City of Bozeman

Water Conservation and Efficiency Plan

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CITY OF BOZEMAN WATER CONSERVATION

February 15, 2023

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ABBREVIATIONS AND ACRONYMS

°F	degrees Fahrenheit
acct	account
AF	acre-feet
AFY	acre-feet per year
AMI	Advanced Metering Infrastructure
AWE	Alliance for Water Efficiency
AWWA	American Water Works Association
AWWARF	American Water Works Association Research Foundation
CAGR	compound annual population growth rate
CII	Commercial, Industrial, and Institutional
CIP	Capital Improvement Plan
COM	Commercial
DSS Model	Least Cost Planning Decision Support System Model
DU	Distribution Uniformity
EPA	Environmental Protection Agency
ET	Evapotranspiration
FTE	full-time equivalent
GIS	Geographic Information System
GPCD	gallons per capita per day
gpd	gallons per day
GPDA	gallons per day per account
gpf	gallons per flush
gpm	gallons per minute
HE	high efficiency
HET	high efficiency toilet
IA	Irrigation Association
IAPMO	International Association of Plumbing and Mechanical Officials
ILI	Infrastructure Leakage Index
INS	Institutional
IWRP	Integrated Water Resources Plan
LI	Landscape Irrigation
MF	Multi-Family
MSMT	multi-stream, multi-trajectory
MSU	Montana State University
MWM	Maddaus Water Management
N/A	not applicable
NOAA	National Oceanic and Atmospheric Administration
NRW	non-revenue water
Plan	Water Conservation Plan
psi	pounds per square inch
R	Residential
REUWS	Residential End Uses of Water Study
SF	Single Family
UARL	Unavoidable annual real losses
WUE	Water Use Efficiency

EXECUTIVE SUMMARY

The purpose of this Executive Summary is to briefly describe the City of Bozeman's (City's) Water Conservation and Efficiency Plan (Plan). The evaluation process and assumptions used to develop this Plan, as well as recommendations for future implementation, are included in this section.

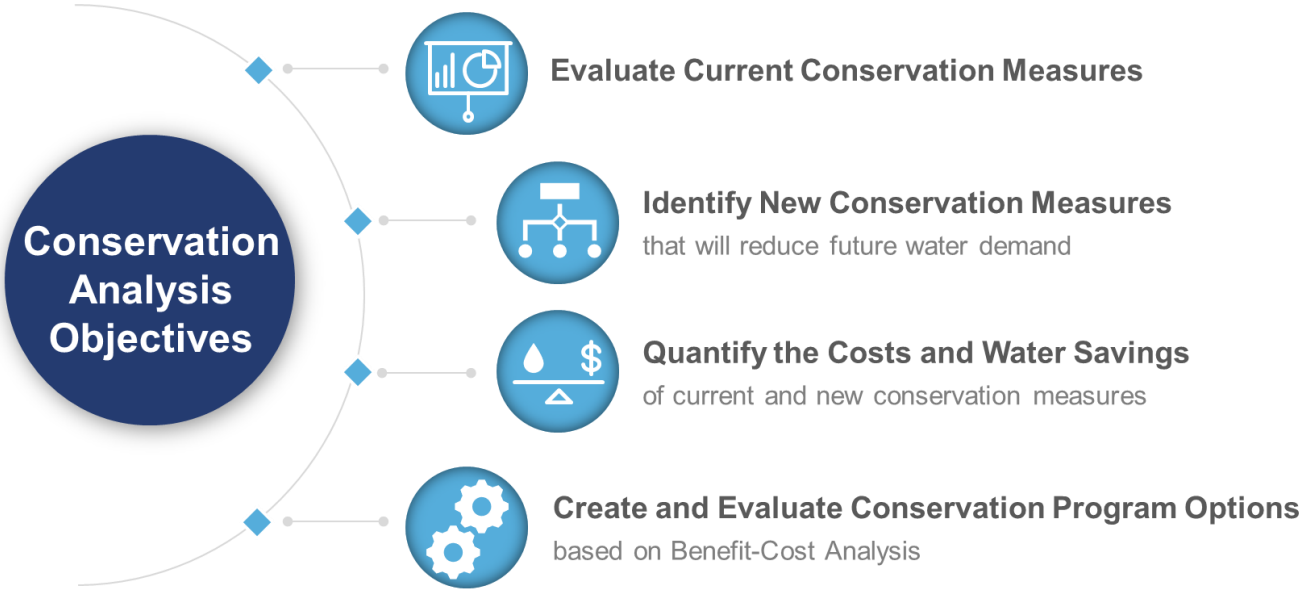
Introduction

This Plan will enable the City to project long-range demands, identify attainable conservation goals, develop strategies, and raise awareness through the identification and prioritization of conservation measures. The Plan sets measurable targets regarding existing and future conservation initiatives through a cost-effective suite of water conservation measures[1] that will help meet future water needs. The Plan also includes implementation and monitoring strategies to aid the City in establishing and administering effective conservation initiatives to achieve program goals.

By combining new initiatives with existing programs as part of a comprehensive strategy for sustainable management of water supplies, the City's conservation activities proposed within this Plan are expected to save an estimated 4,435 acre-feet per year (AFY) of water.

Program Overview

Beginning in 2020, Maddaus Water Management Inc. (MWM) conducted a conservation technical analysis for the City. The purpose of the analysis, as well as the foundation of the development of this Plan, was four-fold:



The planning process included analyzing conservation measures and programs using the Least Cost Planning Decision Support System Model (DSS Model), developed by MWM. A screening of more than 140 measures, directed at existing customers and new development, was conducted following the methodology presented in the American Water Works Association Manual of Practice, *M52 Water Conservation Programs – A Planning Manual* (AWWA, 2017).

[1] Though "demand management measure" is not a term used in this report, it is relevant to note that it is essentially the same as the term "water conservation measure." So, in this report, "demand management" and "water conservation" are used interchangeably.

Program Implementation

The City's Current Conservation Program scenario (referred to herein as Program A) consists of 11 measures, including measures that focus on indoor and outdoor efficiency for both Residential (RES) and Commercial, Industrial, and Institutional (CII) customers.

The City's Recommended Program (referred to herein as Program B) has 18 measures and expands on the Current Conservation Program's foundation by including 7 additional measures soon to be implemented; they are generally cost-effective and save significant amounts of water. The additional measures in Program B include the following:

- Capital Project – Retrofit City Medians with Drought Tolerant Landscaping and Efficient Irrigation
- Impact Fee Credit
- CII High Efficiency Washer Rebate
- Low Income Direct Installation Rebates and Leak Repair Assistance
- Require Irrigation Designers/Installers Be Certified
- Mandatory Water Efficiency Offsets
- Landscape Ordinance – Tier 3

The benefits of the City's Recommended Program measures include:

- Alignment with the City Utility Department's goal of providing residents with the sustainable foundation to thrive by delivering quality services and public infrastructure through efficient and fiscally responsible practices.
- Alignment with the guiding principle to improve local water supply reliability.
- A long-term plan that models a cost-effective means to manage water supplies.
- Alignment with AWWA's G480 standard which includes the following voluntary requirements:
    - Dedicated staff for conservation initiative (point of contact)
    - Conservation and efficiency planning
    - Integrated resources planning
    - Water shortage or drought plan
    - Public information and education
    - Water waste ordinance
    - Universal metering and source water metering practices
    - Non-promotional water rate
    - Monthly billing based on metered use
    - Clear definition of water use units in gallons or liters
    - Landscape efficiency program
    - Water loss control program
- Actions that support objectives outlined in the Bozeman Strategic Plan, 2013 Integrated Water Resources Plan, 2020 Climate Plan, and 2020 Bozeman Community Plan.

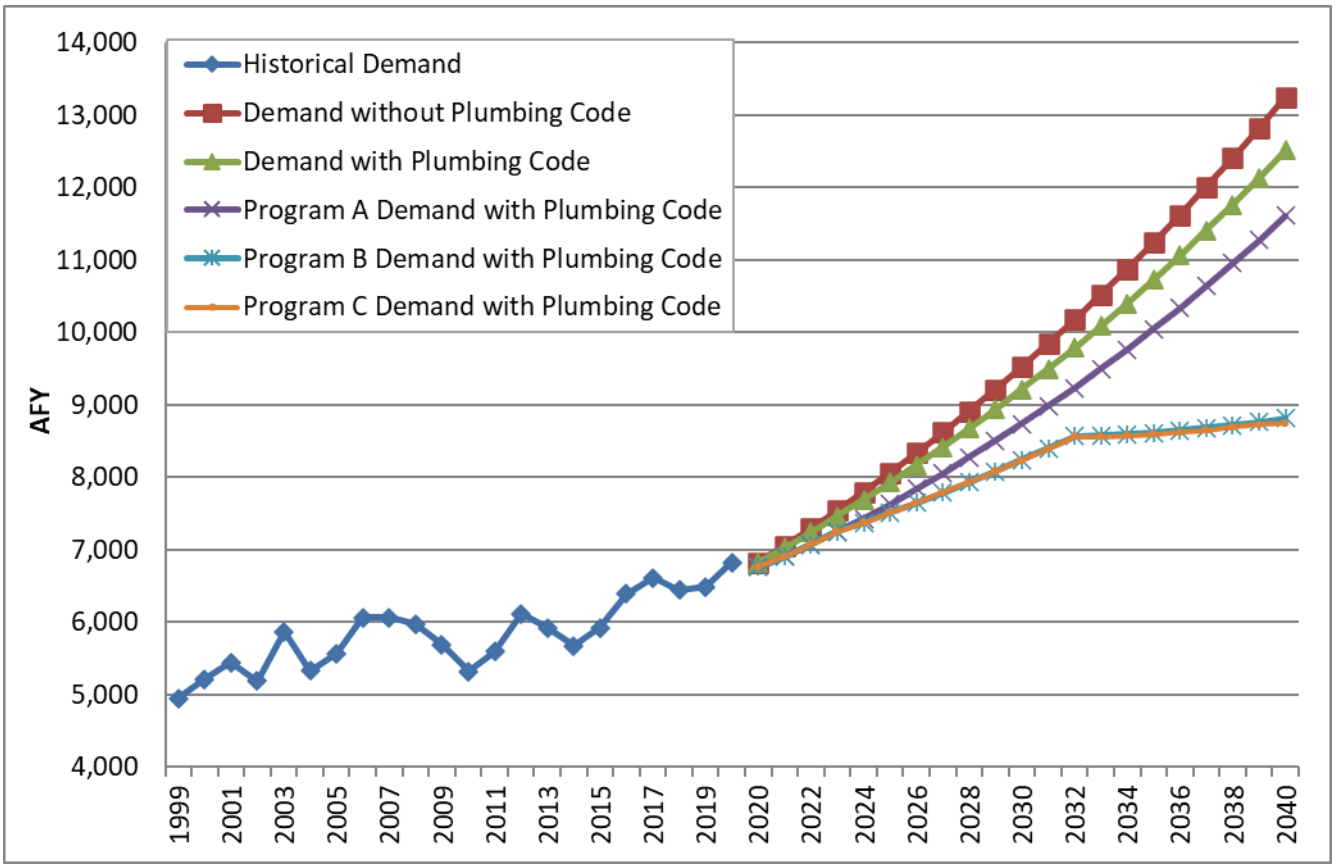
Program C, which includes all 25 measures modeled, adds several more measures making it the most expensive suite of measures as well as the one that will achieve the most water savings.

In addition to active conservation, this analysis investigates plumbing code savings, also known as passive savings. When developing the baseline water demand, the DSS Model accounts for savings due to plumbing codes. Modeling plumbing codes represents the change of fixtures to be efficient over time. Modeling and quantifying these savings helps to analyze the future GPCD. Plumbing code elements include current local and federal standards for retrofits of items such as toilets, showerheads, faucets, and pre-rinse spray valves. At this time, the plumbing code is conservative and only includes the currently adopted legislation. Based on recent history in the U.S. and Montana, as well as a continual movement toward more efficient devices, it is likely that

more codes and efficient practices will be adopted in the future. If more standards are approved, they could yield additional water savings.

The following figure presents historical and projected demand for the City with and without plumbing code savings in AFY.

Figure ES-1. City of Bozeman Historical and Projected Demand



All line types shown in the legend are presented in the graph. However, Program B and Program C demand scenarios are close in value and therefore may be somewhat indistinguishable in the figure.

Recommendations for future water conservation measure implementation begin with actively tracking measure participation, projected water savings (including per capita water use reductions), program costs, and benefits. Each year the City should develop a work plan to ensure the City is on track to meet its conservation goals. This work plan should prioritize measures that contribute the most to meeting the per capita water use targets and include a review of the staffing required to adequately support program needs. If necessary, consider outsourcing to gain enough program support. Lastly, pursue funding opportunities such as state and federal grants as appropriate, retain strategic partnerships, and encourage stakeholder participation as the program evolves.

Future implementation options include pursuing a statistically valid water conservation awareness study to inform program development and ensure the implementation schedule included in the Plan aligns with customer understanding and awareness of local water conservation efforts. Also consider using AMI consumption data to monitor water usage and identify instances of non-compliance with regulatory measures.

1 INTRODUCTION

This section provides an overview of the City of Bozeman's (City) water system, the purpose and scope of the Water Conservation and Efficiency Plan (Plan), and a project background of the steps used to complete the Plan.

1.1 Overview of City of Bozeman Water System and Demand Management

The City of Bozeman, located in Gallatin County, Montana, provides water service to approximately 14,500 metered connections, in which 73% represent single family homes and 18% represent multi-family residences. Total annual metered production during the 2020 calendar year was approximately 6,822 acre-feet (AF). Irrigation demands increase substantially during summer months (May through September), in which 50% of total residential water use goes into lawns and landscapes. The average annual water demand from 2016–2020 was 120 GPCD (based on metered production).

The City relies on snowpack and surface water for its water supply, receiving 80% of its water from the Gallatin Mountains and 20% from developed springs in the Bridger Mountains. Furthermore, the City is in a closed basin as it pertains to new water rights, making it exceptionally challenging to develop additional water supplies to meet growing demands.

The City's Water Conservation Division, under the Utilities Department, was developed after the adoption of the 2013 Integrated Water Resources Plan (IWRP), which recommends alternatives for generating additional water supplies to meet projected future demands through new supply development and demand management initiatives. Ultimately, the IWRP recommends that water conservation measures reduce the City's projected 50-year water supply gap by 50%.

To date, the Water Conservation Division has implemented various incentive and education-based program measures, with a primary focus on voluntary water conservation measures, specifically. This includes rebates for indoor and outdoor water efficient fixtures, free devices and other incentives, technical assistance, and informational resources.

In 2017, the City adopted its first Drought Management Plan, which outlines four stages of drought declarations and temporary response measures to reduce demand during the declared drought, providing the City with a tool to ensure water availability for essential uses when water supplies are stressed. The Drought Management Plan was updated in 2022 to reflect changes to the City's drought reserve and surcharge rates, drought declaration process, and drought monitoring procedure.

Permanent outdoor watering restrictions, which limit outdoor watering of lawns and landscapes to three days per week only during the most efficient times of day, became effective on June 16, 2022. The implementation of these restrictions marks the City's first notable regulatory change in effect year-after-year to ensure water use efficiency in the community.

