Wade, City of Glenwood Springs

EXECUTIVE SUMMARY

PROFILE

The City of Glenwood Springs (City), Colorado, located in Garfield County, is a municipality established in 1885. The City adopted a Home Rule Charter in 1966. Glenwood Springs is located at an elevation of approximately 5,746 feet at the intersection of Interstate 70 and Colorado State Highway 82. The City is approximately five square miles with a current planning population of approximately 10,600 residents. It hosts the largest natural hot springs pool in the world and is a popular tourist destination. It is also home to one of the Colorado Mountain College campuses.

Glenwood Springs owns and operates its own water and wastewater utilities. It provides potable water to all customers in the service area and raw water for irrigation to a small subset of customers. Glenwood Springs obtains potable water through senior water rights on Grizzly and No Name Creeks in the Flat Tops Wilderness Area. The City also holds the rights to 500 acre-feet/yr (AF/yr) of water in Ruedi Reservoir. The City's raw water system is largely gravity fed, which reduces the need for costly pumping. Only two areas of the City require pumping for treated water service.

POPULATION

The City is expanding slowly and anticipates growth between 1 and 2 percent per year through the 2050 planning period. More accelerated growth would be unlikely given the steep slopes, flood plains, river canyons, and federal lands along the City borders. This Water Efficiency Plan covers a 36 year period from 2015 – 2050. Assuming this rate of growth continues, it is forecast that the population of Glenwood Springs will increase from 10,581 in 2013 to approximately 14,800 by 2035 and 18,800 by 2050. This represents a 77% increase in the population, or approximately 1.6% per year.

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 1,998 acre-feet (AF) and under the baseline forecast is expected to increase by 1,546 AF, resulting in a total demand of 3,544 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 City

water demands will increase to approximately 3,065 AF in 2050, or 479 AF less than they would be under the baseline forecast.

A third forecast was prepared that includes the anticipated impact of the City's planned water efficiency program measures described in this plan. Under this forecast, demand increases to just 2,837 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 708 AF/yr as result of passive and active water conservation measures in Glenwood Springs.

These forecasts form the core of the Water Efficiency Plan and are the forecasts on which estimated conservation savings are based. The analysis completed as part of the City's 2009 water conservation plan indicated that the likely yield of the City's direct flow water rights on Grizzly Creek and No Name Creek plus its contract water in Ruedi Reservoir equals 10,026 AF in an average year and 7,525 AF in a dry year. The maximum annual water use in Glenwood Springs over the past 10 years was 2,357 AF in 2007, and the range of forecast future demands in the year 2050 are from 2,837 AF to a maximum of 3,541 AF. Based on this analysis, it is concluded that the dry-year yield of the City's water rights is sufficient to meet current and forecast future demands.[1]

Climate Change Impact on Water Use

Recent climate change forecasts indicate a warming trend in irrigation season temperatures in the Glenwood Springs region. 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 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 having a crystal ball to foresee the future, a sensible approach to water demand forecasting in a changing climate is to regularly update and refine demand projections based on actual current conditions.

Water Efficiency Planning Process and Goal Setting

The City 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 City 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.

[1] The "dry year" is based on an average of historic 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.

To fulfill Colorado's statutory water efficiency planning requirements, a series of water conservation program scenarios were developed that incorporated a wide variety of indoor and outdoor efficiency measures that have been cost-effective when implemented in other Colorado utility service areas. For Glenwood Springs, there is very little (if any) cost savings for the utility or customers associated with reducing water demands because the City's water rights are ample and treatment costs are relatively low. Consequently, it is not cost-effective for Glenwood Springs to expand its mandatory water conservation program at this time, beyond the basic program described in this report.

In spite of the lack of a real financial incentive, Glenwood Springs remains committed to water efficiency and to current conservation efforts, which include the majority of the most important and effective measures such as metering, water loss control, and conservation pricing. Although the City has adequate water supply to meet all anticipated future needs, it has also demonstrated a long-term commitment to wise water stewardship and responsible and efficient use of its water resources. The City has established a water efficiency goal of (0.5%) savings per year compared with a continuation of current demand. Carried through for 20 years to 2035, this water efficiency effort could reduce demand in Glenwood Springs by a total of about 349 AF/yr compared with a continuation of current demand patterns.

Based on careful analysis of current demands and expected growth, the City believes this level of savings to be readily achievable. This goal will be re-evaluated on a regular basis, as Glenwood Springs 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 City's conservation program and goals as needed.

WATER EFFICIENCY PROGRAM

The City of Glenwood Springs does not have a dedicated water conservation staff member and its conservation[2] program is implemented by the Water and Wastewater Superintendent and other staff members. In addition, the City hires outside contractors to assist in implementing certain water efficiency program activities such as leak detection. The City has demonstrated a commitment to water use efficiency, and even without a dedicated staff member, has implemented many fundamental and proven water conservation measures including metering, a conservation-oriented water rate structure, utility water loss reduction, and public education and information about water efficiency.

The City's first water efficiency plan was approved by the City and the Colorado Water Conservation Board (CWCB) in 2009. This Plan updates and builds upon the previous plan.

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

WATER EFFICIENCY PLAN APPROVAL

A 78-day public review period was conducted and no comments were received. The City of Glenwood Springs City Council reviewed the draft Water Efficiency Plan after the completion of the public comment period. On August 6, 2015, the City Council adopted the plan with the updates included in this final version. On August 13, 2015, the City received official notification that the plan was approved by the Colorado Water Conservation Board.

ROARING FORK REGIONAL WATER EFFICIENCY PLAN

The City's primary water supply sources are outside of the Roaring Fork watershed, and the City's Water Efficiency Plan will have a limited direct effect on flows in the Roaring Fork River. The City is pursuing a water efficiency goal of about 0.5% per year so that the firm yields from No Name and Grizzly Creek continue to meet the City's demands through 2050. While these actions will reduce or eliminate the need for the City to utilize Ruedi Reservoir as a primary water supply in dry years, it should be noted that any use of Ruedi Reservoir water by the City could have the impact of increasing flows in the Roaring Fork River given that the City is located at the confluence of the Roaring Fork and Colorado Rivers. The City of Glenwood Springs can, however, make a significant contribution to the regional plan by partnering with other water providers on water efficiency programs and the City 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

Glenwood Springs was originally inhabited by nomadic Ute Indian Tribes, and the natural hot springs continue to attract visitors from around the world today. The City of Glenwood Springs (City), Colorado is a municipality established in 1885. The City adopted a Home Rule Charter in 1966.

Glenwood Springs was originally known as Defiance, Colorado. Defiance was established in 1883 and consisted of a camp of tents, saloons, cabins and various lodging establishments. Town Founder Isaac Cooper's wife Sarah was having a hard time adjusting to the frontier life and in an attempt to make her environment somewhat more comfortable, persuaded the founders to change the name to Glenwood Springs, Colorado after her beloved hometown of Glenwood, Iowa.

The City's unique location at the confluence of the Colorado River and the Roaring Fork River, as well as a stop on the railroad, historically have made it a center of commerce in the area.

Figure 1. Glenwood Hot Springs & Lodge.

Glenwood Springs is located at an elevation of approximately 5,746 feet at the intersection of Interstate 70 and Colorado State Highway 82. The City currently has a planning population of approximately 10,600 residents. It hosts the largest natural hot springs pool (**Figure 1**) in the world and is a popular tourist destination. The Glenwood Whitewater Park, located on the west side of Glenwood Springs, also provides year-round outdoor recreation for river enthusiasts. Additionally, Glenwood Springs is home to one of the Colorado Mountain College campuses.

The City is expanding slowly and anticipates growth between 1 and 2 percent per year through the 2050 planning period. More accelerated growth would be unlikely given the steep slopes, flood plains, river canyons, and federal lands along the City borders. It is estimated that the planning population of Glenwood Springs will increase from 10,581 in 2013 to approximately 14,800 by 2035 and 18,800 by 2050.[3]

[3] This assumes a constant growth rate of 1.6% per year.

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 contributes about 991,100 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 western United States 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 infrastructure, 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 conservation measures in stages that minimize impacts to the economy, life-styles, and environment of the community.

1.3 Water Supply and Reliability

Glenwood Springs owns and operates its own water and wastewater utilities. It provides potable water to all customers in the service area and raw water for irrigation to a small subset of customers. The initial components of the Glenwood Springs water system date back to the early 1900's when the first public water system was established to provide potable water for domestic use and firefighting purposes. The system has been continually upgraded and improved since that time.

The Glenwood Springs Water and Wastewater Department provides safe, high quality drinking water. City staff maintain raw water flows to the Red Mountain Water Treatment Facility in sufficient quantities to meet system demands. Staff also perform operations and maintenance functions for the treatment facility, booster stations, pump stations, vaults and storage tanks. Crews perform routine laboratory testing and reporting per the Colorado Department of Public

Health and Environment (CDPHE) guidelines and requirements. Crews also perform maintenance and repair of system piping and appurtenances on approximately 60 miles of pipe, provide system control, leak detection, line locations, pressure checks, meter calibrations, meter repairs and replacements. City staff regularly perform cross connection control inspections, and install taps for new services and oversee new installations and extensions.

1.3.1 Potable Water Supply

The City of Glenwood Springs obtains its potable water supply from diversions on Grizzly and No Name Creeks. These tributaries are located to the north of the Colorado River, and their headwaters are located on the south side of the Flat Tops Wilderness Area. The watersheds are located on forest service lands, and City staff report that raw water is of excellent quality. The City also holds the rights to 500 AF/yr of water in Ruedi Reservoir, which the City can divert as a backup supply through its emergency pump station located on the Roaring Fork River. A general schematic of the City's water supply system is shown on **Figure 2**.

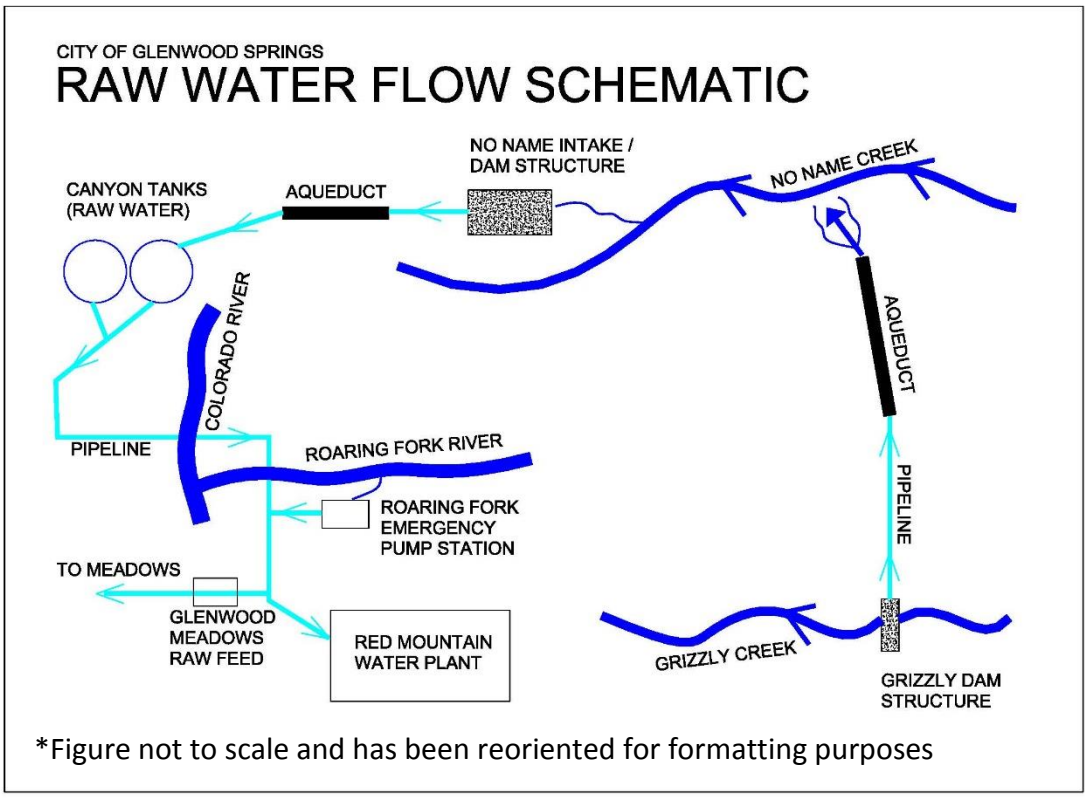

Figure 2. Glenwood Springs Water Supply Schematic.

1.3.1.1 Water Reliability Analysis

The City's 2009 Water Conservation Plan (2009 Plan) included a water availability analysis related to the City's diversions on Grizzly and No Name Creeks (Aquacraft, 2009). The primary source of data relied upon in the 2009 Plan was the Grizzly Creek near Glenwood Springs, Colorado gaging station that was operated from September 1976 to September 1996.

Figure 3. Grizzly Creek at the City's Diversion Structure.