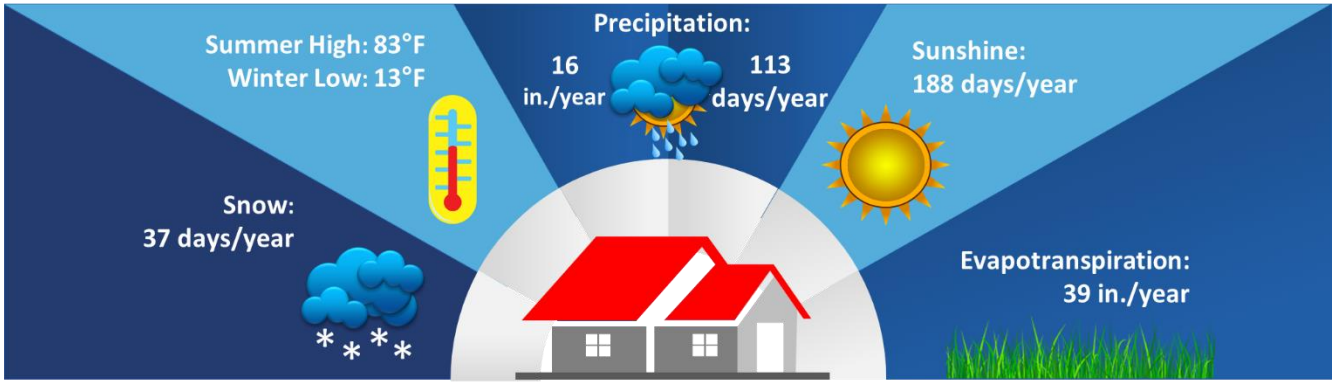
Climate

The climate in the City is typically characterized by short, warm, mostly clear summers and freezing, snowy, partly cloudy winters. Annual precipitation averages about 16 inches,[2] while annual ET_o in the region is 39 inches.[3] Throughout the year, the temperature typically varies from 13 degrees Fahrenheit (°F) to 83°F and is rarely below -7°F or above 93°F.[4]

[2] https://www.usbr.gov/gp/agrimet/station_bozm_bozeman.html

[3] https://www.usbr.gov/gp/agrimet/station_bozm_bozeman.html

[4] https://www.bestplaces.net/climate/city/montana/Bozeman



With a historical average of 16 inches of precipitation annually, the City is considered drought prone. The greater Bozeman area has experienced numerous drought events in the past, and future projections indicate more climate variability, including earlier peak runoffs; more precipitation in the form of rain than snow; and hotter, drier summers – likely stressing the City's water supply.

In 2017, extreme drought caused extensive impacts to agriculture in Montana and neighboring states. According to the National Oceanic and Atmospheric Administration (NOAA) National Centers for Environmental Information (NCEI), "Field crops including wheat were severely damaged and the lack of feed for cattle forced ranchers to sell off livestock" and "Montana in particular was affected by wildfires that burned in excess of 1 million acres."[5]

In 2021, extremely hot and dry weather patterns emerged in Southwest Montana and persisted throughout the summer, impacting the City's local water supplies. Local streamflow levels reached historical lows, and the volume of water available for use in Hyalite Reservoir dropped due to low inflows and likely increased usage by shareholders.[6] As a result, the City declared a stage 2 drought. Outdoor watering of lawns and landscapes was limited to two days per week, and only during the most efficient times of day. As a result of drought-related water conservation efforts, system wide water demand was reduced by 23%.

According to the U.S. Geological Survey's National Climate Change Viewer, temperatures in Gallatin County are expected to increase between 2.89°F and 3.46°F from 2025 to 2049.[7] The City's 2019 Climate Vulnerability Assessment identified average annual temperature increases between 4.5°F and 6°F from 2040 to 2069. The Assessment goes on to state, "in the modeled scenarios, the timing of precipitation (e.g., winter versus spring and summer) and the form in which it will occur (e.g., rain versus snow) is anticipated to shift. This combination of increasingly warmer days with variable precipitation results in interrelated, indirect local climate impacts. For example, decreased snowpack may lead to more severe droughts in the summer and a susceptibility to wildfire risk in the watershed… The heightened susceptibility to wildfire could reduce the amount and quality of water available along with damaging ecosystems and infrastructure, limiting city-wide services available to address the impacts… As snowpack is particularly sensitive to warming trends, a decline in snowpack volume with shifts toward earlier snowmelt will impact management and allocation of local water resources, especially considering Bozeman's limited water storage."

The City's 2020 Climate Action Plan sets mitigation goals including a 26% reduction in emissions by 2025 (in comparison to 2008), 100% clean electricity by 2030 and carbon neutrality by 2050.

[5] National Oceanic and Atmospheric Administration (NOAA) National Centers for Environmental Information (NCEI). (2022). U.S. Billion-Dollar Weather and Climate Disasters, DOI: 10.25921/stkw-7w73. https://www.ncdc.noaa.gov/billions/

[6] City of Bozeman. (2021). Drought Monitoring Tool.

[7] U.S. Geological Survey (USGS). (n.d.). National Climate Change Viewer. https://www.usgs.gov/tools/national-climate-change-viewer-nccv

Demographics

The City has been experiencing high growth for the past seven years, at a rate of approximately 4% annually. From 1990 to 2016, the number of single-family homes in Gallatin County grew by 150%, with the majority being in the Bozeman area. Most housing is single family homes (55%), followed by multi-unit (43%), and some mobile homes. Likely reflective of the local university, Montana State University (MSU), the median age in the City is 27.8, and 58.7% of the population has a bachelor's degree or higher. The median household income is $55,569. However, nearly 18% of the population lives below the poverty line.[8]

1.2 Project Background

For nearly a decade, the City has experienced high growth and anticipates that this growth will continue well into the future. Since the City relies on snowpack and surface water to meet water demands, it faces imminent challenges in addition to the continued population growth, such as being drought prone, increasing climate variability, and issues surrounding the allocation of additional water rights. The City is aware of the importance of developing new water conservation goals and strengthening current ones to create a new water supply in the hopes of addressing these challenges.

As such, the City initiated this project with the goal being to develop a Water Conservation & Efficiency Plan over a minimum 10-year planning period. The Plan will guide the City's water conservation program development to achieve the demand reduction target outlined in the 2013 IWRP and other program objectives. The Plan provides an assessment of existing program measures, identifies cost-effective program measures for future consideration, sets measurable targets for existing and future conservation initiatives, and provides an implementation and monitoring plan to establish and administer cost-effective conservation initiatives to achieve program goals.

1.3 Purpose and Scope of Plan

The intention of this Plan is to systematically evaluate and quantify a long-term water conservation strategy for the City's service area extending through the year 2040. Through the identification and prioritization of conservation measures, the Plan enables the City to project long-range demands, identify attainable conservation goals, develop strategies, and raise awareness. By combining new initiatives with existing program measures, this comprehensive strategy and slate of conservation activities will contribute to a more sustainable management of water supplies for the Bozeman community.

This Plan incorporates the Water Conservation Division's goals and objectives to protect and enhance water resources through conservation to meet the IWRP's 50-year demand reduction target through:

- Establishing and strengthening the community's water conservation ethic by
    - Utilizing a variety of methods to raise awareness as to the value of water, ways to conserve, and to encourage participation in initiatives, and
    - Providing equitable distribution of resources and incentives for all customer classes.
- Ensuring adequate water supplies are available to meet current and future demands, in times of drought, for emergency response and long-term drought mitigation by
    - Implementing data driven decision making, and
    - Developing and implementing mechanisms to track current demand patterns, forecast future demands, and evaluate and modify program elements as needed.

[8] U.S. Census Bureau (2020). American Community Survey 5-year estimates. Retrieved from Census Reporter profile page for Bozeman, MT. http://censusreporter.org/profiles/16000US3008950-bozeman-mt/

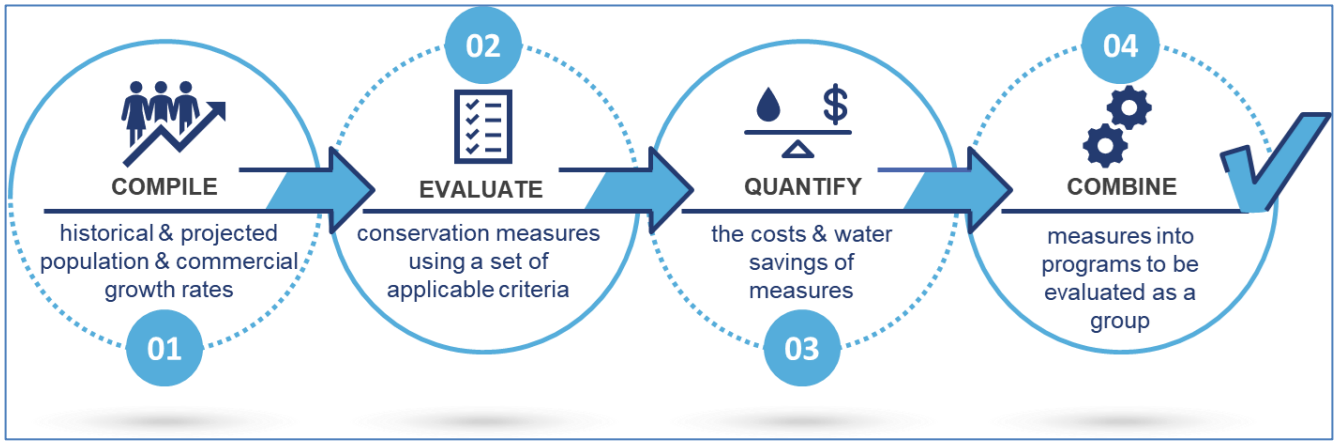
In addition, the Plan is intended to serve as a guide for the City regarding future water use efficiency and conservation investments and activities. It includes a functional implementation plan to establish and administer cost-effective conservation measures.

Based on a preliminary analysis of the 25 individual measures, three programs (Programs A, B, and C) were designed by the City. Each of the three programs were evaluated to determine the net effect of running multiple program measures together over the 21-year analysis period (2020–2040).

1.4 Plan Development

The Plan development included review of past documentation and data analyses. The City provided the following data as requested by MWM:

- Prior year(s) monthly water use data for the different classes of water users
- Complete descriptions of past, present, and proposed future conservation programs including historical annual participation rates and costs to the utility
- Estimated staff costs for measures and measure budgets
- Results of any independent analyses of water savings resulting from prior and current City programs
- Historical and projected water system service area population, employment, and growth projections through the year 2040 (or other suitable end year) along with maps of the water system, and study area(s)
- Customer characteristics and data needed to characterize water conservation measures such as the number of facilities or businesses of a particular type
- Projected baseline water demand without additional water conservation



The City worked closely with MWM to compile extensive historical data on the region, utility, conservation measures, production, consumption, weather, and various census data points. Together, these formed the foundation for MWM's DSS Model, which prepares long-range water demand and conservation water savings projections.[9] More detailed information about the DSS Model can be found in the appendices of this Plan, including a description of the assumptions, analysis, and methodology used.

Based on the analysis of current water use patterns, and considering characteristics of the service area, a list of more than 140 potential conservation measures was compiled and evaluated. The evaluation included

[9] The DSS Model is an "end-use" model that breaks down total water production (water demand in the service area) to specific water end uses, such as plumbing fixtures and appliance uses. It uses a bottom-up approach that allows for multiple criteria to be considered when estimating future demands, such as the effects of natural fixture replacement, plumbing codes, and conservation efforts. It also may use a top-down approach with a utility prepared water demand forecast.

measures directed at existing accounts as well as new development measures to make new residential and business customers more water efficient.

During the program measure evaluation process, the City utilized its “Engage Bozeman” framework to solicit input from the public to arrive at a list of 25 program measures to be selected for a detailed economic analysis and incorporation into the Plan. Detailed information about the public engagement process can be found in Appendix H of this Plan. Assumptions and results for each of the 25 individual measures and three programs (Programs A, B, and C) are described in detail in this Plan.

2 ANALYSIS OF WATER DEMAND

This section describes the data collection and review process; production and consumption, including weather normalization; and the City's historical and current conservation programs.

2.1 Information Review and Data Collection Methods

A thorough collection and review of information relevant to this effort was conducted by MWM and entered into the City's Excel-based Data Collection Workbook. To help streamline the process, MWM initially entered data into the workbook from readily available sources prior to sending the file to City staff for updating and review. This included an inventory of data such as historic water use, climate trends, and demographics (Table 2-1). MWM also reviewed demand projection analyses, any available and relevant information from the City's Geographic Information System (GIS) mapping data queries, and other service area characterization data previously developed for the City.

Table 2-1. Data Inventory for City of Bozeman

Data Type	Data Source(s)
Water Purchase and Consumption Data	
Non Revenue Water	• 2017 Water Facility Plan Update
Historical and Projected Demographics	• 2020 Community Plan • Recent population and employment projections • Historical population
Climate and Weather Data	
Land Use and Irrigation Data	• Parcel size • Ground cover type raster
Housing and Economic Data	
Cost Data	• Avoided Operations & Maintenance and Capital Costs • Water Loss Control Program Costs
Conservation Activity	• City of Bozeman conservation records (costs and water saved)
Existing Demand Models and Future Projections	• Existing strategic and master planning documents • Reports describing current demand projection methodology
Integrated Water Resources Plan	• 2013 Integrated Water Resources Plan

Additionally, using the provided consumption and account values from the City, MWM and City staff confirmed the number and types of customers within the service area. Several follow-up actions of data review were conducted between City staff and MWM to compile all relevant and valuable information and to identify the unique customer categories to be tracked.

Data from each customer category was analyzed separately. Monthly production data from 1999–2020 was reviewed. Based on the City's water billing system, residential water use was broken down into single family, multi-family, and low-income categories. Historical data was segregated into indoor and outdoor water use by customer type using the monthly billing data. Non-residential categories of use were analyzed separately. Average daily water use was expressed on a gallons-per-day-per-account basis.

2.2 Production vs. Consumption

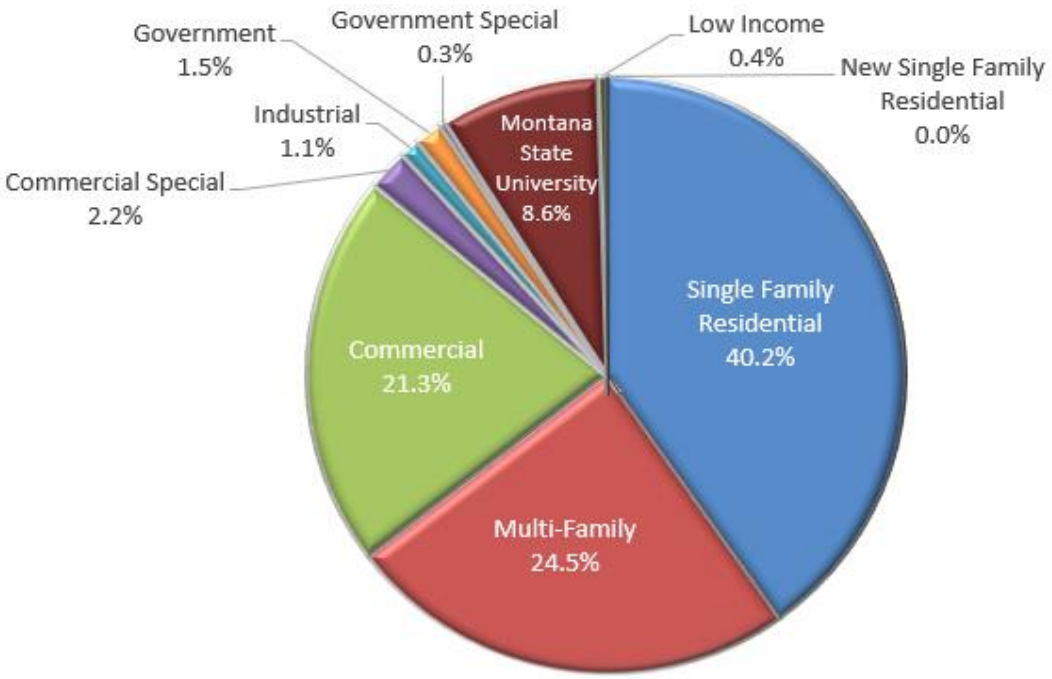
MWM analyzed historical consumption versus production data provided by City staff to calculate a non-revenue water (NRW) percentage to use for modeling. The average 2015–2019 data was used to calculate a NRW of 12.6%. Some amount of NRW, specifically the unavoidable annual real losses (UARL), is inherent in any water distribution system. A water distribution system audit and data validation identifies the volume of NRW. The City completed a water distribution system audit, level 1 validation, and real loss component analysis in 2022. This project provides the City with additional, detailed information about NRW real losses and provides a suite of recommendations to reduce real losses.

2.3 Consumption by User Category

The City has a variety of customer categories utilized in its billing system. This Plan has organized users into Single Family Residential, Multi-Family, Commercial, Commercial Special, Industrial, Government, Government Special, Montana State University, Low Income and New Single Family Residential. All new single-family accounts grow in the New Single Family Residential customer category, whereas the Single Family Residential assumes no growth. Approximately 40% of total annual water use occurs in single family homes followed in magnitude by multi-family connections (24% total annual use) and commercial connections (21% total annual use).

Figure 2-1 illustrates the water usage breakdowns within the City based on water use data provided in the data workbook. An average of years 2012–2017, with the exception of industrial (which used years 2018–2019 due to available data), was used to calculate the average breakdown of customer water use.

Figure 2-1. Consumption by Customer Category in Start Year



Weather Normalization

There is a strong correlation between outdoor water use and weather patterns. Hot, dry weather generally leads to higher outdoor water use, whereas cool, wet weather leads to lower outdoor water use. As such, it is difficult to accurately compare outdoor water use savings from one year to the next, as well as project future savings, without accounting for annual fluctuations in weather. A weather normalization analysis may be performed to represent annual outdoor water use savings more accurately by effectively removing the year-to-year variability in weather patterns, allowing for an 'apples to apples' comparison of outdoor water demands from one year to the next. MWM used information provided in the data collection process to conduct a weather normalization analysis for the City. MWM reviewed local climate data and explored various weather normalization methodologies. The City and MWM decided to use an industry standard approach of 3-5 years of temperature, precipitation, ET, and water demand data to perform the analysis. This selected approach was a straightforward option that used local climate data to average monthly water use based on customer class over the 5-year period to reduce the impacts of weather for any single year. An Excel-based review of historical dry, wet, and normal years was conducted and confirmed by the City. The following patterns were revealed:

- **2000–2006: Drought.** The Bozeman area experienced moderate to extreme drought during several months between 2000 and 2006.
- **2018–2019: Cooler and wetter than normal.** A review of customer consumption indicated there was a notable decrease in outdoor water use.
- **2012–2017: Normal weather.** This period for weather data is representative of more normal years, which allows for a baseline average gallons per day per account (GPDA).

These observations are incorporated into the conservation savings analysis to the extent that years 2017 and 2018 were selected as the basis for the indoor/outdoor water use profile representing both one dry and one wet year. After reviewing historic evapotranspiration rates MWM selected the period from 2012-2017 to be used in the DSS Model to represent 'weather normal' data, as these years represented typical weather patterns for Bozeman. Water demand data for each customer class was also selected during this time frame to be used in the weather normalization analysis. An average of monthly account consumption based on

customer class for years 2012–2017 was used to determine the total water use per account per day for each customer class. In this way, the outdoor demand projection with and without conservation savings is weather normalized, as it is based on historical average values that consider year-to-year fluctuations in weather. The goal of this task was to accurately reflect past outdoor water use trends by taking into consideration variations in year-to-year weather in order to track and project future water use trends and savings from outdoor conservation measures. Thus, the percent of water assumed indoors and outdoors for a given account is based on weather normalized inputs.

2.4 Historical and Current Conservation Programs

MWM analyzed the water conservation potential for the City's existing conservation program measures by performing a benefit-cost analysis. This included a thorough evaluation of avoided utility and customer costs, utility and customer benefits, estimated water savings in AFY, demand reduction as GPCD of each measure, and cost savings per unit volume of water. The current conservation program is listed as "Program A" in the DSS Model.

Existing conservation efforts at the City, prior to this Plan, included various incentive and education-based program measures, with a primary focus on voluntary water conservation measures specifically. This included rebate incentives for indoor and outdoor water-efficient fixtures, free devices and other incentives, technical assistance, and informational resources. Table 2-2 lists participation levels for the City's active water conservation programs over the past five fiscal years.

Table 2-2. City of Bozeman's Active Water Conservation Measures

Program Measure	Description	Participation Numbers
High Efficiency Toilet Rebate	The City issues rebates for the installation of high efficiency toilets. Toilets must have the WaterSense® label. Rebate amounts differ for new construction and retrofitting old fixtures.	826
High Efficiency Showerhead Rebate	The City issues rebates for the installation of high efficiency showerheads. Showerheads must have the WaterSense® label. Rebate amounts differ for new constructions and retrofitting old fixtures.	82
High Efficiency Clothes Washer Rebate	The City issues rebates for the installation of high efficiency clothes washers. Clothes washers must meet CEE Tier specifications. Rebate amounts differ for new construction and replacing old appliances.	765
Showerhead Swap Out	The City offers free high efficiency showerheads for customers who trade in their old, less efficient showerheads.	226
Weather Based Irrigation Controller Rebate	The City offers rebates for the installation of weather-based irrigation controllers. Controllers must have the WaterSense® label. Rebate amounts differ for new construction and retrofitting old controllers. Weather-based controllers use local weather and landscape conditions to make decisions about irrigation duration and frequency to better match plant water demands.	129
Rain Sensor Rebate	The City offers rebates for the installation of rain sensors for irrigation systems. Rain sensors override the irrigation system when a certain amount of rain has fallen. When the sensor dries, the system resumes normal functionality. Rebate amounts differ for new construction and retrofit projects.	78

Program Measure	Description	Participation Numbers
MSMT Sprinkler Nozzle Rebate	The City offers rebates for the installation of multi-stream, multi-trajectory (MSMT) nozzles which deliver water more efficiently than standard fixed spray nozzles. The lower precipitation rate of MSMT nozzles is beneficial for the City's "clayey" soils, and the larger water droplets are less likely to be lost to evaporation and wind drift. Rebate amounts differ for new construction and retrofit projects.	201
Drought Tolerant Plant Rebate	The City offers rebates for the installation of drought tolerant perennials and shrubs, which use 75% less water than turfgrass once established. The City publishes a list of over 100 plants that qualify for the rebate program.	104
Drip Irrigation Rebate	The City offers rebates for the installation of drip irrigation, which delivers water directly to plants – targeting the roots and minimizing water lost to evaporation and wind drift.	32
Turf Removal Rebate	The City began offering rebates for the removal of high water use turfgrass in April 2022. Pre-approval is required, and a minimum of 100 square feet of turfgrass must be removed.	48
Community Events and Presentations	The City regularly participates in community outreach events including local farmers markets and presentations at local schools and Montana State University.	8,171
Public Education Workshops	The City hosts free water wise landscaping webinars that teach residents how to evaluate and transform landscapes into 'mini watersheds' by incorporating water smart vegetation and irrigation techniques.	527
Free Water Saving Kits	The City offers water-saving kits to water customers including fix-a-leak, summer savings, brush better, shower better, and sprinkler system assessment kits.	243
Sprinkler System Assessments	Trained City staff analyze customer sprinkler systems to help identify opportunities for water efficient upgrades or repairs and provide guidance on proper irrigation schedule run times specific to the site location.	362
Dropcountr Water Use Portal	Dropcountr provides a free water use portal for the City's water customers. The online portal translates water use data from meters into actionable information that can help customers set water use reduction goals and allows customers to receive leak alerts.	2,554
Demonstration Gardens	The City has installed water efficient demonstration gardens throughout town to help showcase and educate residents on design and potential water savings.	50,000 visitors per year
Commercial Water Use Assessments	The City offers free commercial site visits and assessments that can help businesses identify water-saving improvements that are tied directly to dollar savings.	6
Public School Curriculum	The City partners with educational groups to help implement the Bozeman Water Conservation and Stormwater Management curriculum throughout elementary schools in the community.	1,501
Drought Rates	The City implemented a drought reserve and surcharge rate to provide financial security for the utility when revenues are decreased due to drought-related watering restrictions and to send	All water customers

Program Measure	Description	Participation Numbers
	a price signal to customers to reduce outdoor water usage during times of shortage.	
Permanent Outdoor Water Use Restrictions	times of day (not between 10am and 8pm).	All water customers

3 CONSERVATION MEASURE EVALUATION

This section details the screening process, the analyzed conservation measures, program measure assumptions and inputs used in the DSS Model, the City's water conservation capital improvement plan (CIP), City operations water use optimization practices, and future water efficient growth policies.

3.1 Screening of Conservation Measures

The City's goal was to develop a Plan that would result in the greatest efficiency of program administration, the lowest cost of implementation, and the greatest water savings. The measures in the Plan would also need to be designed to address water conservation across all relevant customer categories and ensure that the program would be equitable among community members. The screening process undertaken with the City's staff and public input yielded 25 measures for further evaluation.

The experience of many utilities has shown there is a reasonable limit to how many measures can be feasibly implemented at one time. Programs that consist of a large number of measures are historically difficult to implement successfully. Therefore, prioritization of measures is important both as an outcome of this planning effort and as the program is implemented. The approach to program implementation is viewed as a "living" process where opportunities may arise and be adopted as new technologies become available. Program timelines can also be adjusted, with the recognition that doing so may impact the savings objectives.

An important step in updating the City's Water Conservation Program included identification of new measures that may be appropriate and the screening of these measures to a short-list for detailed economic evaluation (benefit-cost analysis). A thorough screening process is necessary to scale a reasonable short-list of measures for evaluation in the DSS Model. This evaluation was specific to factors that were unique to the City's service area, such as water use characteristics, economies of scale, and demographics. The overall initial list of more than 140 potential water conservation measures was drawn from MWM and City experience and a review of what other water agencies with innovative and effective conservation programs were implementing at the time.

During the program measure evaluation process, City staff scored and evaluated each of the 140 measures based on quantifiable water savings, technology availability and market maturity, service area match, customer acceptance, equity, and additional service area benefits. Through this process, the list was reduced to 49 measures. At this point in the process, the City utilized its "Engage Bozeman" framework to solicit input from the public to arrive at a final list of 25 program measures to be selected for a detailed economic analysis and incorporation into the Plan. The City developed customized surveys for five stakeholder groups to capture the voice of specific groups affected by this Plan and inform the City as to which program measures would be of greatest benefit to members of the community. The surveys were available to the public from June 29–July 16, 2021. Table 3-1 shows the number of responses from the targeted groups; Appendix H contains a description of the engagement process as well as full results from the surveys.

Table 3-1. Community Stakeholder Surveys and Number of Responses

Stakeholder Group Targeted	# of Responses
Residential	354
Property Management	14
Landscapers	22
Community Developers	47
Businesses	16

In this measure screening update, City staff considered the results of the survey responses outlined in Table 3-1 when evaluating whether a measure should be included in the DSS Model. More details on the measure screening inputs and results can be found in Appendix E.

Figure 3-1. City of Bozeman Measure Screening Criteria

Capital Improvement Plan Development

As part of the conservation measure screening task, MWM worked with City staff to develop a CIP by identifying potential projects, upgrades, and equipment that could increase water efficiency. MWM and City staff developed and evaluated a list of projects that could be implemented by the City at a reasonable cost of no more than $50,000 per project. Each project has an estimated water savings (AFY) and demand reduction (GPCD) as well as total project cost. The DSS Model benefit-cost approach was utilized to prioritize project scheduling.

Projects that were considered included replacing turf medians with water efficient landscaping, installing weather-based irrigation controllers and efficient irrigation equipment in City-owned facilities, and retrofitting City-owned buildings with water efficient faucets, toilets, and urinals. These were incorporated into the DSS Model analysis as three separate capital projects. The implementation schedule of these capital projects is shown in Table 3-2. Capital projects in Program B are recommended for implementation. The elements and results of the CIP are presented alongside the other measures in the sections that follow.

Table 3-2. Capital Projects Implementation Schedule and Water Savings

Measure	Program(s)	Schedule (years)	Total Measure Savings (AFY)	Total Measure Savings (GPCD)
Capital Project Retrofit City Medians with Drought Tolerant Landscaping and Efficient Irrigation	B, C	2027	25.5	0.28
Capital Project Upgrade City Facility Irrigation Systems	A, B, C	2023–2026	25.5	0.29
Capital Project High Efficiency (HE) Fixture Installation in Government Building	C	2025–2034	49.6	0.53

City Operations Water Use Optimization

Potential operational improvements that would optimize City water use efficiency for City-owned assets were identified. These improvements are presented in Table 3-3. The water savings in AFY from the DSS Model were used to quantify water savings for individual measures to help determine any necessary GPCD reductions by customer class. The elements and results of the City water use optimization improvements are presented alongside the other measures in the sections that follow.

Table 3-3. City Operations Water Use Optimization Measures Implementation Schedule and Water Savings

Measure	Program(s)	Schedule (years)	Total Measure Savings (AFY)	Total Measure Savings (GPCD)
Water Loss	A, B, C	2022–2040	2,657.9	28.50
AMI and Customer Water Use Portal	A, B, C	2020–2040	984.1	10.99

Future Water Efficient Growth Policies

Policies that would reduce the water use associated with new development projects (growth) were identified. These policies are presented in Table 3-4. The water savings in AFY from the DSS Model were used to quantify water savings for individual measures. The elements and results of the City water efficient growth policies are presented alongside the other measures in the sections that follow.

Table 3-4. Future Water Efficient Growth Policies Implementation Schedule and Water Savings

Measure	Program(s)	Schedule (years)	Total Measure Savings (AFY)
Landscape Ordinance Tier 3	B, C	2024-2040	10600.9
Impact Fee Credit	B, C	2025–2033	718.3
Mandatory Water Efficiency Offsets	B, C	2033–2040	8061.9
Require HE Toilets, Showerheads, Faucets, Urinals in New Development	C	2040-2040	26.85

3.2 Conservation Measures Evaluated

Table 3-5 describes the 25 measures selected for analysis in the measure screening. The list includes devices or programs that can be used to achieve water conservation, methods through which the device or program can be implemented, and the distribution method or mechanism that can be used to activate the device or program.