The average and minimum monthly streamflow values over the period of record from the 2009 Report are reproduced below in **Figure 4**. The gage records indicate that the majority of the annual flow occurs during the three-month period from May through July. Flows decline from August through April, and are at the lowest level in late winter and early spring. As noted in the 2009 Plan, the accuracy of the gaged data is not known, and it is possible that the accuracy of wintertime measurements was impacted by ice. The Grizzly Creek gaging station is located above the City's point of diversion on Grizzly Creek, so the 2009 Plan estimated the natural flow available at the City's diversion point by scaling streamflows based on drainage area ratios.

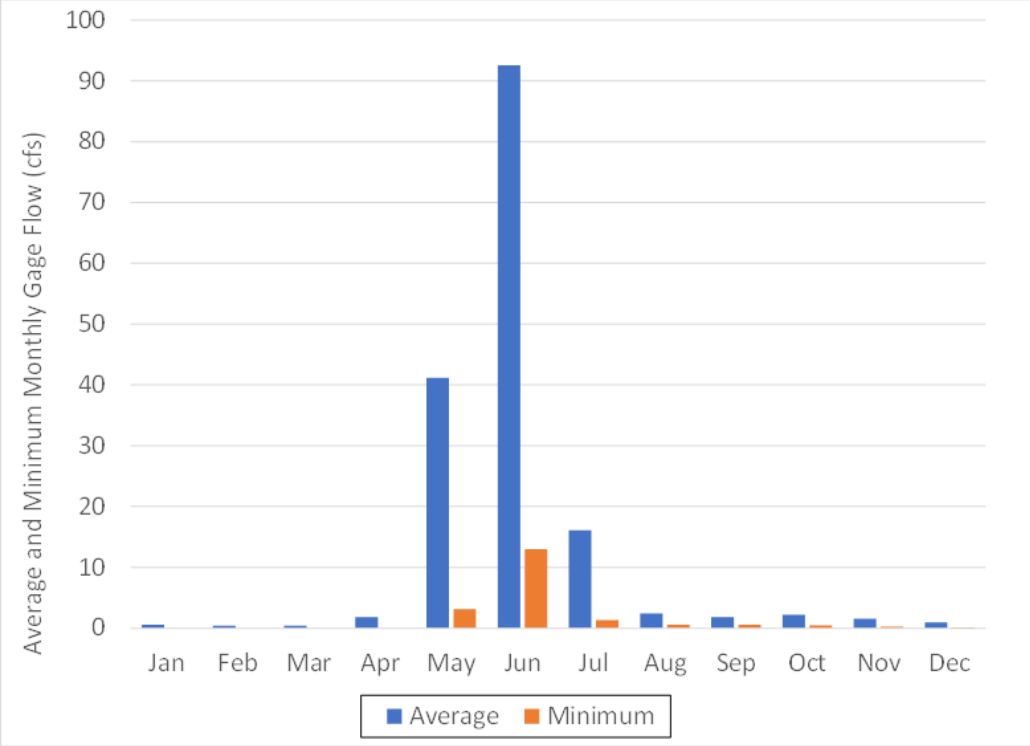

Figure 4. Average and Minimum Monthly Streamflow at Grizzly Creek gage, 1976 through 1996.

The City conveys its Grizzly Creek diversions south and west to the No Name Creek drainage through a pipeline and tunnel where it discharges above the City's No Name point of diversion and tunnel. Water is collected at the City's No Name diversion point from the creek as well as from the discharge from the Grizzly Creek tunnel. Water is conveyed through a series of flumes and settling basins and screens to the No Name tunnel, which is approximately 4,500 feet in length and 5 feet in diameter.

There is not a continuously recording streamflow gaging station located on No Name Creek; however, City staff regularly read staff gages installed near the diversion structure to determine the rates of flow being diverted to the City and bypassed down No Name Creek. There are also daily diversion records for the No Name diversion structure for the period from 1975 to 2013. Based on the way the City operates the No Name structure, there must be at least as much water available in the creek as recorded in the diversion records. The diversion data indicate that the minimum monthly diversion over the period of record was 97 AF/month in October of 1986, and that multiple months had diversions just over 100 AF/month (**Figure 5**). However, based on a review of the City's staff gage records dating back to July 1988, the total streamflow in No Name Creek in a dry year such as 2002 still exceeded 400 AF/month, with a large volume continuing to be bypassed.

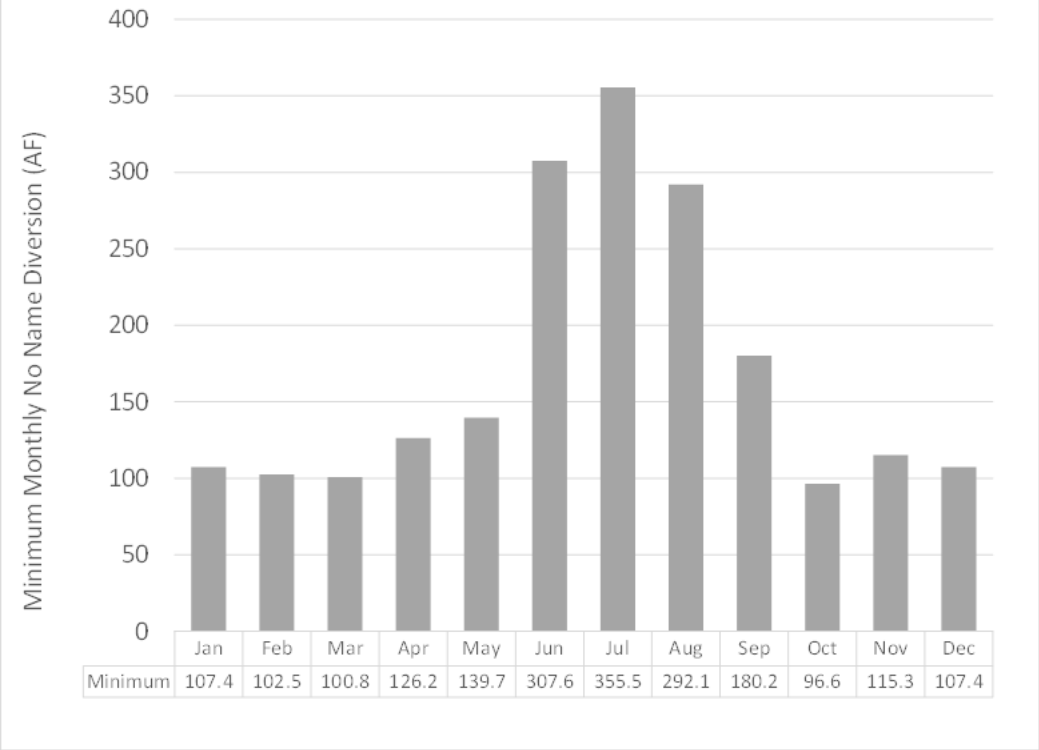

Figure 5. No Name Intake Minimum Monthly Diversions, 1976 through 2013.

1.3.1.2 Canyon Tanks

The City has two raw water tanks of 250,000 gallons each, for a total raw water storage of 0.5 MG (1.5 AF). These tanks provide flow regulation for the pipeline rather than long-term raw water storage.

1.3.1.3 Roaring Fork Intake and Red Mountain Water Treatment Plant

From the Canyon Tanks, the raw water flows in a pipeline across the Colorado River and under the Roaring Fork River (in recently installed pipelines) and up to the Red Mountain Water Treatment Plant. At the crossing of the Roaring Fork River, there is a pump station and inlet, which allows Ruedi water from the Roaring Fork to be delivered to the Red Mountain Water Treatment Plant should water not be available from the Grizzly-No Name system for any reason. The City owns a contract for 500 AF/yr of water from Ruedi Reservoir, which would provide the water by reservoir releases. With the current infrastructure, the City cannot concurrently operate the Grizzly-No Name system with the Roaring Fork pump station, so Ruedi water can be used as an alternate supply but cannot be used as a supplemental supply to the Grizzly-No Name system. The pump house on the Roaring Fork has a 5 MGD (7.75 cfs) capacity. As documented in the 2009 Plan, the capacity of the Red Mountain Water Treatment Plant is 8.65 MGD.

1.3.1.4 Summary of Raw Water Yields

Based on communication with City of Glenwood Springs staff, and review of the No Name staff gage data maintained by the City, the water supply analysis completed as part of the 2009 Plan was determined to be reasonable and applicable for this plan update. The 2009 Plan analysis indicated that the likely yield of the City's two direct flow water rights on Grizzly Creek and No Name Creek plus its contract water in Ruedi Reservoir equal 10,026 AF in an average year and 7,525 AF in a dry year.[4] As noted in the 2009 Plan, these are simply engineering estimates and additional data could show that these estimates should be further refined for certain applications. In addition, the peak day demands of the system will be greater than the average flows. Fortunately, peak demands in Glenwood Springs are due to irrigation that occurs in the summer months when available flows are greatest. City staff have reviewed the analysis presented in the 2009 Plan and indicate that the conclusions remain appropriate.

The 2009 Plan indicated that when drier years occur, shortages to the system could follow. These infrequent shortages are addressed as part of the City's current drought response plan. While the Water Efficiency Plan can and should be an integral part of the drought response plan, in this case, the City appears to have a sufficient supply such that an extraordinary effort in this area does not appear to be warranted, but should be considered as part of the City's normal water resources planning process.

[4] The maximum annual demand for water in Glenwood Springs over the past 10 years was 2,357 acre-feet. Hence, the dry year yield of the City's water rights at 7,525 acre-feet is sufficient to meet current and future demands as shown later in this plan document except potentially under more severe drought conditions.

1.3.2 Water and Wastewater Treatment

The raw water in the system does not have salinity problems and is essentially free of turbidity for ten months out of the year. The City treats all potable water at the Red Mountain Water Treatment Plant (WTP), which went on-line in 1978 and has the capacity to treat 8.65 MGD. In 1995, the Red Mountain WTP was upgraded with new pre-treatment facilities that included chemical treatment, flocculation, and sedimentation.

The City finished construction of a new wastewater treatment plant in November 2012, located in West Glenwood Springs. The new plant replaces the old facility that was operated for 30 years and had exceeded its useful life. The new wastewater treatment plant was designed to accommodate a potential future expansion to treat 3.9 MGD, however the first phase was built for a 1.95 MGD capacity. It is anticipated that the plant will not need to be expanded for at least 15 years and possibly longer. Much of the impetus for developing the 2009 water conservation plan was to fulfill the necessary requirements to secure a construction loan from the Colorado Rural Water and Power Authority (CRWPA).

1.3.3 Capacity and Reliability

Glenwood Springs is fortunate to have physically abundant, high quality water sources that primarily drain a pristine, protected watershed. No Name and Grizzly Creeks provide source diversity and redundancy in the primary supply with the Roaring Fork River as a reliable backup. The City's water rights are senior and are sufficient to meet the supply needs of the community beyond the 2050 planning horizon, even if minimal or no additional conservation measures are implemented. The collection system is well maintained and is extremely reliable.

Glenwood Springs' water supply infrastructure (including the water treatment plant, transmission mains, and storage facilities) is of adequate capacity to meet the supply needs of the community beyond the 2050 planning horizon of this Water Efficiency Plan. The design of the treated water system currently utilizes gravity for most water delivery except for two small high elevation zones that require pumping. Glenwood Springs has a reasonable amount of treatment capacity in the existing water treatment plant, and additional treated water storage will be considered as the need arises. The City staff have done an excellent job of maintaining the infrastructure over the years, implementing an aggressive water main replacement program as well as a leak detection and repair program. Continued replacement and upgrading of water transmission and water distribution will be implemented as funding allows.

The City had an existing Water Conservation Master Plan, which was originally approved in 1996 and revised in 2003. However, this plan did not meet all of the current statutory planning requirements, hence an updated plan was prepared in 2009 and is now being updated again.

1.3.4 Proposed Water and Wastewater Projects

In addition to constructing the new wastewater treatment plant in 2012, the City of Glenwood Springs has made upgrades and capacity increase to portions of the City's main treated water delivery line in recent years. To address peaking issues, the City is currently budgeting a new

500,000 gallon water storage tank to be constructed next to the existing 500,000 gallons of water storage in the Cardiff Tank in the southern service area, for a combined storage of 1,000,000 gallons. The City has a history of requiring new subdivisions to put in additional storage and/or use raw water for irrigation purposes. The City will continue to consider similar and other mechanisms that address the additional costs of supplying new development in upland areas.

The City is also in the process of upgrading all water meters to the Badger Orion system with automated metering reading (AMR). Aside from these efforts, there are no other water and wastewater infrastructure project planned beyond standard maintenance and repair efforts.

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 Glenwood Springs through the year 2050, given anticipated population growth, and to estimate the impact of the water conservation measures that 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 City. These forecasts were also used for the important purpose of establishing the adequacy of Glenwood Springs' 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 Glenwood Springs. Through a careful review of these data and information, a baseline demand for Glenwood Springs was established. Next, historical population data were used to establish the baseline population, and Glenwood Springs planning data were used to forecast population growth out to 2050. This section of the Glenwood Springs Water Efficiency Plan describes historical water demands and demand management efforts in the City.