Table 3-5. Conservation Measure Descriptions

Measure Name	Description
Tiered Rate Structure for MF Residential	Tiered rates for multi-family (MF) residential customers. Existing rates would change to create an incentive to use less water. Modifications could include creating multiple tiers and increasing the rates in the upper tiers to increase the incentive to reduce landscape watering.
AMI and Customer Water Use Portal	Retrofit water distribution system with Advanced Metering Infrastructure (AMI) meters and associated data collector network capable of providing continuous consumption data to utility offices. Improved identification of customer leaks is a major conservation benefit. Some of the costs of these systems are offset by operational efficiencies and reduced staffing as regular meter reading and time spent opening/closing accounts are accomplished without the need for physical or drive-by meter reading. This also enables enhanced billing options and the ability to monitor unauthorized use (such as use or tampering with closed accounts or irrigation occurring outside of permitted watering windows). Customer service is improved as staff can quickly access continuous usage records to address customer inquiries. Optional feature includes online customer access to their usage, which has been shown to improve accountability and reduce water use. The City is on track to complete AMI retrofits in 2027. A water use portal such as Dropcountr, which shows water use at an hourly timescale for customers with AMI meters and sends leak alerts, allows for customers to set billing

Measure Name	Description
	thresholds and see how water use compares to more efficient neighbors. Customers without AMI capability can also see water use in Dropcountr; however, it will only be displayed on a monthly timescale. These customers will not benefit from leak alerts, nor will they benefit from setting billing thresholds. Consideration should be given to improve communication pathways between AMI meters and data collectors by expanding the system of collectors throughout the City and considering the use of cellular data. If all AMI meters are able to consistently communicate with data collectors, the City would benefit from being able to eliminate the need for drive-by reads thus reducing the costs associated with staff time.
Water Budget Based Billing and Water Budgeting	Develop individualized monthly water budgets for all customers. Water budgets are linked to a rate schedule where rates per unit of water increase when customers go above their budgets or decreases if they are below their budgets. Budgets are based on size of the irrigated area and average indoor use estimates. These rates have been shown to be effective in reducing landscape irrigation demand (DeOreo, 2016; Dziegielewski, 2000). This would require a rate study and capable billing software.
Residential Efficiency Fixture Incentive Program	Utility would provide various rebate incentives for the installation of high efficiency indoor plumbing fixtures. Provide a rebate or voucher for the installation of a high efficiency toilet (HET, toilets flushing 1.28 gpf or less). Rebate amounts would reflect the incremental purchase cost for up to 2 toilets. Provide a rebate for the installation of high efficiency showerheads (2.0 gpm or less). Provide a rebate for efficient clothes washers to single family and multi-family homes. It is assumed that the rebates would remain consistent with relevant local and federal regulations (Department of Energy, Energy Star) and only offer the best available technology.
Residential Water Use Surveys	Provide free indoor and outdoor water surveys for single family and multi-family residential customers. Target those with high water use and provide a customized report to owner. Includes giveaway of efficient showerheads, aerators and toilet devices. This measure is combined with sprinkler system assessments in which irrigation systems are evaluated for signs of needed repair and opportunities to increase system efficiency, and customized watering schedules are developed.
Low Income Direct Installation Rebates and Leak Repair Assistance	Provide a direct installation rebate program for toilets, high incentive amount for clothes washers, and leak repair assistance. Customer leaks can go uncorrected at properties where owners are least able to pay repair costs. These programs may require that customer leaks be repaired, but either subsidize part of the repair and/or pay the cost with revolving funds that are paid back through water bills over time.
Fixture Retrofit on Resale or Name Change on Water Account	
Capital Project HE Fixture Installation in Gov t Bldg.	Direct installation of high efficiency (HE) faucets, toilets, urinals, and showerheads in City facilities.

Measure Name	Description
School Building Retrofit	School retrofit program wherein schools receive a grant to replace fixtures and upgrade irrigation systems.
CII High Efficiency Washer Rebate	Offer rebate for commercial grade clothes washers. Target high-use facilities such as laundromats, hotels, etc.
Efficient Fixture Giveaway	Provide free 1.15 gallons per minute (gpm) or lower pre-rinse spray valves for commercial kitchen facilities. Provide free HE fixtures, including showerheads, faucets, aerators, pre-rinse spray valves, soil moisture meters, leak repair kits, and hose nozzles to all customer classes.
Require HE Toilets, Showerheads, Faucets, Urinals in New Development	Require developers to install HE toilets, lavatory faucets, kitchen faucets, and showerheads in all new development projects. IAPMO Green Building Supplemental Code is 1.5 gpm for residential lavatory faucets, 0.5 gpm for non-residential lavatory faucets, 1.8 gpm for kitchen faucets, 2.0 gpm for showerheads, 1.28 gpf for toilets, and 0.125 gpf for urinals. Consideration should be given to state code requirements which may prohibit or limit local municipalities from requiring the installation of plumbing fixtures that exceed efficiency requirements in the state-adopted plumbing code.
Mandatory Water Efficiency Offsets	This measure is modeled after the Net Blue water offset framework. The intent of this measure is to require developers to offset a portion, or all, of their estimated water demand from new development with efficiency projects. The City has already implemented a program supporting voluntary water offsets for new developments as part of its water adequacy requirements. See Appendix I and J for more information about the Net Blue framework and the City's current water offset policy.
Capital Project Retrofit City Medians with Drought Tolerant Landscaping and Efficient Irrigation	Retrofit turfgrass street medians with drought tolerant landscaping and efficient irrigation to serve as an example of Best Management Practices for the community and to reduce water use.
Capital Project Upgrade City Facility Irrigation Systems	Perform irrigation system audits to document existing irrigation system components and retrofit with multi-stream, multi-trajectory (MSMT) nozzles, weather-based irrigation controllers, soil moisture sensors etc. as needed. Include recommended watering schedule to reduce overwatering.
Dedicated Irrigation Meters & Irrigation Account Rate Structure	Require dedicated irrigation meters be installed for all new commercial and multi-family residential customer classes. An irrigable area threshold would be set indicating when an account would be required to have a separate irrigation meter.
Impact Fee Credit	The purpose of an impact fee credit is to promote non-turf landscaping in some area of a customer's property (e.g., front yard of residential home) and more water efficient device installation indoors. A credit amount would be established to offset a portion or all of the cost a developer might incur through impact fees from installing the more

Measure Name	Description
	expensive landscaping or fixtures. Any drought tolerant plants would be included in the utility's recommended water smart plant list, or other City-approved plant list.
Financial Incentives for Irrigation and Landscape Upgrades	This would apply to all SF, MF, CII customers with landscapes and provide rebates for substantive landscape retrofits and the installation of water efficient upgrades. Rebates contribute towards the purchase of selected types of irrigation equipment upgrades (weather-based irrigation controllers, MSMT nozzles, rain sensors, drip irrigation). Landscape plant conversion and turf removal is not part of this measure.
Landscape Conversion or Turf Removal Rebate	Provide a per-square-foot incentive to remove turf and replace with low-water-use plants or permeable hardscape. Landscape conversion could include conversion of turf to low-water-use turf alternative varieties. Rebate based on dollars per square foot removed and capped at an upper limit for SF, MF, and CII.
Landscape and Irrigation Contractor Efficient Outdoor Use Education and Training Programs	Utility would offer, organize, and sponsor a series of educational workshops or other means for educating landscapers and contractors in efficient landscaping and irrigation principals. Utilize guest speakers, native demonstration gardens, and incentives (e.g., nursery plant coupons). Classes would include those such as Irrigation Association (IA) classes/certifications, U.S. Environmental Protection Agency (EPA) Qualified Water Efficient Landscaper course, etc.
Xeriscape Demonstration Gardens	Provide additional demonstration gardens showcasing drought tolerant landscaping and efficient irrigation so the community has local resources available to see these types of products and plants.
Require Irrigation Designers/Installers Be Certified	Require contractors be trained/certified in order to design and perform work on irrigation systems in the City. Certification might be through the IA or specialized training provided by the utility.

Landscape Ordinance Tier 3	Tier 3 of a prescriptive landscape ordinance measure would:
	• Restrict turfgrass installation to 35% of total landscaped area – SF
	• Restrict turfgrass installation to 20% of total landscaped area – MF
	• Restrict turfgrass installation to 20% of total landscaped area – COM
	Additionally, for SF, MF, and Commercial (COM) customer classes the following would apply:
	• Landscape Design Standards
	  ○ Require adequate topsoil depth and quality
	  ○ Require adequate mulch depth on bare soil
	  ○ Require submittal of soil quality lab test documentation
	  ○ Require drought tolerant vegetation for parkland, right-of-way
	• Irrigation Design Standards
	  ○ Detailed irrigation plan required for parkland and plan review projects demonstrating head-to-head coverage, hydrozoning, and low-flow drip for trees/perennials/shrubs
	  ○ Prohibit overhead spray in areas less than ~8 feet wide
	  ○ Irrigation operation and maintenance plan (including schedule for establishment and post-establishment)
	• Irrigation Performance Standards
	  ○ Adequate operating pressure

Measure Name	Description
	○ Weather-based controller ○ Rain/soil moisture sensor ○ Nozzle maximum application rate of ~1.25 inches/hour • Large Landscape Requirements ○ Irrigation submeters required ○ Flow sensor required ○ Separate irrigation rate structure for all irrigation submeters
Water Loss	In conjunction with system accounting (maintaining a thorough annual accounting of water production, sales by customer class and quantity of water produced but not sold), include audits that identify and quantify known legitimate uses of non-revenue water (NRW) within the distribution system to determine remaining NRW losses. Goal would be to lower the Infrastructure Leakage Index (ILI) and NRW every year by a pre-determined amount based on cost-effectiveness. These programs typically pay for themselves based on savings in operational costs; saved rate revenue can be directed toward system repairs/replacement and other costs.
Public Education	Utilize a range of printed and digital materials to raise awareness of conservation measures available to customers, including incentive programs offered by the utility. This could include newsletters, bill stuffers, water smart indoor and outdoor guides, brochures/rack cards, newspaper ads, signs at retailers, radio ads, boosted social media posts and accompanying imagery. Provide a variety of conservation information on the City's website and through production of videos. Conduct presentations at various community venues, MSU, local public schools. Have booths at community events such as famers markets, Catapalooza, etc. This measure would also include educational resources that are provided for free at events (shower timers, kids' activity books and pencils). Contract services to support public educational initiatives, such as working with Green Gardens Group and Montana Outdoor Science School are also included. Also consider a program initiative with focused action like the "Take Control of your Controller" Campaign for a targeted social media-based campaign.

Information about the DSS Model analysis approach to measure unit costs, water savings, and market penetrations can be found in Appendix D. Actual measure inputs used in the DSS Model to evaluate the water conservation measures selected by the City can be found in individual measure screenshots in Appendix E.

3.3 Conservation Measures Analysis

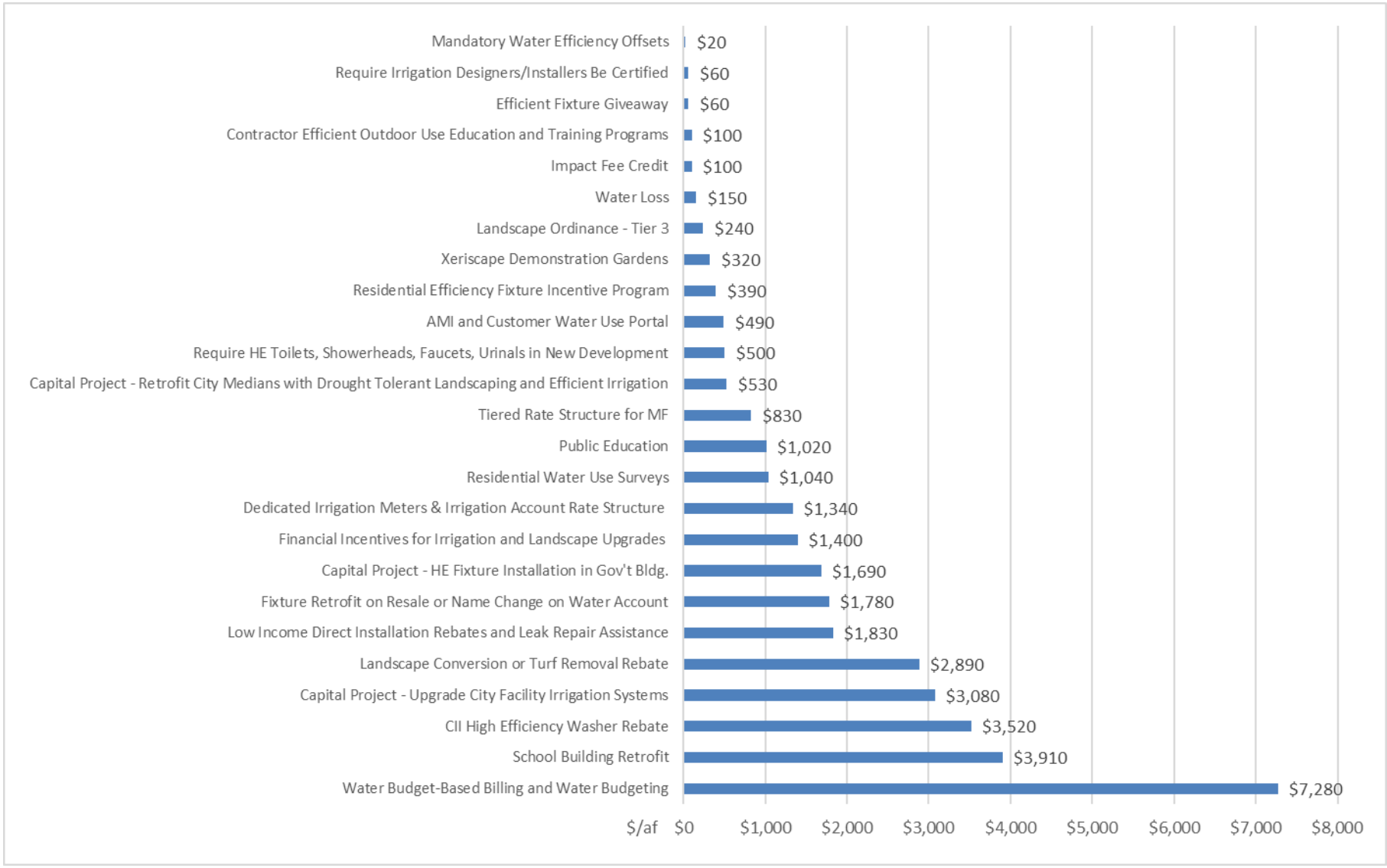
MWM conducted an economic evaluation of each selected water conservation measure using the DSS Model. Appendix F presents detailed results regarding how much water each measure will save through 2040, how much each measure will cost, and the cost of water saved per unit volume if the measure were to be implemented on a stand-alone basis (i.e., without interaction or overlap from other measures that might address the same end use[s]). Dollar savings from reduced water demand was quantified annually and based on avoided costs provided by the City.

While each measure was analyzed independently, it is important to note that few measures operate independently. For example, the AMI and Customer Water Use Portal measure may lead to a Landscape Conversion or Turf Removal Rebate, and Efficiency Fixture Incentive Program measures go hand-in-hand with Residential Water Use Surveys and Public Education.

It should be noted that the water savings from Public Education are not double counted with other conservation measures. As a result, the costs appear significantly higher for Public Education than for other measures due to the minimal water savings estimated for the high staff time investment. However, other measures certainly would be less effective or possibly infeasible without an active public outreach program since customers would be less aware of conservation measures and participation would likely plummet.

Figure 3-2 presents a comparison of each measure's cost of water saved per unit volume.

Figure 3-2. Conservation Program Cost of Savings per Unit Volume



Costs are rounded to the nearest $10.

4 CONSERVATION PROGRAM EVALUATION

This section provides a summary of which measures were included in each of the three conservation programs as well as which program the City selected to implement. The three programs were designed to illustrate a range of various program measure combinations and resulting water savings. The following key items were taken into consideration during measure selection for Programs A, B and C:

- Existing conservation measures
- Capital improvement measures
- New and innovative measures
- Measure equitability among customer categories
- Customer demographics

In addition, this section identifies and prioritizes the conservation programs and projects by cost-effectiveness and quantifiable water savings.

4.1 Measure Selection for Conservation Program Alternatives

MWM developed an economic analysis to show the true cost of conducting conservation. The City's existing conservation program was evaluated, then two additional, increasingly aggressive programs were developed for the City to consider.

Using the data gathered, MWM created a list of all potential program concepts that were appropriate for the City's service area. Factors for determining which measures should be in each program included budgeting, feasibility to implement the program, and the time at which each measure would need to be introduced to promote conservation efforts. Programs also needed to address water conservation across all relevant customer categories.

These program scenarios were not intended to be rigid but rather to demonstrate the range in savings that could be generated if selected measures were run at the same time. When programs were analyzed, any overlap in water savings (and benefits) from individual measures was considered to provide a total combined water savings (and benefits). Each program is described below:

- **Program A: Current Measures.** Current conservation program with no changes; includes 11 measures.
- **Program B: Recommended Measures.** In addition to existing efforts, includes more customer-centric, extended programs in indoor and outdoor efficiency as well as commercial efficiency, capital improvement, and regulatory measures; includes 18 measures. This is the program that was selected by the City for implementation.
- **Program C: All Modeled Measures.** In addition to all those above, includes expanded indoor residential efficiency requirements, including tiered rate structure for MF customers and water budget-based billing; includes all measures modeled in this effort for a total of 25 measures.

Figure 4-1 presents the City's conservation measure program scenarios, indicating which measures were selected and modeled within each program. Each program builds on the program before it, so the measures included in Program B include all measures listed in Program A and B, and Program C includes all measures listed in Program A, B, and C.

Figure 4-1. Selected Conservation Program Measures

4.2 Conservation Program Analysis

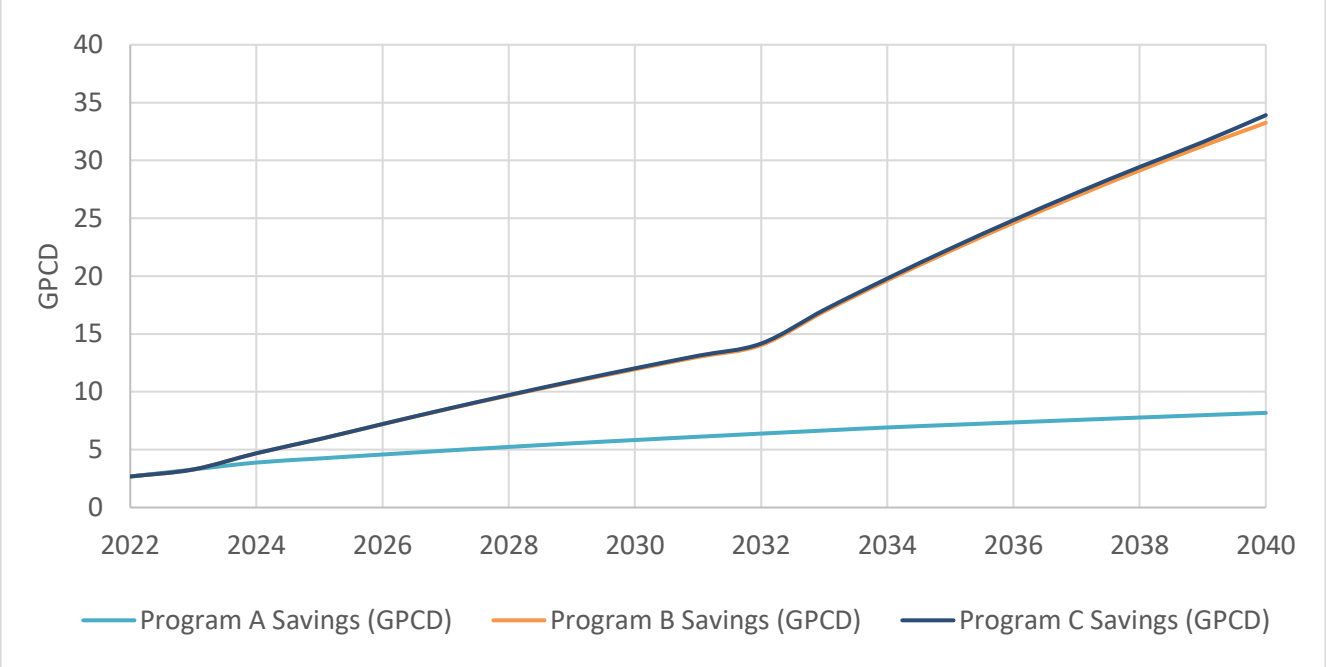
Table 4-1 shows the benefit-cost ratios for conservation Programs A, B and C. Each program's present value of water savings and utility costs as well as cost of water saved can be found in Appendix F.

Table 4-1. Conservation Program Benefit-Cost Ratios

Conservation Program	Water Utility Benefit-Cost Ratio
Program A with Plumbing Code	1.84
Program B with Plumbing Code	3.43
Program C with Plumbing Code	3.09

Figure 4-2 shows the per capita water savings for Programs A, B and C.

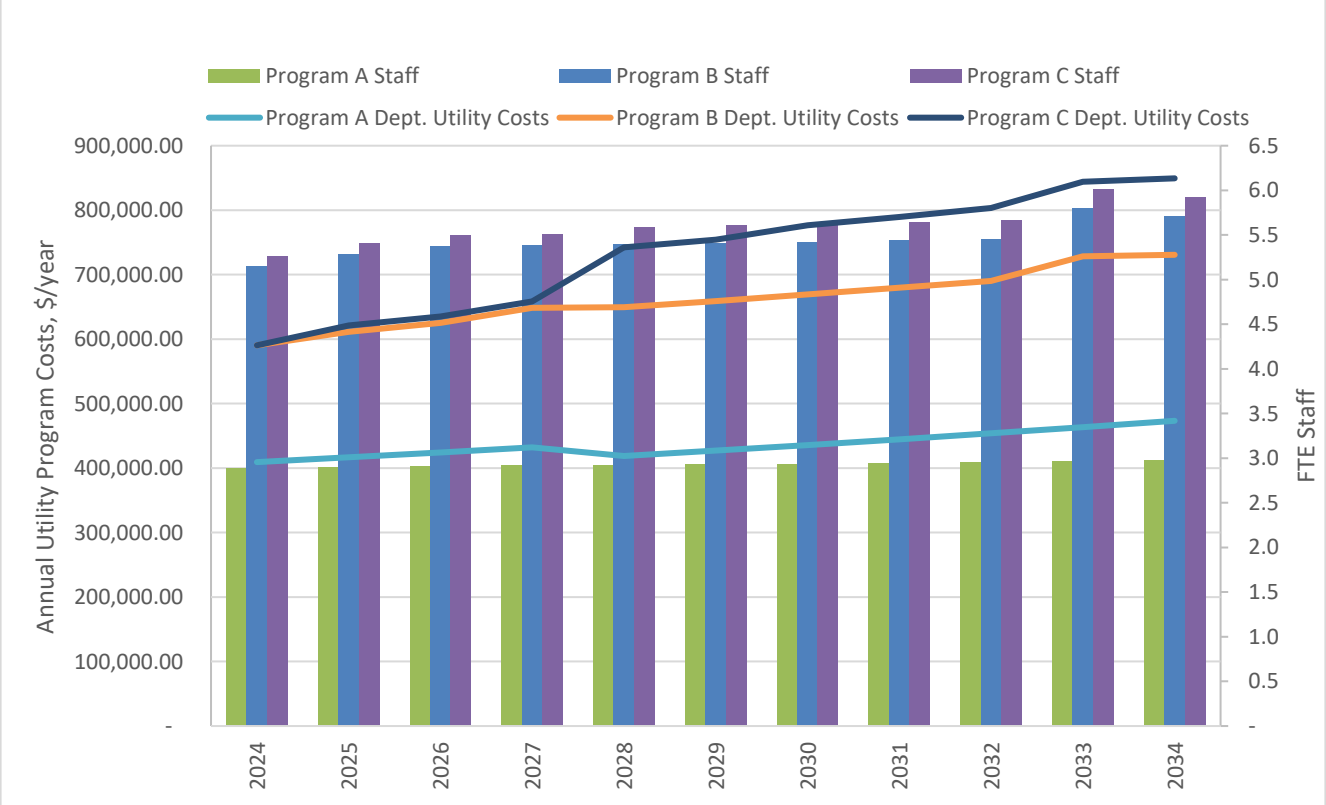
Figure 4-2. Conservation Program Per Capita Water Savings



All line types shown in the legend are presented in the graph. However, Program B and Program C demand scenarios are close in value and therefore may be somewhat indistinguishable in the figure.

Figure 4-3 shows estimated conservation program utility costs and staffing for Programs A, B, and C.

Figure 4-3. Estimated Conservation Program Utility Costs and Staffing



Staffing levels in Figure 4-3 include existing conservation program staff, however, it is important to note that these numbers have not been weight averaged or stepped based on salary, nor do they represent any additional duties expected of staff. For example, these hours may not accurately reflect the total amount of time dedicated to providing unrelated customer service, employee break periods, processing paperwork or addressing other programmatic or utility needs.

Tables 4-2 and 4-3 show the water system demands for the City of Bozeman. Demand is shown in 5-year increments in acre-feet in Table 4-2 and GPCD in Table 4-3. Table 4-2 and Figure 4-4 include demand with and without plumbing code as well as projected demand with plumbing codes and three active conservation program scenarios; Figure 4-4 also includes historical demand.

Table 4-2. City of Bozeman Potable Water System Demands for Years 2025–2040 in AFY

AFY	2025	2030	2035	2040
Baseline Demands	8,070	9,530	11,240	13,250
Plumbing Code Savings	140	320	510	730
Demands with Plumbing Code Savings	7,930	9,210	10,730	12,520
Conservation Program A Savings	300	470	680	910
Demands with Plumbing Code and Conservation Program A Savings	7,630	8,740	10,050	11,610
Conservation Program B Savings	420	970	2,120	3,700
Demands with Plumbing Code and Conservation Program B Savings	7,510	8,240	8,610	8,820
Conservation Program C Savings	420	980	2,130	3,780
Demands with Plumbing Code and Conservation Program C Savings	7,510	8,230	8,600	8,740

All numbers in the above table are rounded to the nearest 10 AFY.

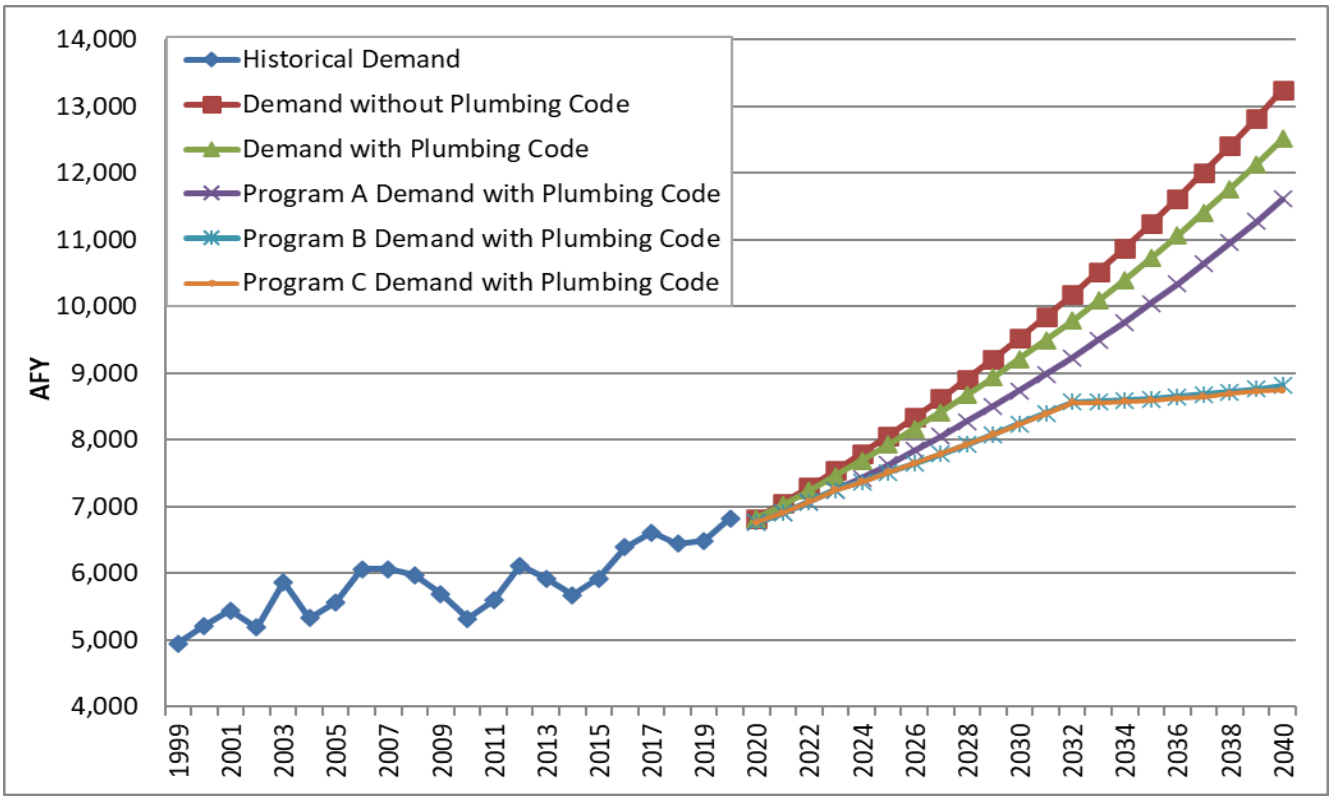
Table 4-3. City of Bozeman Potable Water System Demands for Years 2025–2040 in GPCD

GPCD	2025	2030	2035	2040
Baseline Demands	116	117	118	119
Plumbing Code Savings	2	4	5	7
Demands with Plumbing Code Savings	114	113	113	112
Conservation Program A Savings	4	6	7	8
Demands with Plumbing Code and Conservation Program A Savings	109	107	105	104
Conservation Program B Savings	6	12	22	33
Demands with Plumbing Code and Conservation Program B Savings	108	101	90	79
Conservation Program C Savings	6	12	22	34

Demands with Plumbing Code and Conservation Program C Savings	108	101	90	79

Figure 4-4 presents historical and projected water demand in AFY given multiple scenarios. Plumbing code elements include current local and federal plumbing code standards for retrofits of items such as toilets, urinals, showerheads, faucets, and clothes washers.