2.1 Demographics and Service Area Characteristics

The City of Glenwood Springs provides treated water and wastewater services to a service area with a current planning population of approximately 10,600 people[5]. The City is expanding slowly and anticipates growth between 1 and 2 percent per year through the 2050 planning period. More accelerated growth would be unlikely given the steep slopes, flood plains, river canyons, and federal lands along the City borders. For planning purposes, it is estimated that the population of Glenwood Springs will increase to approximately 14,800 by 2035 and 18,800 by 2050.[6]

[5] A 2013 population estimate of 10,581 is used by the City for certain internal planning purposes, however comparison to 2010 census data indicates that planning numbers are higher than actual population (see Table 1 footnote below).
[6] This assumes a constant growth rate of 1.6% per year.

To better understand water use among different water use sectors, Glenwood Springs uses the following customer category assignments for its water service accounts. Each water account is assigned one of the category designations below.

- Residential (all dwelling types)
- Motels and hotels
- Restaurants
- Hospitals and nursing homes
- Schools
- Commercial
- Irrigation
- Bulk users[7]
- Senior residential
- Senior irrigation

Customer information is stored in the utility's customer billing system.

2.2 HISTORICAL WATER DEMANDS

Annual metered water use in Glenwood Springs has ranged from 1,788 AF/yr to 2,357 AF/yr over the last 9 years (**Table 1**). This level of use means that Glenwood Springs is a "covered entity" that is required 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 Colorado Revised Statute §37-60-126. According to the statute, a "covered entity" is defined as 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. Water use increased in 2007 and 2008, but the subsequent demands returned to more or less the same level of increase the City experienced prior to 2005, while population continued to increase (**Figure 6**). These changes are typical of municipal demand trends across the United States, which have generally declined or held steady in recent years. Fluctuations in Glenwood Springs water demand is normal for a city of this size and character, located in a region with variable weather conditions and irrigation requirements.

[7] Bulk water is treated water provided via a water drop station located in the City.

Table 1. Population and Annual Water Deliveries (AF/yr) from 2005 through 2013[a].

Year	Population	Residential	Commercial	Hospital/ Nursing	Schools	Irrigation	Bulk	Total
2005	9,553	1,115	590	26	13	343	8	2,094
2006	9,715	1,157	599	35	12	379	2	2,184
2007	9,881	1,224	682	48	14	388	1	2,357
2008	10,049	1,183	623	52	12	366	2	2,238
2009	10,219	1,059	532	44	11	306	2	1,954
2010	10,527	1,115	515	43	13	361	2	2,048
2011	10,545	969	509	38	11	259	2	1,788
2012	10,563	1,164	578	45	17	366	6	2,176
2013	10,581	1,085	521	46	17	287	3	1,958
BASELINE	**10,581**	**1,083**	**531**	**43**	**17**	**318**	**6**	**1,998**

Note:

a) Population data presented in Table 1 is used by the City for certain internal planning purposes, however census data indicated that the 2010 population was actually 9,614 people. Higher planning population projections are reasonable for purposes of this document.

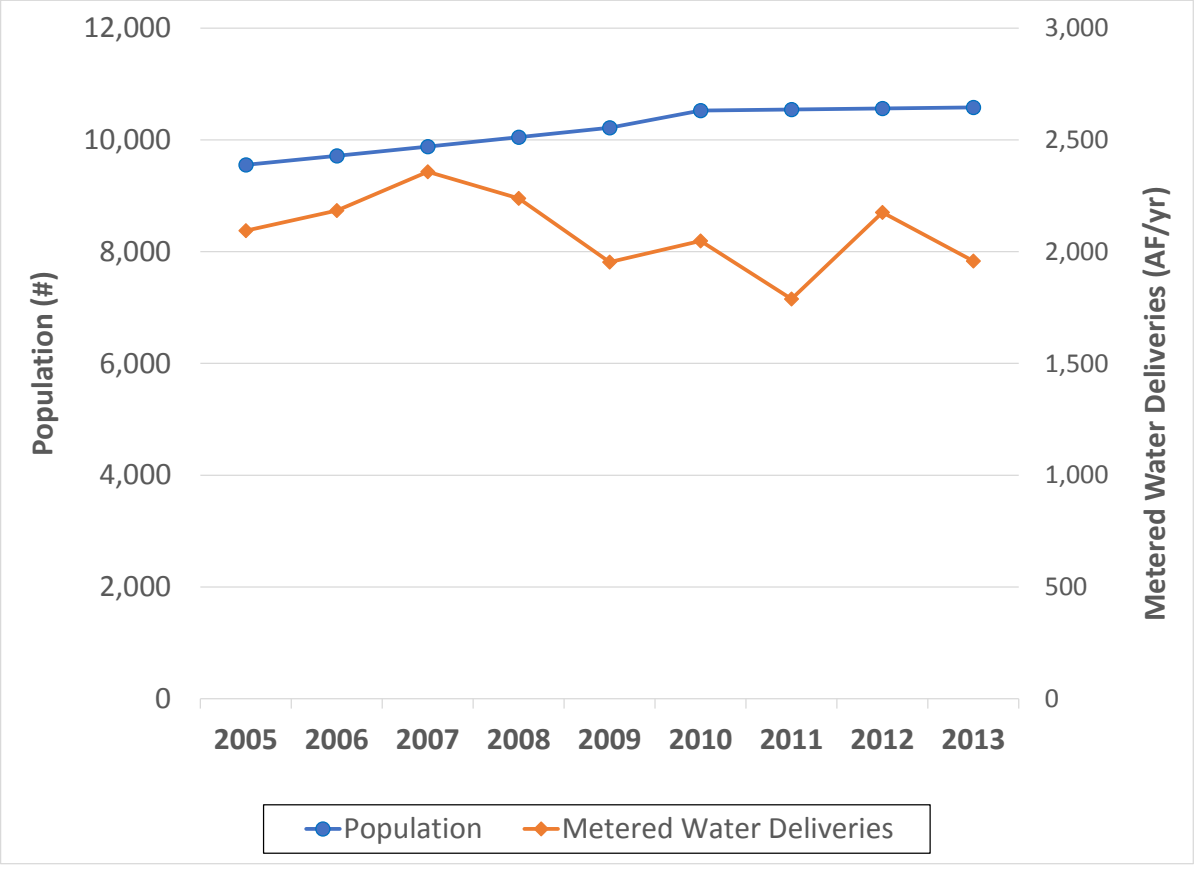

Figure 6. Changes in Population and Annual Water Deliveries from 2005 through 2013.

The baseline population and demand data shown in Table 1 were selected based on recent historical demands and the best available understanding of water use in Glenwood Springs moving forward into the future. The baseline demands are an important element of the three demand forecasts developed in this plan. In some cases, baseline demands that exceeded the actual demands in 2013 were chosen because 2013 water use in those categories was less than in other recent years. 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.

An estimated breakdown of indoor and outdoor historical demands in Glenwood Springs based on periodic consumption data provided by the City are shown in **Table 2**. Typically, about 54% of the annual water demand in Glenwood Springs is for indoor purposes and 46% is for outdoor irrigation.

Table 2. Total Indoor and Total Outdoor Water Deliveries from 2005 through 2013.

Year	Indoor (AF/yr)	Outdoor (AF/yr)	% Indoor	% Outdoor	Apr to Oct Temp (deg F)
2005	1,092	1,003	53%	47%	60.4
2006	1,196	989	55%	45%	59.6
2007	1,260	1,098	53%	47%	60.7
2008	1,196	1,042	53%	47%	58.5
2009	1,106	848	57%	43%	58.2
2010	1,126	922	55%	45%	59.6
2011	993	796	56%	44%	58.6
2012	1,106	1,070	51%	49%	60.6
2013	1,108	850	57%	43%	59.6
5-YR AVG	**1,082**	**909**	**54%**	**46%**	**59.6**

Glenwood Springs' consumption data was further disaggregated by water use sector as shown in **Table 3**. 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 3: Sectoral and Seasonal Water Deliveries from 2005 through 2013 (AF/yr).

	Residential		Commercial		Hospital/Nursing		Schools		Irrigation Only		Bulk	Total
Year	Indoor	Outdoor	Indoor	Outdoor	Indoor	Outdoor	Indoor	Outdoor	Indoor	Outdoor	-	-
2005	659	456	398	192	26	0	11	2	0	343	8	**2,094**
2006	716	440	450	149	19	15	8	4	0	379	2	**2,184**
2007	723	501	494	188	29	19	12	2	0	388	1	**2,357**
2008	710	473	436	187	41	11	7	5	0	366	2	**2,238**
2009	669	390	388	144	39	5	8	3	0	306	2	**1,954**
2010	691	424	387	128	36	6	9	3	0	361	2	**2,048**
2011	598	371	355	154	30	8	8	4	0	259	2	**1,788**
2012	669	495	382	196	38	7	12	6	0	366	6	**2,176**
2013	669	417	386	135	39	7	11	5	0	286	3	**1,958**
5-YR AVG	**656**	**426**	**377**	**153**	**36**	**7**	**10**	**4**	**0**	**318**	**3**	1,993

As with most municipalities in Colorado, the City of Glenwood Springs demands are higher during summer months due to outdoor water use. **Figure 7** shows the average monthly demands over the past 5 years from 2009 to 2013 by water use sector. As expected due to outdoor water use, most water use sector demands increase during summer months from June through October and the residential pattern correlates particularly well with temperature during summer months. Residential usage peaks in August, and the demand is 2.8 times the AWC. Commercial water usage increases during summer months to a lesser degree, as evidenced by the peak monthly usage being 2.1 times the AWC. The "Other" accounts shown in Figure 7, which include schools, hospitals/nursing, and bulk accounts, are more consistent throughout the year and are not as influenced by outdoor demands. The distribution of sectoral demands in Glenwood Springs are also very consistent between years, as shown in **Figure 8**.

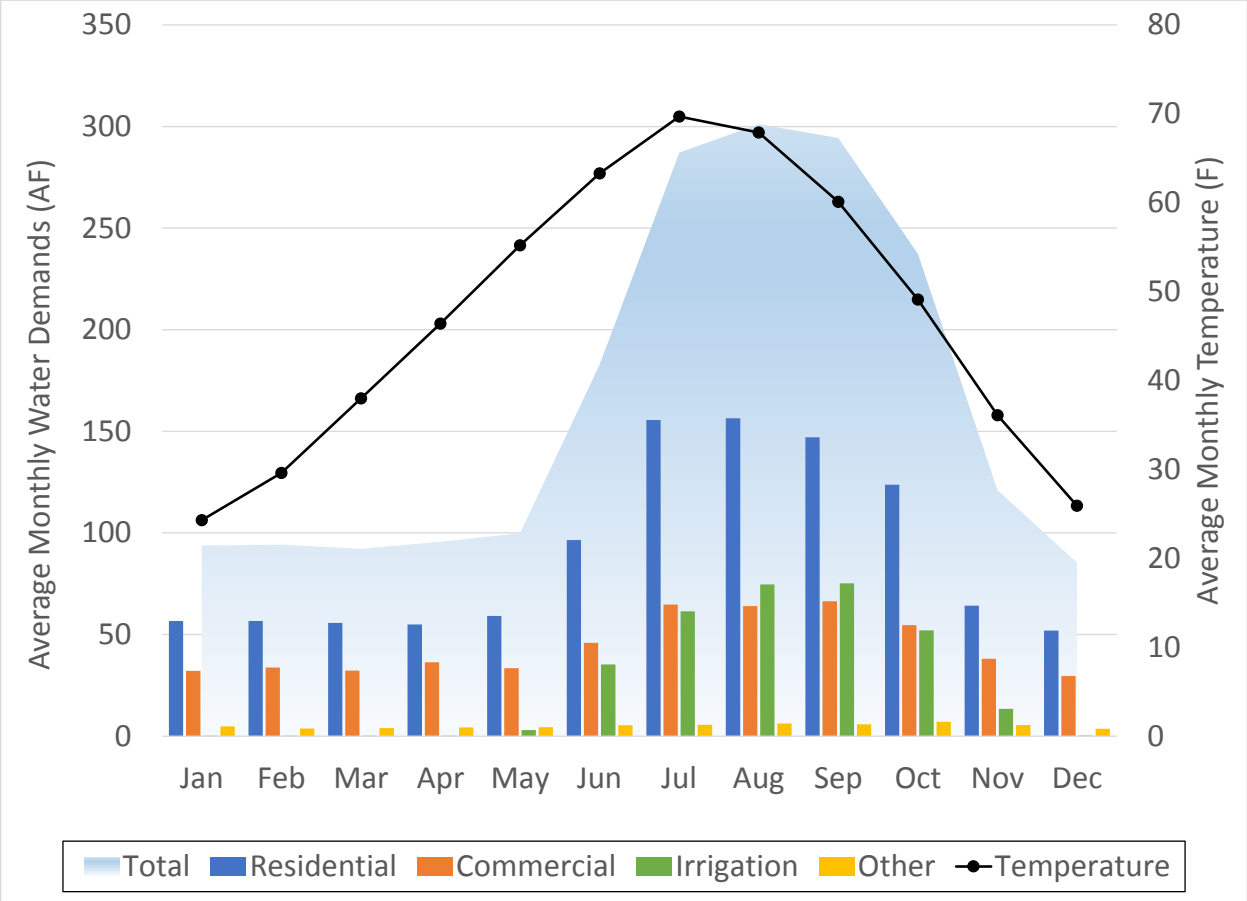

Figure 7. Average Monthly Demands by Water Use Sector from 2009 through 2013.