Figure 4-4. City of Bozeman Historical and Projected Demand



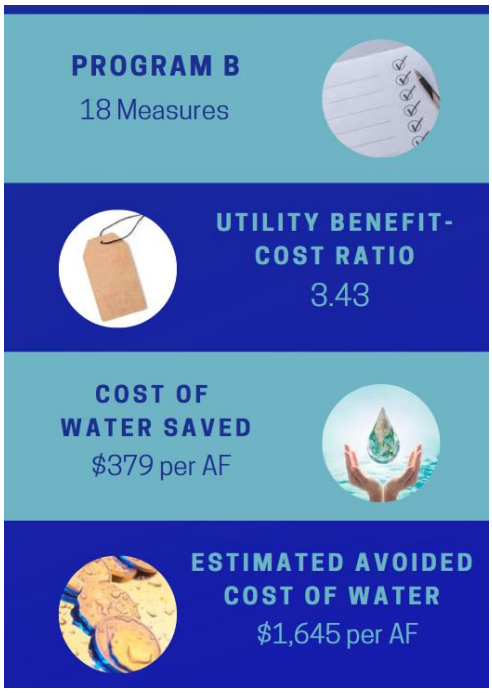
All line types shown in the legend are presented in the graph. However, Program B and Program C demand scenarios are close in value and therefore may be somewhat indistinguishable in the figure.

4.3 Recommended Program

The City has been refining its water use efficiency program measures since 2015. Seeing the need for more up-to-date and expansive measures to meet further water use reductions, the City has elected to implement Program B (Figure 4-5) as the most forward-thinking, comprehensive option, which includes 18 of the measures modeled in this planning effort and represents a thoroughly robust program with the highest benefit-cost ratio.

Measures that have been analyzed and included in the Plan are more likely to be implemented as well as deemed eligible for funding and outside partnerships. Program B provides a full range of measures, builds goodwill with partners, and is equitable by providing benefits for all categories of City customers.

Figure 4-5. Selected Program Details



5 WATER CONSERVATION IMPLEMENTATION PLAN AND SCHEDULE

This section presents an overview of the conservation planning options for the service area including data monitoring strategies, implementation recommendations, scheduling, and staffing needs.

5.1 Monitoring Progress

Each year the progress made toward meeting the Plan's targeted water savings will be analyzed. It is imperative to track activities and water demand for this analysis.

The City tracks rebate and incentive program information in its GIS Rebate Viewer application and Microsoft Excel, which includes but is not limited to capturing the following information:

- Customer information such as name, address, account number, water customer class
- Rebate product information such as type (including make and model), quantity, unit water savings
- Cost information such as rebate amount
- Number and type of rebates or other incentives issued (including water savings details for rebates such as efficiency level of clothes washers installed through incentive program)
- Number of turf removal rebates including square footage of turf removed.

The City also tracks and evaluates estimated water savings achieved through its sprinkler system assessment program and number of people reached through outreach events and presentations. As the City continues to implement new Water Use Efficiency (WUE) program measures, it is recommended to continue utilizing a tracking database (Excel spreadsheet) to understand program effectiveness and support data-driven decision making.

For future measures, such as those in Program B, recommendations for tracking and monitoring are as follows:

- Prepare an annual performance plan in concert with the budget planning process.
- Set up a method to store and manage new measure participation, cost, and compliance, especially for measures that relate to code changes (landscape ordinance) and impact fees (impact fee and mandatory offsets) to gauge successes and identify areas that need improvement.
- Review plan goals in the DSS Model annually and update measure participation or other elements that are refined through experience.
- Track water use to ensure the plan is on target to meet water use reduction goals. Use input from City staff and the annual work planning process as the forum to amend the plan, budget, staffing, contracting, implementation timing, etc. to stay on schedule.
- Work with appropriate City departments to ensure enforcement is occurring with the Landscape Ordinance – Tier 3 measure, Impact Fee Credit measure, Mandatory Water Efficiency Offsets measure, and the Require Irrigation Designers/Installers be Certified measure.
- Develop outreach and marketing plans as part of each measure's implementation plan. Identify measure and general program outreach techniques that engage customers (e.g., use actual customer testimonials in outreach materials and presentations).

5.2 Track and Update for New Codes and Emerging Technologies

It can be challenging to track the changes in the consumer marketplace for the vast array of water-using appliances and plumbing fixtures in both the residential and commercial sectors. The following are some options for tracking the latest in national standards and building codes as well as technologies and emerging trends in customer preferences:

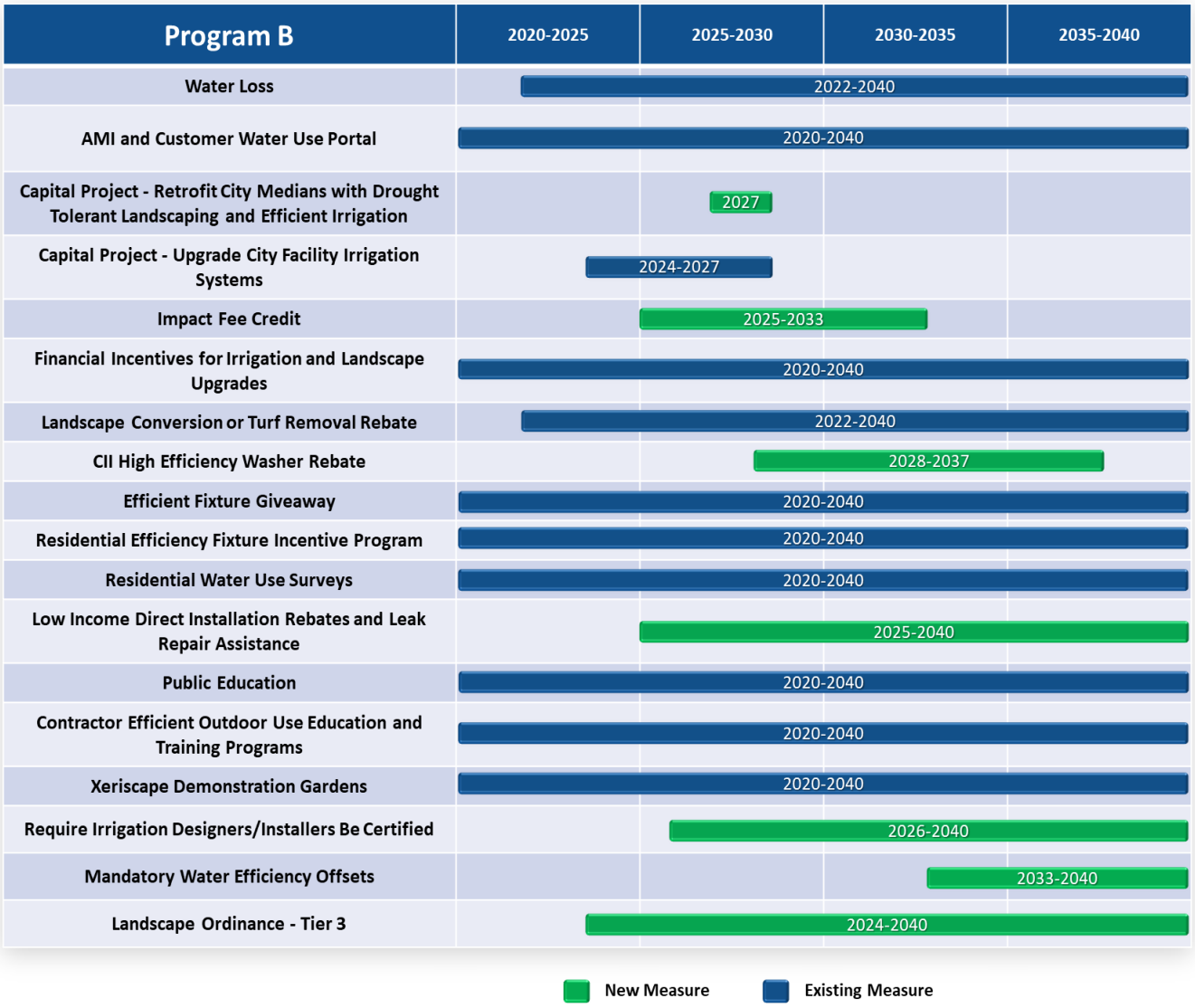
- Have staff member(s) voluntarily participate on the AWWA Water Conservation Division's committees with attendance at the Annual Conference Committee meetings and conference calls, in particular the Water Efficiency Programs and Technology Committee.
- Monitor the Alliance for Water Efficiency (AWE) for updates or changes to National Standards and Codes as well as opportunities to comment on future national changes to codes and regulations. Frequently, AWE has performance testing results posted on its websites that provide particularly useful information to consumers.
- Continue being a WaterSense® Partner. Track the U.S. Environmental Protection Agency (EPA) WaterSense® posts on new technologies and updated equipment lists.
- Monitor performance information that may also be available through Consumer Reports or Consortium for Energy Efficiency (http://www.cee1.org).
- Attend the WaterSmart Innovations Conference (https://www.watersmartinnovations.com/) and other water efficiency-related conferences for exposure to the vendors participating in the exhibition and to gather information on emerging trends in water conservation programs.
- Leverage the City process for adopting new building codes and regulations - especially building codes, to help implement proactive changes in future development in the City's service area.
- Maintain and use a network of 10-20 key contacts at progressive utilities to inquire about new technologies (e.g., through known contacts or new contacts made at conferences).
- Host events with other partner utilities and applicable stakeholders on related water loss control programs or conservation measures.
- Conduct surveys every three years with other water utilities to gain insight on programs and product testing.

Emerging products may be worthy of pilot programs and could be attractive for grant funding projects through agencies like the U.S. EPA or U.S. Bureau of Reclamation. However, use caution when adopting new technologies that have yet to be adequately researched or evaluated.

5.3 Proposed Implementation Schedule

Figure 5-1 presents an implementation schedule for Program B measures through 2040. A detailed description of each of these 18 measures can be found in Table 3-4.

Figure 5-1. Conservation Measures Implementation Schedule (2020–2040)



5.4 Five-Year Implementation Recommendations

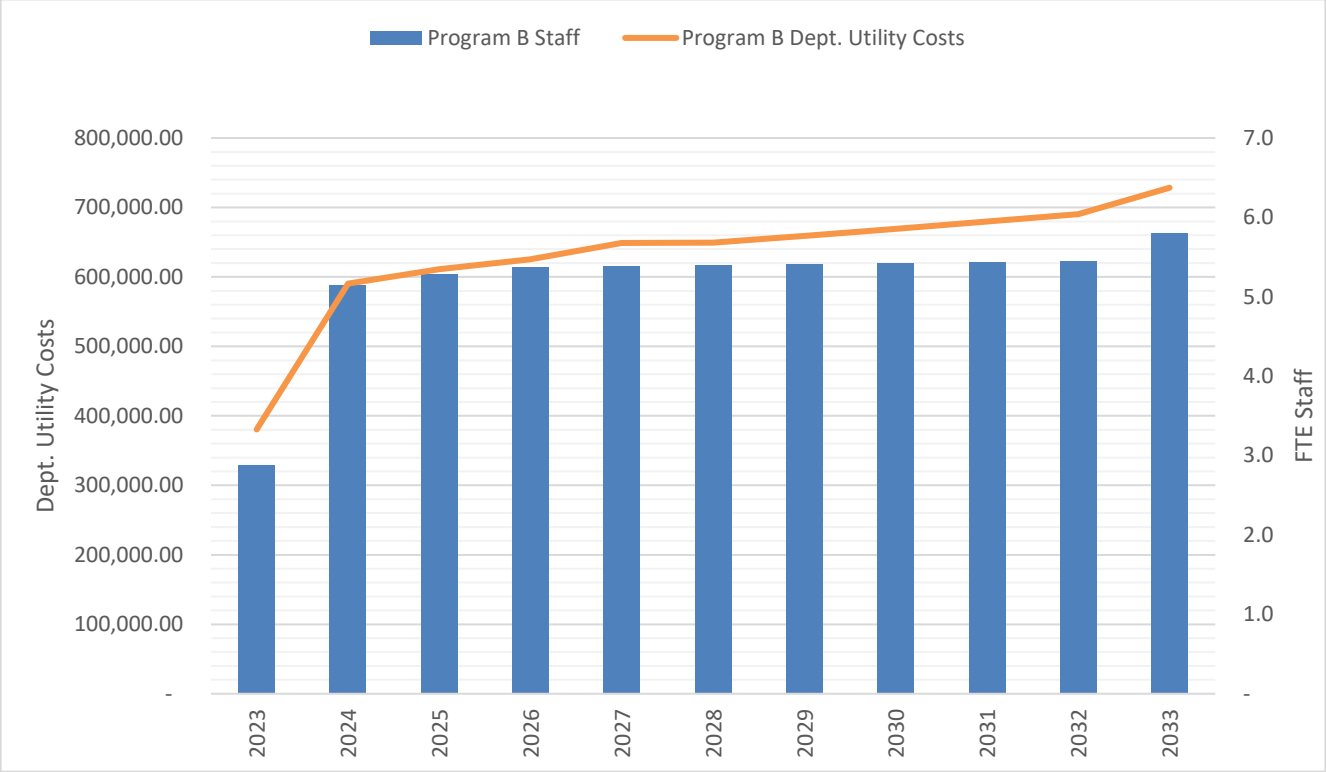
Recommendations to assist with implementation over the next five years:

- Track any upcoming state or federal regulations regarding residential, CII, landscape, and water loss management.
- Consider launching pilot studies for new measures.
- Consider soliciting and tracking community input and feedback via an online or phone survey or at outreach and education events.
- Consider pursuing a statistically valid water conservation awareness study. The last study was completed in 2014 at the inception of the Water Conservation Program. It would benefit the City to reassess the community's awareness in order to inform program development and ensure the implementation schedule included in the Plan aligns with customer understanding and awareness of local water conservation efforts.
- Prioritize measures that contribute the most to meeting the per capita water use targets and are relatively easy to operate with limited staff.
- Consider pursuing a detailed analysis of mandatory water use efficiency offsets (scheduled for implementation in 2033), which yields the greatest water savings of all measures evaluated, to better understand the wide array of program measure costs, determine a reasonable lifetime for the measure (saturation), and ensure a smooth program implementation.
- Consider working with the largest 100 water using customers to reduce water use.
- Develop an annual work plan for each plan year as soon as the budget is adopted (or in concert with the budget planning process).
- Form partnerships and apply for grants where appropriate.
- Outsource to gain enough staff support to administer the expanded programs (as needed).
- Develop analytical tools to track water use by customer class and overall per capita water use, adjusted for the weather and external factors as discussed in section 2.3.1.
- Consider using AMI consumption data to monitor water usage and identify instances of non-compliance with regulatory measures.
- Use the analytical tools annually to help decide on priorities for the following plan year.
- Set up a database to store and manage measure participation, cost, and other data to gauge successes and areas that need improvement/added attention.
- Annually update the plan to ensure the City is on track to meet conservation goals. This includes updating actual measure participation, projected water savings, and expected per capita water use reductions.

5.5 Staffing Needs

As part of the analysis, staffing needs for each of the conservation programs was considered. For the recommended program to be implemented, the City of Bozeman will need to increase their full-time equivalent (FTE) staff from 3 to 5 in 2024, and gradually increase to 5.28 FTEs by 2025, and 5.8 FTEs by 2033. It is important to note that these numbers have not been weight averaged or stepped based on salary, nor do they represent any additional duties expected of staff. For example, these hours may not accurately reflect the total amount of time dedicated to providing unrelated customer service.

Figure 5-2. Estimated Conservation Program Utility Costs and Staffing for the Recommend Program



Funding Opportunities, Partnerships, and Stakeholder Group Participation

The City has strong partnerships with other regional public agencies, neighboring utilities, and regional stakeholder groups that provide program support, such as support for outreach, building customer awareness, and maximizing participation. The City will continue to pursue future state and federal grants as appropriate, as well as maintain these existing partnerships.

Each measure in the recommended water use efficiency program has both common and unique funding sources and partnership opportunities, as well as potential implementation obstacles including legal barriers. In some cases, these matters can be identified in advance, but some cannot.

Partnership opportunities and funding sources may include the following:

- City water use efficiency and public outreach budgets
- Existing and new regional, county, and statewide partnerships such as waste management authorities and Green Business Certification organizations
- State and federal grants
- Local schools/university students or student organizations
- Local community organizations with an interest in water efficiency such as resource conscious gardening groups/advocates and green jobs advocates
- Partnerships with energy and sewer utilities

6 NEXT STEPS AND CONCLUSIONS

Current conditions have encouraged the City to choose Program B for implementation. However, water use is very dynamic and responds to changes in population, economy, weather, climate, efficiency of devices, and types of industry. As the City's community evolves, water use and weather pattern changes may necessitate adjustments to measure implementation targets and schedules. This may include, expanding upon or scaling back various program components and measures to increase efficiency, improve benefit-cost ratios, adopt better technology or methods, or meet budget and staffing restrictions. Whether additional measures become necessary would be dependent on several factors including potential future drought conditions, compliance with the annual aggregate water use objectives as provided by the City, the City's ability to support new and more innovative programs, community growth, and the City's ability to develop additional water supplies.

With individual measures clearly defined and water saving objectives and customer target goals measurable, the City has quantifiable performance goals to track on both an individual measure and overall program level.

6.1 Next Steps

Next steps in Plan implementation include the following:

- Engage in the processes to update the Montana Drought Response Plan and any other water efficiency or water loss legislation. The City should consider reviewing state documents, submit written comments as needed, and participate in public workshops and stakeholder groups.
- Evaluate the effectiveness of the permanent outdoor water use restrictions, which became effective on June 16, 2022, and consider making adjustments as needed.
- Continue to monitor local water supplies and engage in drought monitoring, including updating the 2022 Drought Management Plan as needed.
- Review program staff needs and hire accordingly to adequately support program needs.

Suggestions for Future DSS Model Updates

With the level of investment in both capital projects that may be deferred due to this program and investments in the program itself, City staff should be ready with an answer to the question: "How much water has been saved and at what cost?" In addition, due to the need for ongoing water conservation efforts to maintain and attain more water savings, the City will need to track program water savings, costs, and benefits (i.e., cost savings).

The following two types of updates are envisioned for the DSS Model:

- **Annual or more frequent model updates for monitoring costs and water savings** – The conservation measure worksheets can be used to track actual activities and compare them to the planned activities defined as part of the model development for this program. It is recommended that this update be done in conjunction with the development of an annual work plan and budget. At minimum, it should happen every 3-5 years, but more frequent updates are recommended as the City expands and improves upon its data.
- **Recalibration of the model** – The DSS Model has a base "year" of 2020. Depending on water demand and account growth rates, it is advisable to update the base year as soon as a complete year of comprehensive data is available, and on a 5-year basis thereafter. This update requires reviewing historical demand trends, future population and demand forecasts, fixture models calibration, new or updated conservation measures, and cost and water savings assumptions.

Specific triggers for updates may include:

- Significant changes to cost associated with water production (more than 10-20% energy or chemical cost increase or decrease would modify the "savings worksheet" and change the benefit-cost ratios).

- Significant change in population or number of accounts for one of the customer categories (more than a 5% shift).
- Significant changes to water system balance (e.g., more than 10% change in water losses or other parameter in the Demands Section of the DSS Model).
- An updated valuation of the cost for developing additional water supplies, including infrastructure costs and the costs for purchasing additional water rights.
- New codes or regulations that affect natural replacement rates of fixtures.
- Alternatives for staffing versus outsource contracting or other changes to the cost of implementation of a conservation measure (change to conservation measure worksheet only).
- New technologies for conservation measures being considered (change or addition of new conservation measure worksheet).
- Any other change in conservation measures (i.e., updates to the measure worksheets can be changed or modified at any time without altering the water system balance worksheets or affecting fixture model calibration).

6.2 Conclusions

Following is a summary of the water conservation analysis findings:

- More than 65% of the City's service area water use is associated with residential water use. Consequently, residential conservation programs will produce the most savings. The remaining 35% of the City's service area water use is associated with commercial, industrial, government, Montana State University water use. In conjunction with plumbing codes, Program B (the Recommended Program) saves 33% of projected demand in 2040 when compared to demands in 2040 without plumbing codes or active conservation. From the utility standpoint, the average cost of water saved for Program B is $379/ AF, which is less than the avoided cost of water at $1,645/AF. Therefore, this program has the potential to reduce per capita water use in a cost-effective manner based on the implementation level of the plan.
- Conservation is the least expensive means of meeting future water supply needs for the area. The implementation of these conservation measures should reduce per capita water use and has the potential to defer the need for further infrastructure expansion. Water savings in the year 2040 are an estimated 4,435 AF/yr. While the conservation actions identified can have a significant cost, the costs are even higher to not participate in conservation and instead rely on engineering solutions to address increased demand. Furthermore, with climate change, long-term drought, and challenges associated with the delivery of imported water, without conservation, additional water supplies may not be available to meet future increases in demands.
- Through the DSS Model analysis, the City identified fixture costs, applicable customer classes, time period of implementation, measure lifespan, administrative costs, end uses, end-use savings per replacement, and a target number or percentage of accounts per program year.
- Creating expanded water conservation efforts appears to be a feasible and cost-effective means of:
    - Meeting City conservation/water use reduction targets
    - Managing existing water supplies in a more sustainable manner
    - Planning for sustainable future growth incorporating water efficiency
- Based on the analysis, the City has selected to implement Program B, with 18 measures, a utility benefit-cost ratio of 3.43 and a cost of water saved of $379/AF versus the estimated avoided cost of water of $1,645/AF.

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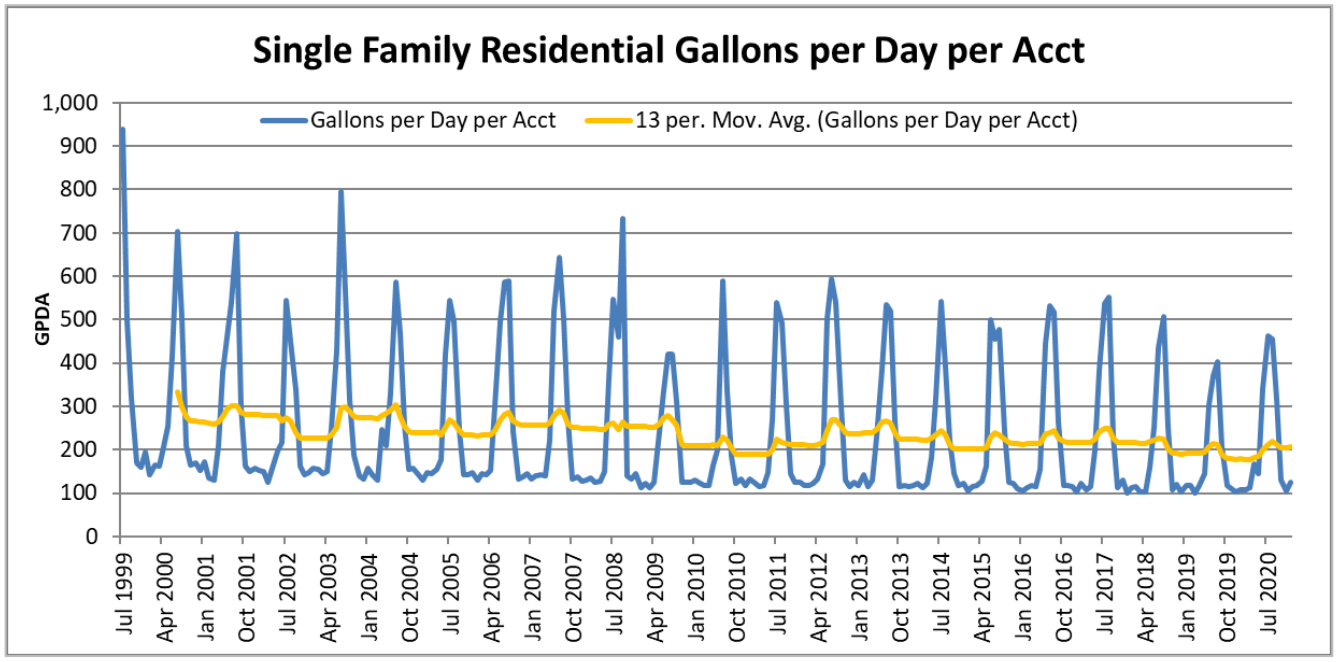
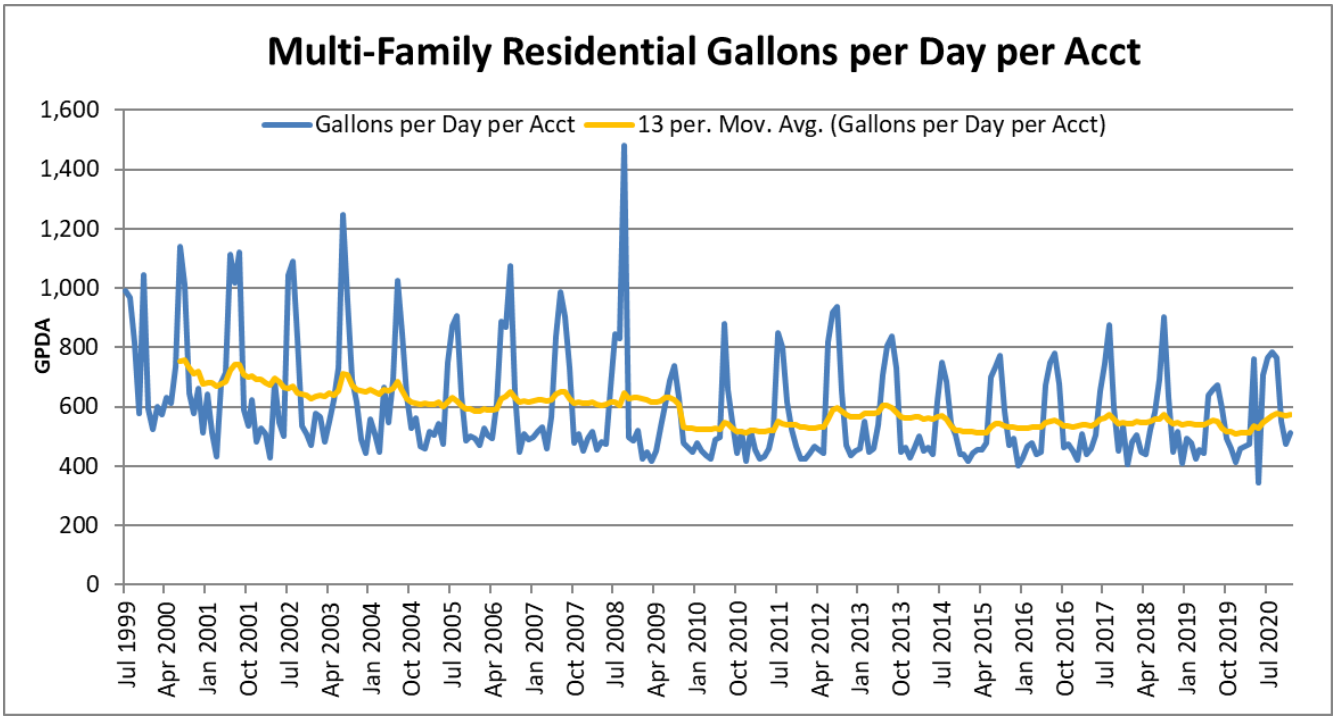
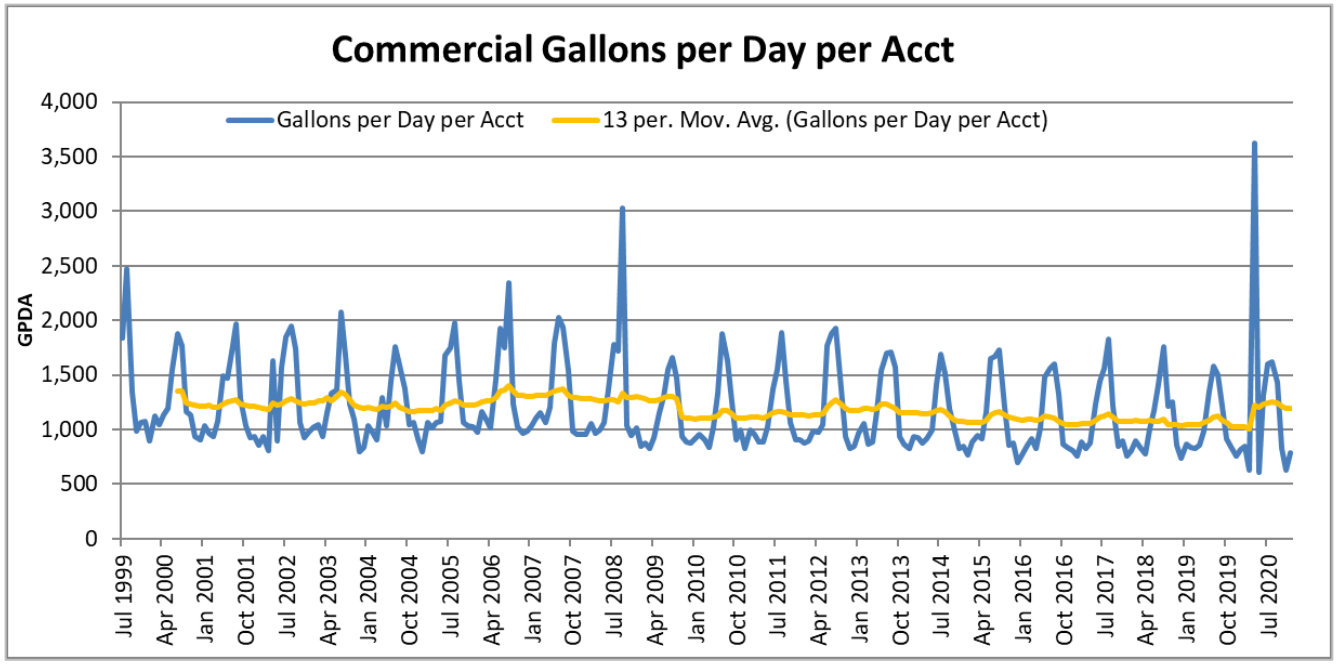
APPENDIX A – HISTORICAL MONTHLY WATER USE PER ACCOUNT TYPE