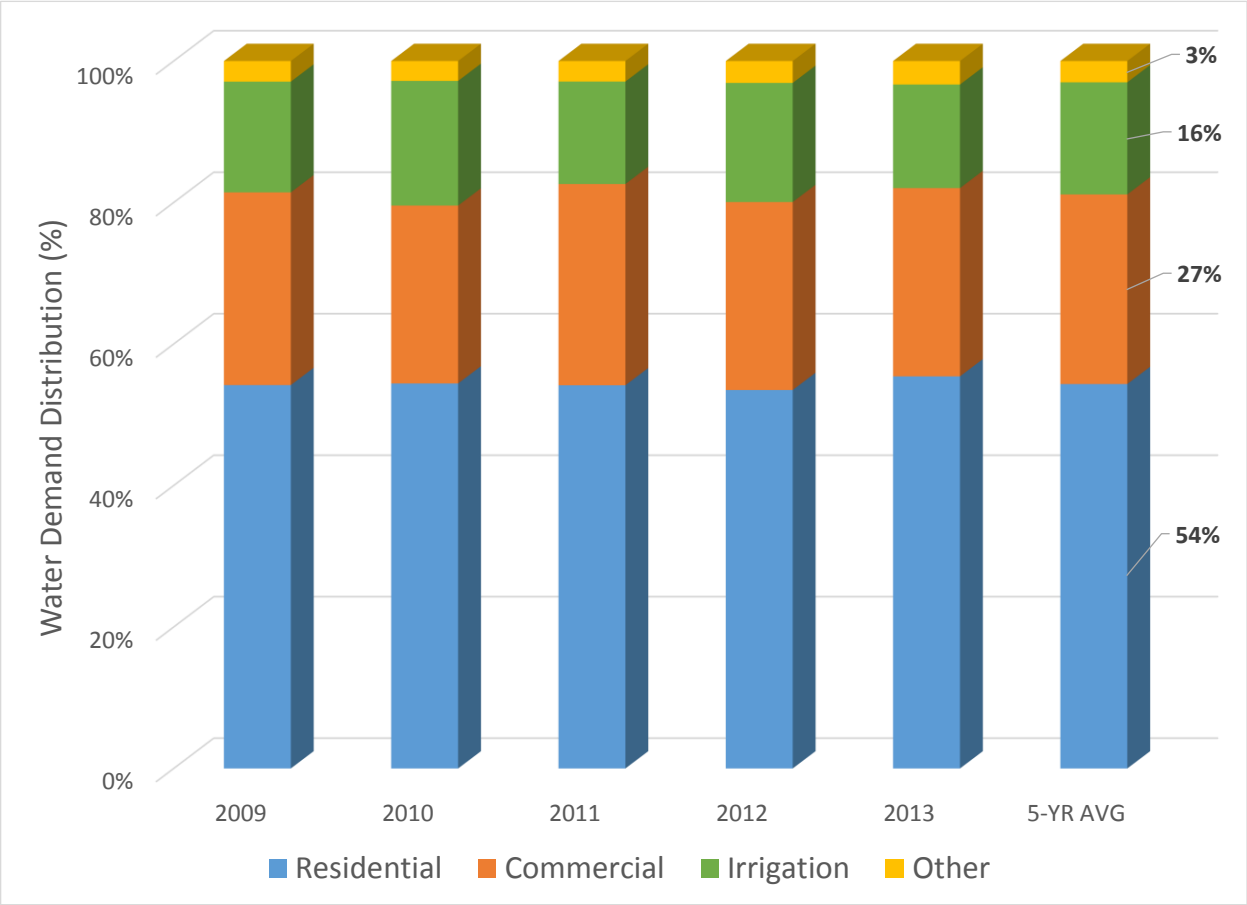

Figure 8. Distribution of Sectoral Demands from 2009 through 2013.

In 2013, residential demand accounted for 55.4% of the total demand in Glenwood Springs, commercial accounted for 26.6% and the other categories (hospitals, schools, irrigation, and bulk sales) accounted for the remaining 18%. A pie chart showing the components of the 2013 water usage in Glenwood Springs is presented in **Figure 9**.

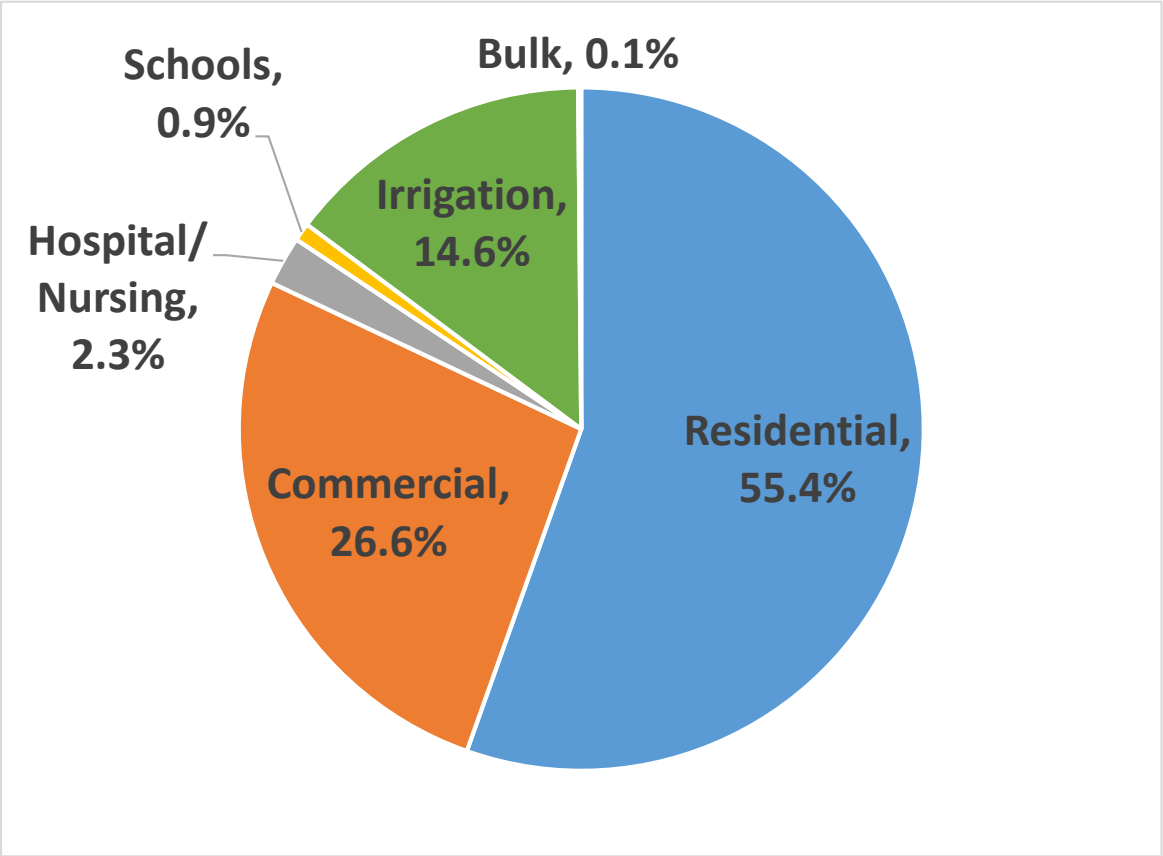

Figure 9: Distribution of Annual Water Use by Sector in 2013.

A pie chart showing the percentage of customer connections in 2013 by water use sector in Glenwood Springs is provided in **Figure 10**. Residential customers are most prevalent in Glenwood Springs, accounting for 83.7% of all service connections. Commercial customers account for 13.0% of connections, dedicated irrigation accounts account for 2.6% of connections, and the remaining accounts are attributed to schools, hospitals, and bulk customers.

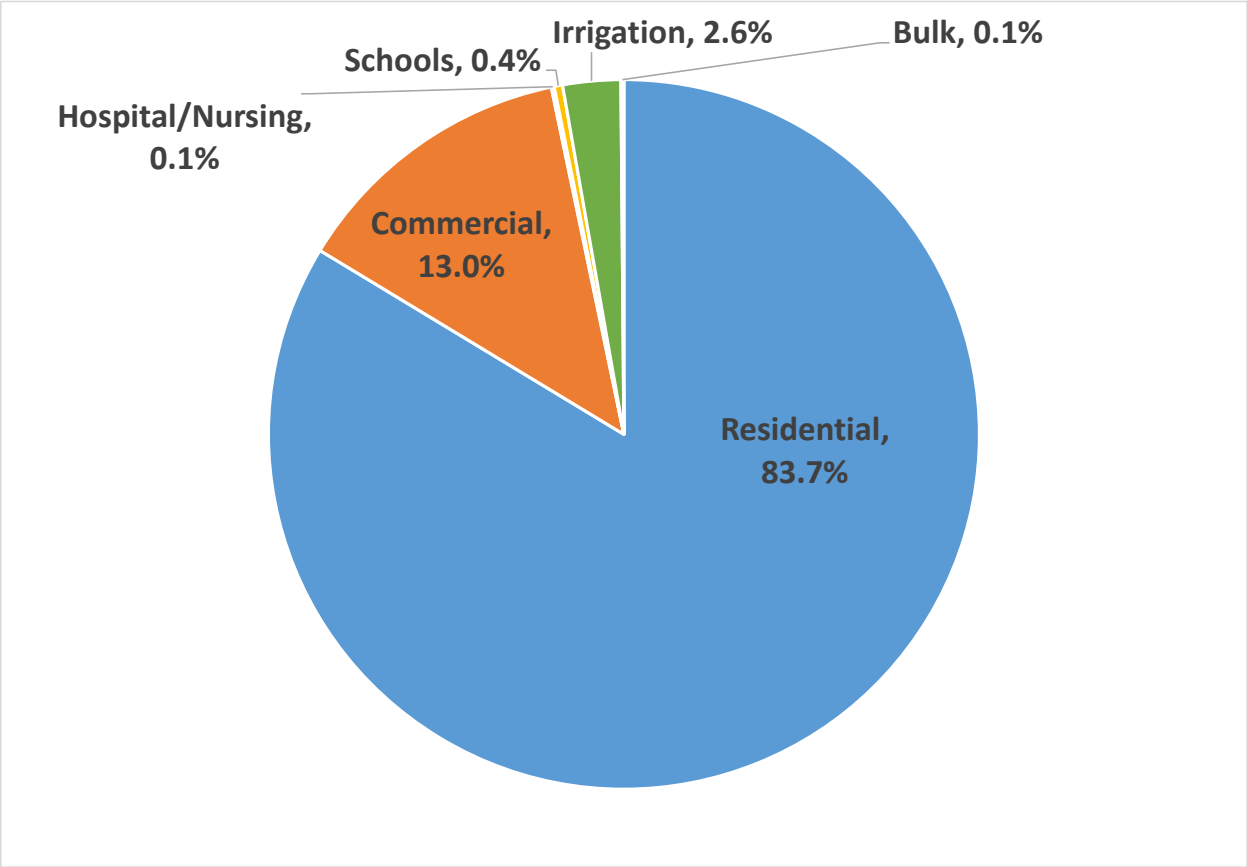

Figure 10. Distribution of Customer Connections in 2013.

Although residential customers make up approximately 84% of customer connections, they comprise only 55.4% of the total annual demand. Commercial customers (13% of connections) account for 26.6% of annual demand. Dedicated irrigation accounts make up 2.6% of connections but account for 14.6% of annual demand.

2.3 Seasonal and Peak Day Production

A summary of average day and peak day water production at the Red Mountain WTP is provided in **Table 4**. Over the last five years, the average day water production has averaged 2.23 MGD and the peak day production has averaged 4.14 MGD. This indicates that the City experiences an average peaking factor of approximately 1.86. The Red Mountain WTP has a maximum rated capacity of 8.65 MGD, so the City has an excess capacity of 4.51 MGD on the peak day and consequently has no problem meeting current peak production demands for water. In addition, the City has the ability to store 5.65 million gallons in treated water storage tanks, which can be used to meet short-term peak demands. As discussed later in this plan, peaking capacity is not a constraining factor for Glenwood Springs in any of the future demand scenarios.

Table 4: Annual and Daily Flow Production Characteristics from 2005 through 2013.

Year	Annual Production (AF/yr)	Annual Production (MG)	Average Daily Flow (MGD)	Maximum Daily Flow (MGD)	Peaking Factor
2005	2,551	831	2.278	5.5	2.4
2006	2,737	892	2.444	5.5	2.2
2007	2,756	898	2.460	5.7	2.3
2008	2,889	941	2.579	5.0	1.9
2009	2,555	833	2.281	4.2	1.9
2010	2,566	836	2.290	4.5	1.9
2011	2,563	835	2.288	3.4	1.5
2012	2,256	735	2.014	4.0	2.0
2013	2,548	830	2.275	4.6	2.0
5-YR AVG	**2,497**	**814**	**2.230**	**4.1**	**1.9**

2.4 System Water Losses

The City's water mains are in good condition and system leakage in Glenwood Springs is currently estimated to be between 5% and 7% (as further described below), which is well below the 10% threshold that is often estimated as the national average. The City annually contracts with a leak detection firm that utilizes sophisticated listening equipment to locate leaks in approximately 25% of the water mains each year. Repairs are then made based on this analysis.

While a comparison of average annual production to total metered water deliveries shows an annual loss on the order of 20%, the largest loss of water in the Glenwood Springs system is associated with intentional bleeder losses from aerial pipes that cross the Colorado River. Because pipes are exposed to the ambient air temperature, freezing is a real threat. To prevent freezing, the City must continually bleed raw water from aerial pipes during the winter (November – April) to ensure that water is always moving through the pipe. The water bled from the pipe drains into the Colorado River. While this is a standard practice for utilities located in cold climates, the City is working toward eliminating the need for this discharge.

Several years ago, the City temporarily metered these aerial pipes to determine the extent of the water loss associated with the required bleeding. From this metering effort, bleeder losses of treated and raw water were estimated at 350,000 gallons per day. The practice of bleeding water from the raw water pipelines to the Colorado River is a planned procedure and really does not constitute a "loss" to the system, since reducing the amount of bleed would not increase the available water supply. Water from the No Name diversion is simply being diverted over and above the requirement for water by the system, and then returned to the river through the bleed valves. In the American Water Works Association (AWWA) M36 Water Audits and Loss Control Programs manual, the City's practice of bleeding water is categorized as "Unbilled Unmetered Consumption", which falls under the broader category of "Authorized Consumption" and by definition is not a water loss. This operational practice is necessary in

that demand in the water system is so low during the winter that flow in the pipe would drop to the point where it could freeze. If the demand in the system were greater, then the bleed would be reduced accordingly and the flow into the treatment plant would be increased. Since the water is available for use if needed, it does not represent a true loss to the system.

When accounting for the authorized consumption associated with the bleeder practice, the remaining losses are estimated to be on the order of 5% to 7%. Currently there are no readily available options for reducing or eliminating the losses associated with these bleeder valves. By metering the aerial pipes from time to time, the City is able to ensure that these losses are kept to an acceptable level. While this is a standard procedure for utilities located in cold climates, Glenwood Springs is investigating new technologies and options for insulating the pipe to reduce these losses. For the present, the City's efforts are adequate and represent best practices based on industry standards.

2.5 Past and Current Demand Management Activities

The Glenwood Springs Water and Wastewater Department currently employs seventeen people including the Public Works Director and Water and Wastewater Superintendent. The City of Glenwood Springs does not have a dedicated conservation staff member and its conservation program is implemented by the Water and Wastewater Superintendent, billing staff, and other staff members. The City has demonstrated a real commitment to water use efficiency, and even without a staff member dedicated to water conservation, has implemented many of the most essential water efficiency and conservation program measures.

The City of Glenwood Springs has implemented a variety of water efficiency activities since 2009, when the last water conservation plan was prepared. The City's 2009 conservation plan called for a total savings of 130 AF by 2030 over the baseline demand forecast. The City estimates the implementation of the 2009 plan and the passive and active efficiencies achieved have already conserved more than 200 AF to date. Based on this, in five years, Glenwood Springs has already achieved (and exceeded) the goal the previous plan had set for 2030. It should be acknowledged that part of the reason the goal was achieved is that population growth in Glenwood Springs was significantly slower than anticipated from 2009 through 2013.

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 continued without change. This is a standard approach to demand forecasting, but it does not take into account any 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 customer sector category. 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

The planning population of Glenwood Springs in 2014 was approximately 10,600. Staff have indicated that the City plans for growth of 1.6% per year; however, the rate of growth from 2010 to 2013 averaged only about 0.2% due to the economic downturn. For the purpose of water supply planning, the full 1.6% annual growth rate was assumed so that the adequacy of future water supplies can be assessed. **Table 5** shows the population forecast from 2015 through 2050. These data are shown graphically in **Figure 11**. Under this forecast, population grows from 10,770 in 2015 to 18,771 in 2050, an overall increase of 74% in the next 36 years.

Table 5: Population Growth Projections from 2015 through 2050.

Year	Population
2015	10,770
2016	10,942
2017	11,117
2018	11,295
2019	11,476
2020	11,659
2025	12,622
2030	13,665
2035	14,794
2040	16,016
2045	17,338
2050	18,771

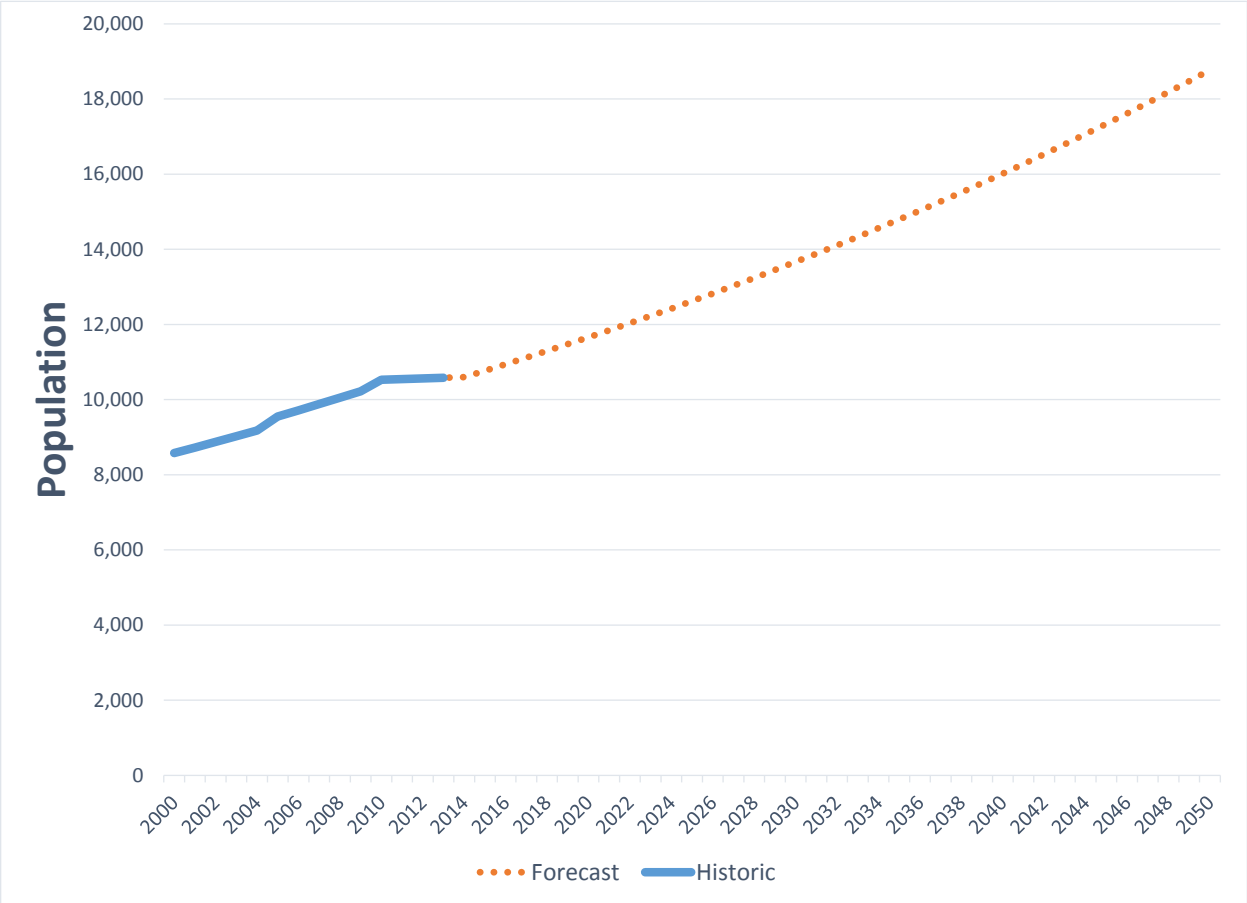

Figure 11: Actual and Forecast Population from 2000 through 2050.

Glenwood Springs does not currently have a build-out population planning projection. However, the physical characteristics of the City's setting will likely function as an effective limit to large-scale future growth. Steep canyon walls, the Colorado and Roaring Fork River flood plains, and federal lands that abut City boundaries are all likely to limit future growth and development. As such, the City's population planning projections, while conservative by the standards of many Colorado communities, may over-estimate future population. In the forecasts shown here, a 1.6% annual growth rate is anticipated. The actual growth rate (pre-recession) over the past few years has been closer to 0.2% per year. For water and conservation planning purposes, the projections used by the City 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 Glenwood Springs.

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 extending through 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 Glenwood Springs. In the baseline forecast, all demands (indoor and outdoor) increase proportionally with the population at the current rate of usage. A second water demand forecast through 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 City'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 Glenwood Springs. 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 3. Then a separate demand forecast through 2050 was prepared for indoor and outdoor demand in each customer category. 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 12** and further described in the sections below.

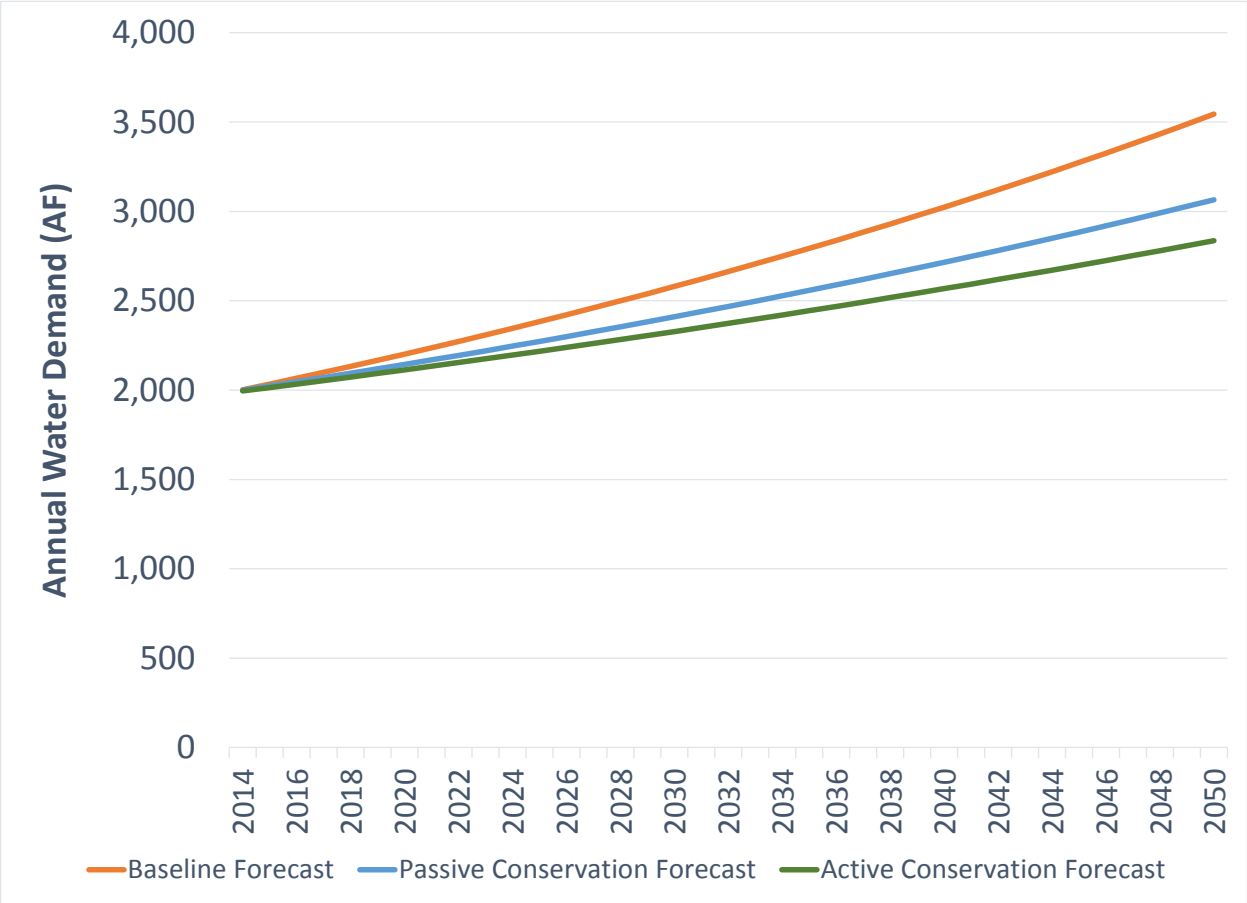

Figure 12: Baseline, Passive, and Active Demand Forecasts through 2050.

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 2000-2013) are continued into the future without change. It is also assumed that typical water demands for the City 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 to demonstrate the anticipated impact of water efficiency in Glenwood Springs from both passive and active conservation programs. The baseline forecast is presented in Figure 12.

Key assumptions in the baseline forecast include:

- Baseline water use patterns for Glenwood Springs (Table 1).
- Population forecast for Glenwood Springs (Table 5).
- 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 was 1,988 acre-feet (AF) and under the baseline forecast is expected to increase by 1,546 AF/yr to 3,544 AF in 2050. This represents a 77.4% increase in water demand over the next 36 years.

Passive Conservation Forecast

A second water demand forecast was prepared through 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. 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 City water demands will increase to 3,065 AF in 2050. The passive forecast is presented in Figure 12.

Key assumptions in the passive conservation forecast include:

- Baseline water use patterns for Glenwood Springs (Table 1).
- Population forecast for Glenwood Springs (Table 5).
- 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 54.9 gallons per capita per day (gpcd) in 2014 to 38.3 gpcd in 2050), continuing trends of the past 15 years[8].
- 0.5% per year decrease in per capita commercial indoor use from ongoing replacement of fixtures, appliances and equipment and new Colorado legislation under Senate Bill 14-103 that phases in the sale of only high-efficiency WaterSense labeled fixtures starting in 2016.
- 0.5% per year decrease in per capita hospital/nursing indoor use from ongoing replacement of fixtures, appliances, and equipment and new Colorado legislation under Senate Bill 14-103 that assures high-efficiency plumbing in new construction.
- 0.5% per year decrease in per capita school indoor use from ongoing replacement of fixtures and appliances and new Colorado legislation under Senate Bill 14-103 that assures high-efficiency plumbing in new construction.
- Bulk water sales increase annually, proportionally with increases in population.

[8] 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 53.4% increase in water demand over the next 36 years and suggest that more efficient fixtures and appliances could help reduce future demands in Glenwood Springs by 478 AF/yr compared with the baseline.

Active Conservation Forecast

A third forecast was prepared that includes the anticipated impact of the City's planned water efficiency program measures described in this plan. Under this forecast, demand increases to just 2,837 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 708 AF as result of passive and active water conservation measures in Glenwood Springs. The active conservation forecast is presented in Figure 12.

Key assumptions in the active conservation forecast include:

- Baseline water use patterns for Glenwood Springs (Table 1).
- Population forecast for Glenwood Springs (Table 5).
- 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: Glenwood's conservation-oriented rate structure which charges higher rates for outdoor use, densification as the City grows, anticipated smaller lot sizes in future developments, irrigation efficiency improvements, ongoing landscape transformation from traditional turf to water-wise plants, and the City'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 54.9 gpcd in 2014 to 36.9 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 under Senate Bill 14-103 that assures high-efficiency plumbing in new construction.
- 0.75% per year decrease in per capita hospital/nursing indoor use from ongoing replacement of fixtures, appliances, and equipment and new Colorado legislation under Senate Bill 14-103 that assures high-efficiency plumbing in new construction.
- 0.75% per year decrease in per capita school indoor use from ongoing replacement of fixtures and appliances and new Colorado legislation under Senate Bill 14-103 that assures high-efficiency plumbing in new construction.
- Bulk water sales increase annually, proportionally with increases in population.

The active conservation forecast hypothesizes a 42.0% increase in water demand over the next 36 years and suggests that more efficient fixtures and appliances and reduced outdoor water

use could help reduce future demands in Glenwood Springs by 708 AF/yr compared with the baseline.

2.6.2.2 Limited Financial Benefits of Conservation

The City of Glenwood Springs has an ample raw water supply and excess water treatment capacity to meet current demands and all projected future demands over the next 36 years. There are no infrastructure projects that could be delayed or eliminated if the City were to adopt a more aggressive water conservation program. Because of the City's fortunate position regarding its water supply and delivery system, the financial benefits of increased water efficiency in Glenwood Springs are essentially non-existent. Some small cost savings might be achieved through reduced chemical costs and a small amount of reduced pumping, but these would most certainly be offset by the decrease in revenue associated with demand reductions. The City of Glenwood Springs does not see a significant financial benefit to increased water use efficiency at this time. In spite of the lack of a real financial incentive, Glenwood Springs remains committed to water efficiency and to current conservation efforts.

2.6.2.3 Climate Change Impact on Water Use

Recent climate change forecasts indicate a warming trend in irrigation season temperatures in the Glenwood Springs 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 the period from 1971 to 2000 (CIRES, 2014). 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 projections, will assist in this process.

2.6.3 Estimated Cost of New Supply Options

Given that the Glenwood Springs water supply is ample to meet anticipated future demands, and since Glenwood Springs has no pending water supply infrastructure projects beyond normal maintenance, there are no calculable avoided costs for new supply associated with demand reduction. Consequently it is not possible to calculate a benefit/cost ratio for any of the conservation activities developed in this study. For this plan, all required elements were considered, but ultimately the current conservation program was selected as the best option for Glenwood Springs.

In spite of the lack of a real financial incentive for water efficiency, Glenwood Springs remains committed to its current conservation efforts, which include many of the most important and effective measures such as metering and conservation pricing.

3. SELECTION OF WATER EFFICIENCY ACTIVITIES

The City of Glenwood Springs 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:

- Feasibility and practicality,
- Water savings and estimated cost per AF.

The City 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 City 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.

Cost was a key factor for Glenwood Springs, when considering which efficiency program measures to implement. As noted above, the financial benefits of increased water efficiency in Glenwood Springs are essentially non-existent. A traditional cost-benefit analysis could not performed because no financial benefit could be quantified. Conservation program measures were selected with the knowledge and understanding that the City does not have a designated water conservation budget or dedicated program staff. At the same time, the City has developed an effective demand management program over time by including core foundational elements like rates and ordinances that are part of the City's regular management activities. This information and understanding helped guide the efficiency activity selection process.

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 final selection of water efficiency activities was made by the City's Public Works Director, Water and Wastewater Superintendent, and other water department personnel. During the final screening, care was taken to select a suite of activities capable of achieving the level of water savings needed by Glenwood Springs to achieve the stated water efficiency goals.

3.2 DEMAND MANAGEMENT ACTIVITIES

Table 6 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 6: New and Updated Water Efficiency Activities and Water Savings Estimates.

Water Efficiency Activities	Sectors Impacted	Ongoing Activity?	Implementation Period of New Activities	Projected Water Savings 2015 - 2050 (AF/yr)
FOUNDATIONAL ACTIVITIES				
Automatic Meter Reading Installation and Operation	All	YES	2014-2018 for existing & ongoing for new customers	50
Enhanced Water Loss Control	All		annual	50
Conservation-Oriented Rates	All	YES		100
TARGETED TECHNICAL ASSISTANCE AND INCENTIVES, AND NATURAL REPLACEMENT OF FIXTURES AND APPLIANCES				
Fixtures, Appliances, and Incentives	All, indoor	YES		108
Outdoor Water Efficiency	All, outdoor	YES		150
Commercial, Institutional, and Industrial Water Efficiency	CII	YES		120
ORDINANCES AND REGULATIONS				
Regulatory Measures	All	YES		
Water Reuse and Recycling	Irrigation	CONSIDERING		Savings depend on size and scope of reuse project.
Waste of Water Ordinance Update	All	YES	2015	
Update landscape development regulations for new construction to place emphasis on water efficiency in residential development	SF & MF residential		Potential 2018 under Regional Plan Collaboration	100
EDUCATIONAL ACTIVITIES				
Public Information and Education	All	YES		30
K-12 Education	All	YES		
TOTAL SAVINGS THROUGH 2050 (AF/YR)				**708**

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 its customers and to bill based on metered consumption. In Glenwood Springs, 99.5% of the customers (including all

municipal facilities) are metered and billed based on metered consumption. Municipal customers including City parks, the local cemetery, and water and wastewater treatment plants all pay for the water they use.[9]

The City is in the process of upgrading all water meters with AMR, with a goal of being fully automated within the next three to five years. Approximately 2,000 AMR meters have been installed to date, which is a substantial increase from the 2009 plan estimate of approximately 296 AMR meters installed at that time. The effort is ongoing, and the City is already taking advantage of the capabilities of this system where the meters have already been installed. City staff are using information from the AMR system to identify customer side leaks and for general water management and system improvements. Customers with abnormal usage during a billing period are automatically flagged in the system and alerted to the situation, offering opportunity for prompt repair.

The Badger Company makes a water meter-monitoring device that can be provided to the customers. This attaches to a magnetic surface such as a refrigerator and works like the odometer of a car. It has three registers that display volumes recorded by the meter. The main register ("=") displays the total volume that has flowed through the meter since it was installed. In addition there are two other registers ("A" and "B") that display the volume recorded since the last time these were reset (like trip registers on an odometer). The customer can use these to track annual, monthly or daily water use. In addition, the monitors have a light that flashes if a period of zero flow has not occurred in the last 24 hours. This alerts customers of a leak in its system. The City is evaluating the usefulness of this device as part of its conservation and drought response efforts and considering providing these devices on a limited basis after the meters are updated.

3.2.1.2 Enhanced Water Loss Control

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 Glenwood Springs is currently estimated to be between 5% and 7%, which is well below the 10% threshold that is often estimated as the national average. This low rate of system leakage is not an accident, but rather the product of an aggressive water main replacement and repair program in Glenwood Springs. The City's largest loss of raw and treated water is related to the intentional bleeder losses from aerial pipes that cross the Colorado River. However, since the water lost as a result of the bleeding operations is available for use if needed, it does not represent a true loss to the system. Furthermore, the City is investigating opportunities to mitigate the freezing issues as a water conservation effort.

[9] Some agencies in Colorado provide unlimited, free water to some municipal customers.

Conducting an annual system water audit, using the AWWA Water Audits and Loss Control Programs software, will further assist the City in managing its water by categorizing all water uses and identifying real losses that directly impact revenue, as shown in **Table 7** below.

Table 7: 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

Glenwood Springs is a fully metered community and currently bills its customers on a monthly basis using a three tier inclining block rate structure. The City is in the process of upgrading the entire metering infrastructure to the AMR system. This system enables frequent remote interrogation of water meters. The City is already taking advantage of this capability to help identify leaks and abnormal usage in the approximately 2,000 sites where the meters have been installed. The meter replacement project will be implemented over approximately a five year timeframe.

The City's computerized billing system includes a residential category, but does not distinguish between single family and multi-family residential customers. Similarly, it does not distinguish between sub-categories of commercial and institutional end users. These additional billing categories, while not essential, would be useful in identifying above-normal water uses, forecasting changes in demand, and in targeting specific conservation programs. Such an effort could be most efficiently undertaken when upgrading the City's computerized billing system, and the City will revisit the idea of expanding customer categorization at that time.
This City's three-tier inclining block rate structure has been in place since January 2000 and the rates shown below in **Table 8** were recently adopted and made effective in April 2015. In this rate structure, tier 2 represents a 33% increase over tier 1 and tier 3 represents a 33% increase over tier 2. The 5,500-gallon block one allotment represents a reasonable estimate of indoor water use for the single-family sector (the largest customer class in the City) and as a result, the rate structure sends an effective price signal that differentiates between indoor and outdoor

use for many customers. Irrigation taps that utilize treated water are charged at the tier 2 rate. Separate rate structures apply to bulk water purchases and raw water customers. The rates themselves are set based on the cost of service requirements of the City.

Table 8: Treated Water Rates and Rate Structure Effective 2015.

Rate Tier	Water Rate Per 1,000 gallons
Tier 1 – up to 5,500 gallons/month	$2.38
Tier 2 – from 5,501 – 17,500 gallons/month	$3.16
Tier 3 – over 17,500 gallons/month	$4.20
Fixed monthly service fee	$13.83/month

The schedule of rates and charges for bulk water customers is shown in **Table 9**. Bulk water sales are made to residents and visitors filling up water tanks and other large containers. Charges for bulk water are more than eight times higher than the tier 1 charges for regular Glenwood Springs' customers. There are only 5 bulk water accounts in the entire City and bulk demand summed to about 0.1% of total demand in Glenwood Springs in 2013.

Table 9: Bulk Water Rates Effective 2015.

Rate Tier	Water Rate Per 100 gallons
Per 100 gallons	$1.97
Fixed customer charge	$13.83

The schedule of rates and charges for raw water customers is shown in **Table 10**. Raw water is sold to a limited number of parks and dedicated irrigation sites that are located with convenient access to raw water supply infrastructure. Charges for raw water are 17% lower than tier 1 treated water rates, reflecting the lower cost of service to provide untreated water.

Table 10: Raw Water Rates Effective 2015.

Rate Tier	Water Rate Per 1,000 gallons
Per 1,000 gallons	$1.97
Fixed customer charge	$13.83

3.2.1.4 Wastewater Rates

Wastewater charges comprise the largest chunk of the combined monthly bill for many Glenwood Springs customers. The minimum monthly wastewater bill for customers inside corporate limits is $66.82 regardless of the volume of use during the billing period. Wastewater charges are typically based on the winter average billing for each customer (except for restaurants and hotels or motels with beverage service in which case it is based on actual year-round consumption). The schedule of wastewater rates and charges for customers inside

corporate limits is shown in **Table 11**. Charges for customers outside the corporate limits are approximately 50% higher.

Table 11: Inside Corporate Limits Wastewater Rate Effective 2015.

Customer Category	Volume Charge ($/1,000 gallons)	Billing Period
Minimum monthly bill – all users regardless of consumption (i.e. volumetric charges only apply if they exceed this minimum amount)	$66.82 (not volumetrically based)	Billed monthly, 12 months/year
Restaurant	$9.13	Billed monthly, 12 months/year
Hotel or motel with food & beverage service	$7.32	Billed monthly, 12 months/year
Hotel or motel without food & beverage service	$6.31	Billed monthly, 12 months/year
All others (residential, commercial, etc.)	$6.31	Billed monthly, 12 months/year. Volumetric charges during the summer months are based on the winter average water consumption.

3.2.2 Targeted Technical Assistance and Incentives

3.2.2.1 Fixtures, Appliances, and Incentives

In Glenwood Springs' case, the threat of water shortages primarily occur during low flow times in the late fall through early spring prior to snowmelt runoff. This means that for Glenwood Springs, there is a substantial value in reducing its non-seasonal, or indoor, water uses. The gradual replacement of inefficient fixtures and appliances and other water using devices is an excellent way to accomplish this objective.

Glenwood Springs promotes the replacement of old and inefficient toilets, showerheads, faucets, and clothes washers through its regular education efforts. The City is considering updating promotional materials to include WaterSense and Energy STAR labeled fixtures and appliances that represent an efficiency improvement over Energy Policy Act requirements.

In the past, Glenwood Springs has sponsored a retrofit program for showerheads, toilets, and faucets but does not currently implement this program because it is not cost effective given the water supply conditions. For the same reasons, Glenwood Springs has not implemented a rebate program to encourage and accelerate installation of efficient fixtures and appliances for the purpose of water savings, preferring instead to rely on natural replacement. However, in 2014, the Glenwood Springs Electric Department is offering rebates for Energy Star qualified

dishwashers and clothes washers, with the primary impetus being the associated energy savings.

3.2.2.2 Outdoor Water Efficiency

Glenwood Springs experiences high summer peak water demands due in part to the regular influx of tourists, but largely due to irrigation demands from customers with automatic sprinkler systems. The City has taken a number of steps to help reduce irrigation demands, starting with customer education. The City actively promotes efficient irrigation practices. In the spring, the City often sends outdoor efficiency information as a bill stuffer and encourages customers to tune up their irrigation systems for maximum efficiency and beauty, and to avoid water waste with additional public television messaging. The City previously established a Xeriscape demonstration garden at the Community Center, featuring a variety of plants that are suitable to the local region and climate and require less water than traditional turf landscapes. While that specific demonstration garden was subsequently removed to accommodate a facility expansion, other public areas throughout the City including trail systems accomplish similar objectives.

City staff work to set an example through the efficient irrigation of parks and public lands. All City parks, medians, and other irrigated areas are metered and billed based on actual water use. The City delivers and sells raw water to a number of parks and large irrigation sites that are located in close proximity to the City's piped raw water supply. It is cost prohibitive to extend the raw water system much beyond its current reach, but sites located on or very near the raw water pipe network are encouraged to join the raw water system and to remove their treated water irrigation demands from the system.

The City's billing rate structure encourages outdoor water efficiency for its largest customer class, single-family residential, by setting the tier 2 break point at 5,500 gallons which effectively distinguishes indoor use (tier 1) and outdoor use (tier 2 and tier 3). The City 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 put this effort on hold for the time being.

While not a long-term water conservation measure, in the event of a climatological drought that affects the City's supply, Glenwood Springs is prepared to implement outdoor watering restrictions to reduce demands as required.

3.2.2.3 Commercial, Institutional, and Industrial Water Efficiency

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

Pricing water and wastewater 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

Glenwood Springs, 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 and tier 3 rates. Wastewater rates, presented above in Table 11, are tailored to specific customer categories such as restaurants and the hospitality industry (typically the largest water users in Glenwood Springs). Restaurants pay the highest wastewater charges because of the cost associated with treating the wastewater from these customers, which includes significant amounts of food waste.

The hospitality industry in Glenwood Springs, the largest block of non-residential water customers, has adopted a number of the best management practices regarding unnecessary washing of towels and sheets promoted through the US EPA WAVE program as well as other hospitality related efficiency efforts. Guests at many Glenwood Springs lodging establishments are encouraged not to change their sheets and towels every day unless necessary. The City also encourages the replacement of old and inefficient toilet fixtures in hotels and motels through education, information, and price signals, but does not have a rebate program to incent fixture replacement.

3.2.3 Ordinances and Regulations

3.2.3.1 Regulatory Measures

The City regularly reviews local codes and regulations for opportunities to specify water conservation requirements. The City's Comprehensive Master Plan also reflects water conservation and regional planning effort goals and values.

Several significant conservation-oriented regulatory measures have been enacted in Glenwood Springs including a mandatory (where practical) connection to the City's raw water system, landscape development standards that focus on water efficiency, the consideration of Xeriscape when developing parking facilities, the adoption of the International Plumbing Code (IPC) as a requirement for new construction, and the adoption of a waste of water ordinance and drought management plan. Some of these specific regulations are described further below. The current waste of water ordinance included in Article 080.040.060 of the City's Municipal Code focuses on waste of water from fixtures. Future code updates should consider including specific requirements on outdoor water use such as: prohibiting excessive watering, limiting the maximum number of irrigation days per week, and prohibiting irrigation in the middle of the day, during high winds, while raining, etc.

City codes state that, if practical and reasonable in the sole opinion of the City, any property proposed to be developed or redeveloped that is located within the City and within four hundred (400) feet of any established raw water irrigation line with available water rights for such purposes must connect to the City's raw water irrigation system in order to irrigate any lawn or other vegetation located thereon.

The City has adopted the IPC as a requirement for new construction, which includes a number of standard efficiency measures. A section that impacts Glenwood Springs is P2903.3.1 (reprinted below) that requires a pressure reducing valve if the maximum static pressure exceeds 80 psi.

> ***P2903.3.1 P2903.3*** *Maximum pressure. Maximum static pressure shall be 80 psi (551 kPa). When main pressure exceeds 80 psi (551 kPa) an approved pressure-reducing valve conforming to ASSE 1003 shall be installed on the domestic water branch main or riser at the connection to the water service.*

Through the IPC, pressure reducing valves are required in locations where water main pressure exceeds 80 psi. Pressure Reducing Valves (PRVs) have been shown to dramatically reduce indoor and outdoor leakage in communities with high water pressure. In a city such as Glenwood Springs that has high irrigation demands, PRVs can reduce the frequency of blown sprinkler heads and valves and can improve overall irrigation system efficiency. PRVs have also been shown to have an impact on indoor demands in both the residential and commercial sectors. The EPA WaterSense New Home Specification requires a maximum static pressure of 60 pounds per square inch, which is often achieved through installation of a PRV, and builders have noted that customers like the consistency provided through a PRV.

Glenwood Springs' landscape development regulations for new construction place a strong emphasis on water efficiency in new commercial development. The intent of the commercial landscape design standards (Article 070.150.080) is to "enhance the visual appeal of new development and to protect and preserve the natural beauty of Glenwood Springs. Landscaping improves air quality, complements the appearance of buildings, buffers potentially incompatible neighboring land uses, mitigates the environmental and visual impacts of surface parking areas, and conserves residential and commercial property values."

The general guidelines for commercial landscaping specifically recommend the following elements related to water conservation (Article 070.150.080(b)):

(2) Limit to the greatest extent possible the amount of over-site grading and the amount of land area devoted to impervious surfaces in order to preserve existing native vegetation and natural landforms.
(5) Incorporate water conservation into all aspects of the design including species selection and plant location and groupings based on irrigation needs.
(6) Select native species that have a proven ability to withstand drought and that adapt well to the urban environment.

Glenwood Springs also promotes the use of Xeriscaping in parking lot construction. The landscaping design code for parking lots (Article 070.050.100) states, "For lots with twenty (20) or greater spaces, at least twenty percent (20%) of the total unenclosed parking area, including access ways, shall be devoted exclusively to landscaping of trees, shrubs, ground cover and Xeriscaping, which reduce the visual impact and assist in defining on-site traffic movement."

The City has adopted a Drought Management Plan that authorizes the City manager to implement water use restrictions as needed to address mild, moderate, and severe drought restrictions. Mild drought restrictions are intended to achieve a water use reduction of 10%, while moderate and severe drought restrictions are more restrictive to achieve reductions of 30% and 50%, respectively.

3.2.3.2 Water Reuse and Recycling

Glenwood Springs used treated effluent at the pervious wastewater treatment plant site and is currently considering the reuse of treated effluent at the new wastewater treatment plant for irrigation purposes.

3.2.4 Public Education and Information

A key component of Glenwood Springs' water conservation efforts is public education and information. The City provides information to customers about ways to conserve water and avoid water waste through flyers and bill stuffers and the utility maintains conservation materials and information that are available upon request. Education efforts focus on both indoor and outdoor water demands. More recently, the City has also been providing public education on outdoor water efficiency through the local television station. The City finds this method of communication to be far reaching and extremely cost-effective.

Glenwood Springs' education efforts extend into the local public schools and community college. Since the City is built at the confluence of two major rivers, water appears plentiful and abundant at first glance. A regular series of field trip tours of the water and wastewater treatment plants and conservation demonstration project are provided to K-12 students and teachers. These tours include discussions of water conservation behaviors and importance of water efficiency. The City also currently makes funding available for the LivingWise Program in which kits containing efficiency measures for hands-on activities at home were made available to all elementary school 5th grade classes in 2013. The program facilitates installation of efficiency measures in homes and builds knowledge about energy and water. The City is also looking into other programs like River Watch of Colorado and Project WET.

4. IMPLEMENTATION AND MONITORING PLAN

The City of Glenwood Springs does not have a dedicated conservation staff member or a formal, stand-alone water conservation program. However, the City has demonstrated a real commitment to water use efficiency, and even without a formal program has implemented many of the most essential water conservation program measures as described above.

Even though Glenwood Springs has ample water supply to meet all forecast future needs in the absence of any water conservation efforts, the City believes water efficiency and demand management are important values to instill in the utility and citizenry. The City plans to continue to promote wise water use and efficiency through a variety of efforts, most notably its

conservation-oriented rate structure, automatic meter reading infrastructure, utility water loss control efforts, and public education.

4.1.1 Monitoring and Evaluation

Glenwood Springs will review and update this Water Efficiency Plan at least every seven years, or as needed. The City 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 Glenwood Springs meet its stated goal by 2050.

Beyond tracking conservation progress every seven years, the City produces monthly and annual demand reports for each customer sector and the system as a whole and keeps close track of demand. Unexpected or abnormal water usage by a customer or sector is quickly identified and investigated. The City is already using the new Badger AMR system to identify customer-side leaks and plans to expand this effort as more Orion meters are installed. The City also plans to participate in annual water demand reporting to the State as required under House Bill 1051. It is anticipated that this annual effort will produce useful data to assist the City in monitoring and evaluating progress toward achieving its conservation goals.

When the conservation plan is updated, new forecasts will be developed and the adequacy of the City's water supplies will be compared against forecast future demand. If necessary, the City will adopt additional demand management measures. The evaluation done for this plan indicates that the Glenwood Springs has ample raw water supply to meet all forecast future demands.

4.1.2 Revenue Stability

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

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

5.1 PUBLIC REVIEW

The public review process is described in Appendix A. No comments were received during the 78-day public review period.

5.2 Water Efficiency Plan Adoption

The City of Glenwood Springs City Council reviewed the draft Water Efficiency Plan after the completion of the public comment period. On August 6, 2015, the City Council adopted the plan with the updates included in this final version. A copy of the City Council Resolution approving the Water Efficiency Plan is included in Appendix B.

5.3 Water Efficiency Plan Approval

The draft plan was submitted to the CWCB Office of Water Conservation and Drought Planning on July 16, 2015 during the public review period. CWCB comments were addressed in this updated final version. On August 13, 2015, the City received official notification that the plan was approved by the CWCB.

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.

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 Glenwood Springs' compliance with this statute.

6.1.1 Glenwood Springs Compliance

The City of Glenwood Springs developed this conservation plan in order to comply with Colorado Revised Statute § 37-60-126. Each element of compliance is documented below.

A. Consideration of specific conservation measures.

(I) *Fixture and appliances* – The City actively promotes the installation of water efficient fixtures and appliances through its regular conservation education efforts and through its adoption of the International Plumbing Code. The City has carefully considered and evaluated the costs and benefits associated with give-aways, rebates, and incentives to encourage more rapid adoption of efficient technology, but no additional expenditures are economically justified because of the ample raw water supply available and the resulting benefit-cost analysis.

(II) *Low water use landscaping* – The City actively promotes water wise landscaping practices through its conservation education efforts and conservation-oriented rate structure, and demonstration of Xeriscape principals in public spaces and trail systems throughout the City. The City encourages the installation of water wise landscapes through landscape development ordinances. The City irrigates a number of properties using raw water and will continue to seek new opportunities for raw water irrigation. The City has carefully considered and evaluated the costs and benefits associated with rebates and incentives to encourage more efficient irrigation and water wise landscaping, but no additional program expenditures are economically justified because of the ample raw water supply available and the resulting benefit-cost analysis.

(III) *Commercial, Industrial and Institutional (CII) measures* – The City actively promotes CII water conservation through its regular conservation education efforts and conservation-oriented rate structure. The hospitality industry – the biggest water users in Glenwood Springs – has voluntarily adopted a variety of water efficiency measures and practices. The City has carefully considered and evaluated the costs and benefits associated with rebates and incentives to encourage CII retrofits and efficiency, but no additional program expenditures are economically justified because of the ample raw water supply available and the resulting benefit-cost relationship.

(IV) *Water reuse systems* – Glenwood Springs is currently considering the reuse of treated effluent at the wastewater treatment plant for irrigation purposes.

(V) *Water loss and system leakage reduction* – The current program includes an active utility water loss and leak detection program that includes testing approximately 25% of the system annually. The new metering system is being used to help identify customer side leaks. The City has worked hard to replace aging water mains and reduce water loss where possible.

(VI) *Information and public education* – A key component of Glenwood Springs' water conservation efforts is public education and information. The City provides information to customers about ways to conserve water and avoid water waste through flyers, bill stuffers, and public television messages, and the utility maintains conservation materials and information that are available upon request.

(VII) *Water rate structure* – Glenwood Springs currently bills its customers on a monthly basis using a three-tier inclining block rate structure. This conservation-oriented rate structure has been in place since January 2000.

(VIII) *Regulatory measures* – Glenwood Springs has regulatory measures in place that encourage the use of raw water and mandate the inclusion of a pressure-reducing valve when pressure's exceed 80 psi. The City promotes water wise landscaping in new construction through two ordinances: 070.150.080, and 070.050.100 (discussed in detail earlier). The City has adopted the International Plumbing Code as a requirement for new construction, which includes a number of standard efficiency measures. The City regularly reviews local codes and regulations for opportunities to specify water conservation requirements.

(IX) *Incentives* – Glenwood Springs promotes the replacement of old and inefficient toilets, showerheads, faucets, and clothes washers through its regular education efforts. However, in 2014, the Glenwood Springs Electric Department offered rebates for Energy Star qualified dishwashers and clothes washers. In the past, Glenwood Springs has sponsored a retrofit program for showerheads, toilets, and faucets but does not currently implement this program because it is not cost effective given the water supply conditions.

B. Role of conservation in Glenwood Springs supply planning. This Water Efficiency Plan represents Glenwood Springs' most comprehensive effort to integrate water conservation into water supply planning. Through this plan, the City has clearly established that its raw water supply is sufficient to meet future growth under all current planning scenarios.

C. Plan implementation, monitoring, review, and revision. The City monitors water use on a regular basis and will continue to do so. The City produces monthly and annual demand reports for each customer sector and the system as a whole and keeps close track of demand. The City also plans to participate in annual water demand reporting to the State as required under House Bill 1051. It is anticipated that this annual effort will produce useful data to assist the City in monitoring and evaluating progress on achieving its conservation goals. Glenwood Springs will 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.** Glenwood Springs will review and update this Water Efficiency Plan every seven years or as needed.

E. **Estimated savings from previous conservation efforts and current plan.** Since 2009, it is estimated that Glenwood Springs has already conserved more than 200 AF of water which exceeds the forecast from the previous conservation plan. The active conservation forecast prepared for this 2014 plan includes the anticipated impact of the City's planned water efficiency program measures. Under this forecast, demand increases to around 2,837 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 708 AF (20% total reduction, 0.53%/year) as a result of passive and active water conservation measures in Glenwood Springs.

F. **Public comment period.** A 78-day public review process was held from March 6, 2015 through April 30, 2015 and from July 16, 2015 through August 6, 2015, as described in Appendix A. No comments were received during the public review period.

7. ROARING FORK REGIONAL WATER EFFICIENCY PLAN

The development of the City of Glenwood Springs 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 City's Water Efficiency Plan will have a limited direct effect on flows in the Roaring Fork River because the City's primary water supply sources are outside of the Roaring Fork watershed. The City is pursuing a water efficiency goal of about 0.5% per year so that the firm yields from No Name and Grizzly Creek continue to meet the City's demands through 2050. These actions will reduce or eliminate the need for the City to utilize Ruedi Reservoir as a primary water supply in dry years, although any use of Ruedi Reservoir water by the City could have the impact of increasing flows in the Roaring Fork River given that the City is located at the confluence of the Roaring Fork and Colorado Rivers.

The City of Glenwood Springs can, however, make a significant contribution to the regional plan by partnering with other water providers on water efficiency programs and the City is committed to assisting with the implementation of the Roaring Fork Regional Water Efficiency Plan.

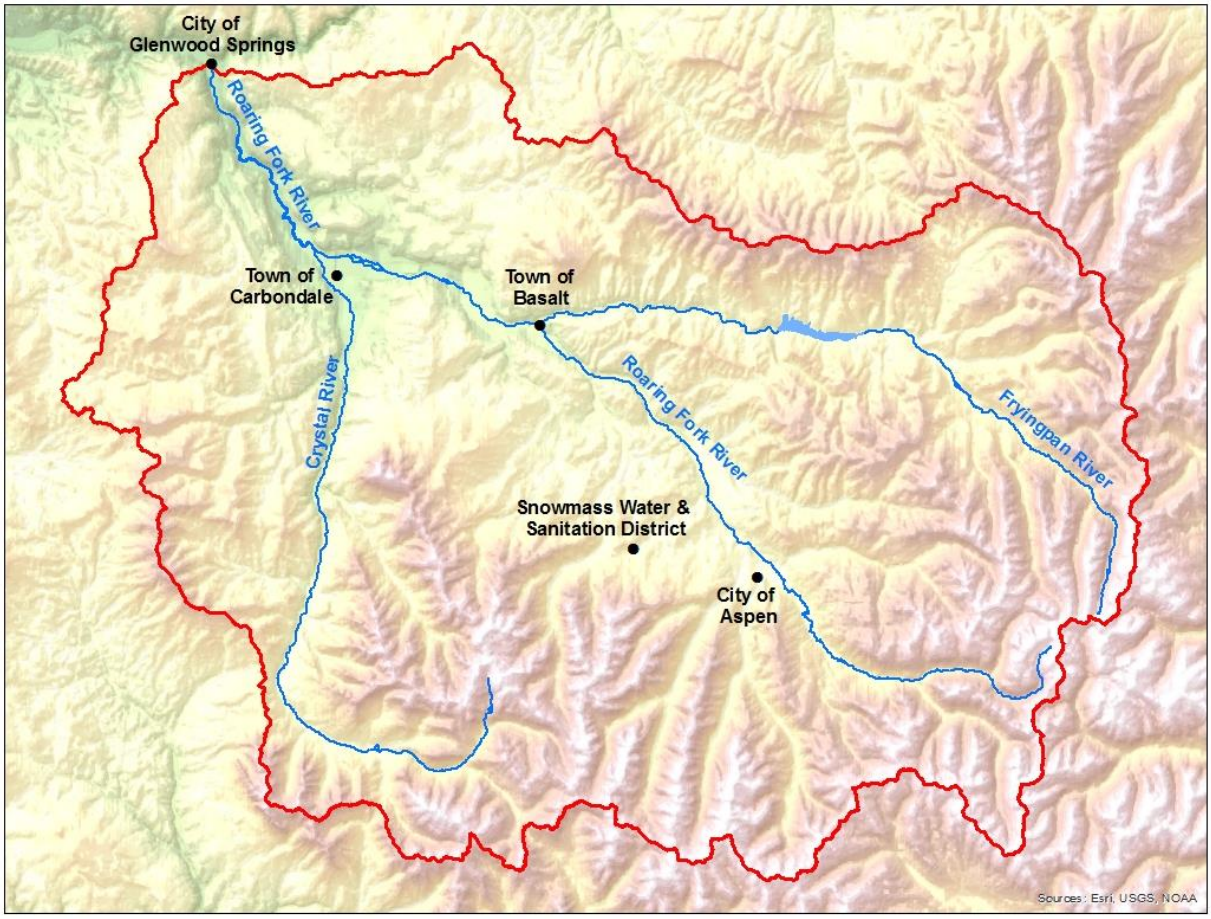

Figure 13. Water Providers Participating in the Roaring Fork Regional Water Efficiency Plan.

8. REFERENCES

Aquacraft, Inc. (2009, June). Water Conservation Plan, Glenwood Springs, Colorado.

CIRES Western Water Assessment (2014, August). Climate Change in Colorado: A Synthesis to Support Management and Adaptation, Second Edition.

Colorado Water Conservation Board (2012, July). Municipal Water Efficiency Plan Guidance Document.

Colorado WaterWise (2010). Guidebook of Best Practices Guidebook for Municipal Water Conservation in Colorado.

Howe, C. W. (1982). The Impact of Price on Residential Water Demand: Some New Insights. Water Resources Research 18(4):713-16.

Mayer, P.W. et. al. (2008, May). *Water Budgets and Rate Structures: Innovative Management Tools*. Journal of the American Water Works Association. Vol. 100, No. 5.

Mayer, P.W, et. al. (2004). National Submetering and Allocation Billing Program Study – Project Overview and Preliminary Results. Proceedings of the Water Sources Conference 2004, Austin, TX., Proceedings of the AWWA Annual Conference, Orlando, FL.

SWSI (2010). Statewide Water Supply Initiative 2010 Final Report, Colorado Water Conservation Board.

USGS (2013). Water-Data Report 2013, 09085000 Roaring Fork at Glenwood Springs, CO. http://wdr.water.usgs.gov/wy2013/pdfs/09085000.2013.pdf

APPENDICES

APPENDIX A

CITY OF GLENWOOD SPRINGS MUNICIPAL WATER EFFICIENCY PLAN PUBLIC NOTICE ANNOUNCEMENT, PUBLIC COMMENTS, AND OFFICIAL PLAN ADOPTION RESOLUTION

A1. PUBLIC NOTICE ANNOUNCEMENT

The draft Water Efficiency Plan was made available for public comment through the City of Glenwood Springs' website.

A2. PUBLIC COMMENTS

A 78-day public review process was held from March 6, 2015 through April 30, 2015 and from July 16, 2015 through August 6, 2015. No comments were received during the public review period.

A3. OFFICIAL PLAN ADOPTION RESOLUTION

The City of Glenwood Springs City Council reviewed the draft Water Efficiency Plan after the completion of the public comment period. On August 6, 2015, the City Council approved the plan with the updates included in this final version. A copy of the City Council Resolution adopting the Water Efficiency Plan is included in Appendix B.

APPENDIX B

CITY OF GLENWOOD SPRINGS MUNICIPAL WATER EFFICIENCY PLAN
CITY COUNCIL APPROVAL OF GLENWOOD SPRINGS' MUNICIPAL WATER EFFICIENCY PLAN

B1. OFFICIAL PLAN ADOPTION RESOLUTION

Attached is a copy of the City Council Resolution adopting the Water Efficiency Plan dated August 6, 2015.

RESOLUTION 2015-20

A RESOLUTION OF THE CITY COUNCIL OF THE CITY OF GLENWOOD SPRINGS, COLORADO APPROVING THE MUNICIPAL WATER EFFICIENCY PLAN AND AUTHORIZING STAFF TO SUBMIT SAID WATER EFFICIENCY PLAN TO THE COLORADO WATER CONSERVATION BOARD FOR FINAL APPROVAL.

WHEREAS, the City Council of the City of Glenwood Springs is committed to water resource sustainability and to the efficient use and conservation of water; and

WHEREAS, the City is committed to do its part to preserve water for future generations; and

WHEREAS, the City understands the needs and benefits of long-term water conservation and efficiency measures and is committed to the implementation of a Municipal Water Efficiency Plan; and

WHEREAS, the City Council of the City of Glenwood Springs desires to approve a Municipal Water Efficiency Plan and authorize its submission to the Colorado Water Conservation Board for final approval, pursuant to the requirements of the Colorado Water Conservation Act of 2004; and

WHEREAS, the Colorado Water Conservation Board requires the City Council approval of the Municipal Water Efficiency Plan.

NOW, THEREFORE, IT IS RESOLVED BY THE CITY COUNCIL OF THE CITY OF GLENWOOD SPRINGS, COLORADO THAT:

Section 1. The City Council of the City of Glenwood Springs hereby approves the Municipal Water Efficiency Plan prepared by Element Water Consulting, P.O. Box 140785, Denver, CO 80214 in conjunction with Water DM, 1339 Hawthorn Avenue, Boulder, CO 80304, dated December 16, 2014.

Section 2. Glenwood Springs City Staff is hereby authorized and directed to submit said Municipal Water Efficiency Plan to the Colorado Water Conservation Board for consideration of final approval.

INTRODUCED, READ, AND PASSED THIS 6th DAY OF August, 2015.

CITY OF GLENWOOD SPRINGS, COLORADO

ATTEST:

Michael Gamba, Mayor

Catherine Mythen

Catherine Mythen, City Clerk