Commercial Gallons per Day per Acct
Gallons per Day per Acct
13 per. Mov. Avg. (Gallons per Day per Acct)
GPDA
4,000
3,500
3,000
2,500
2,000
1,500
1,000
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Jul 1999
Apr 2000
Jan 2001
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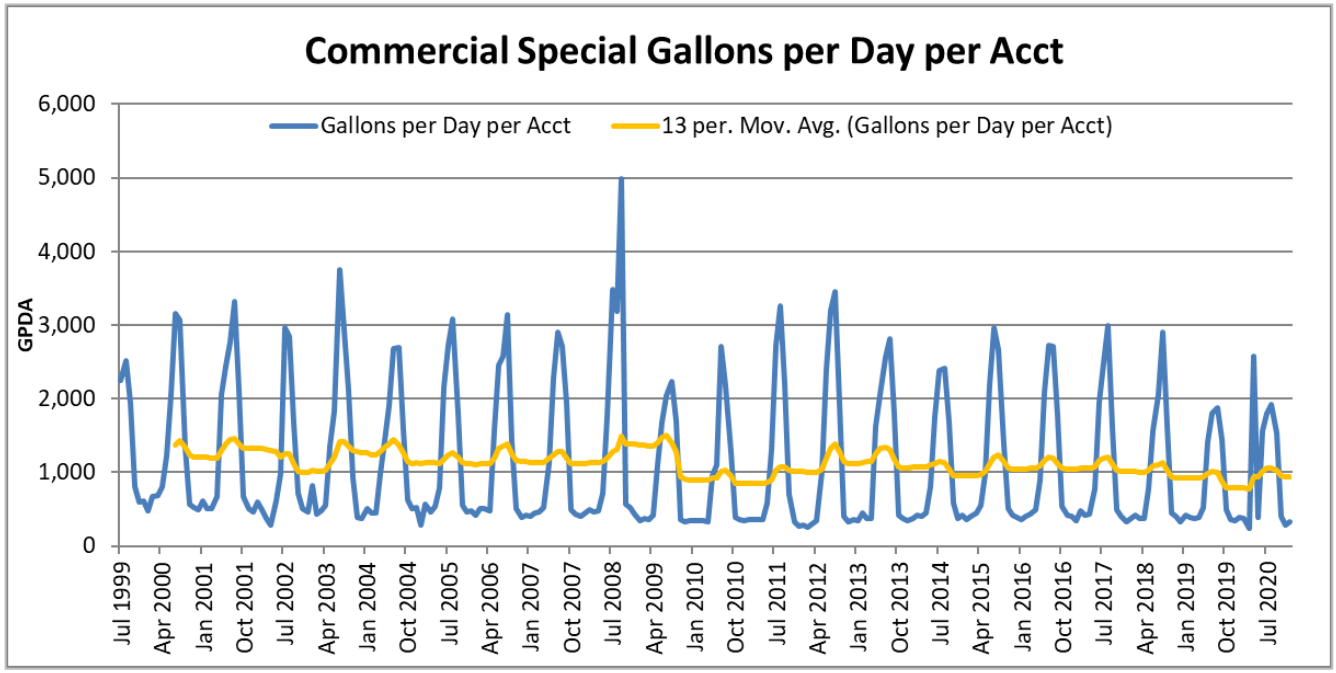
Commercial Special Gallons per Day per Acct
Gallons per Day per Acct
13 per. Mov. Avg. (Gallons per Day per Acct)
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4,000
3,000
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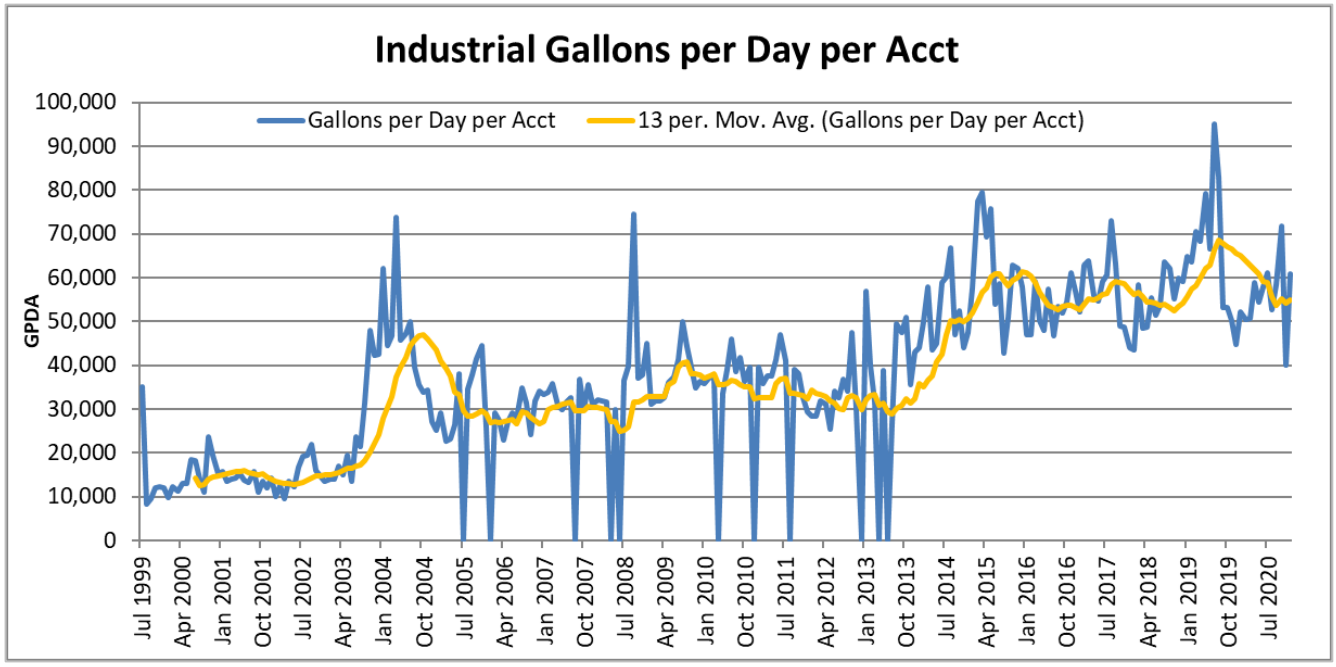
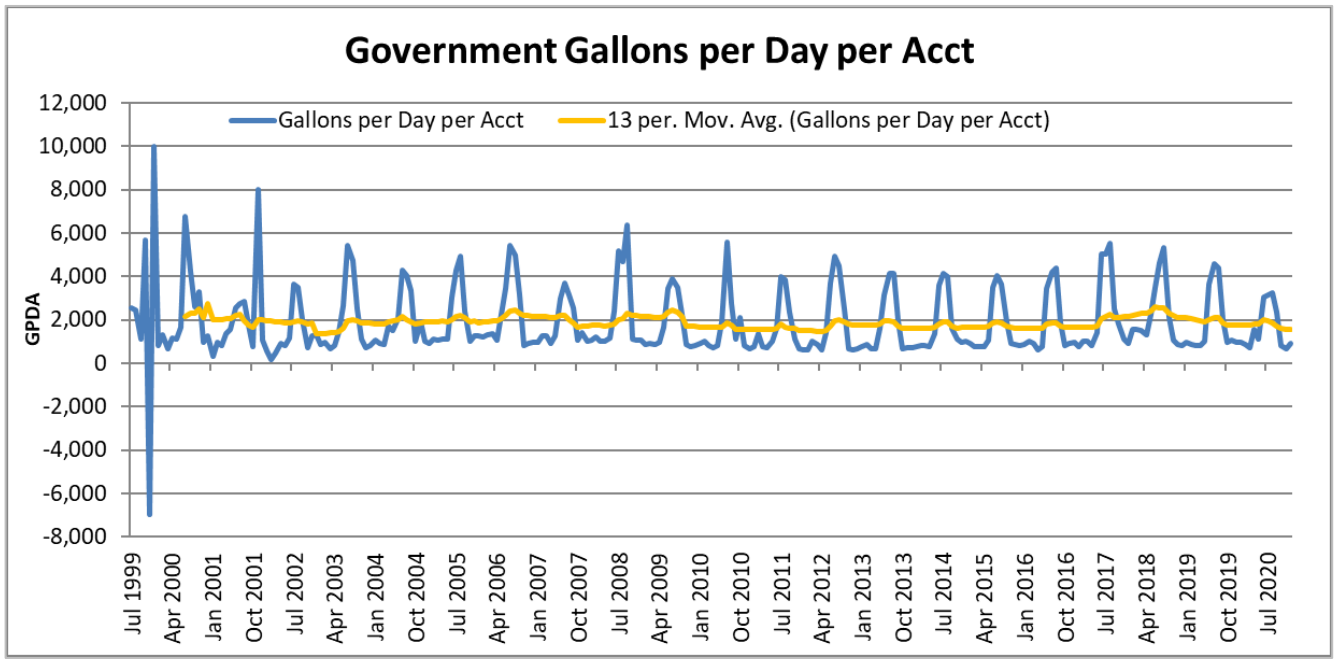
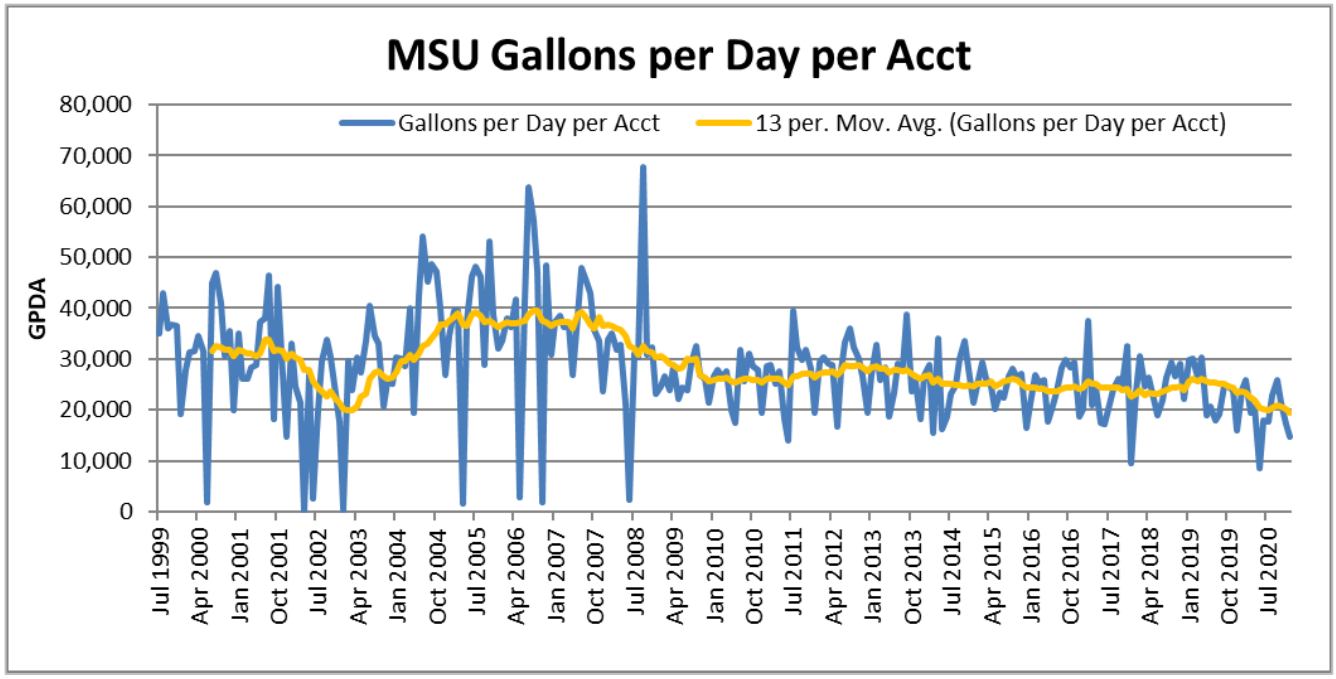


Zero values in the above graph are due to billing issues.



Negative values in the above graph are due to billing corrections.



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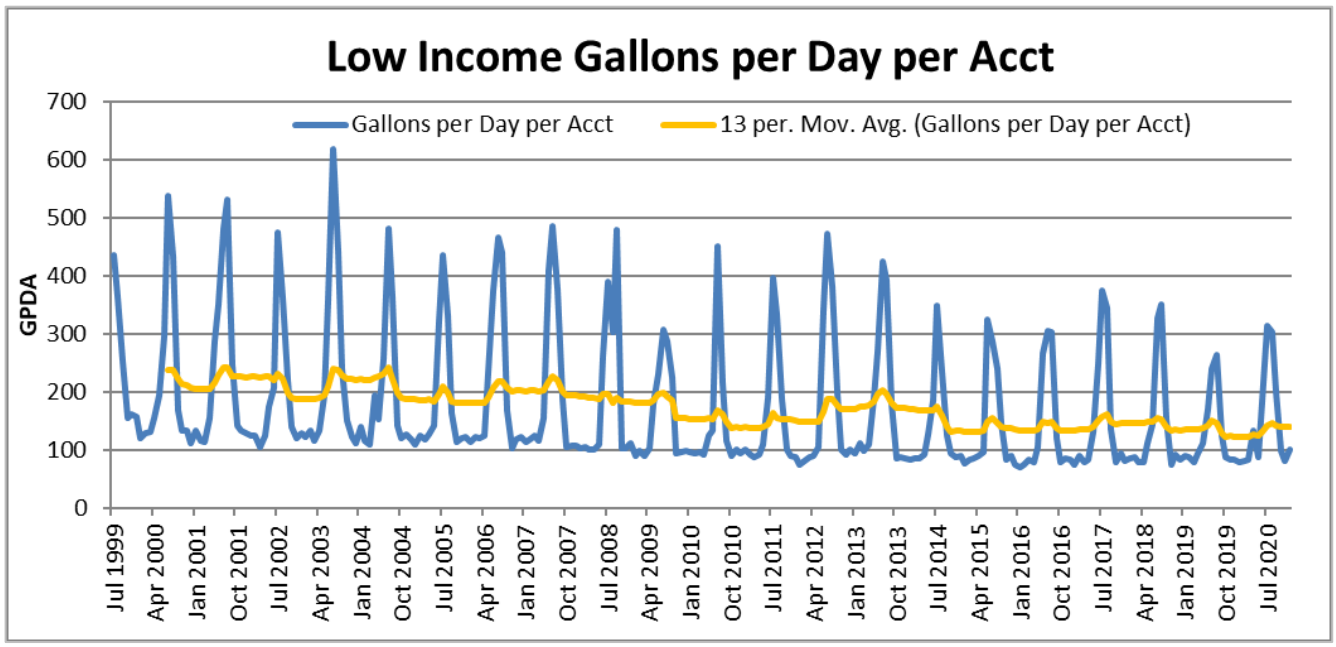


APPENDIX B – DSS MODEL OVERVIEW

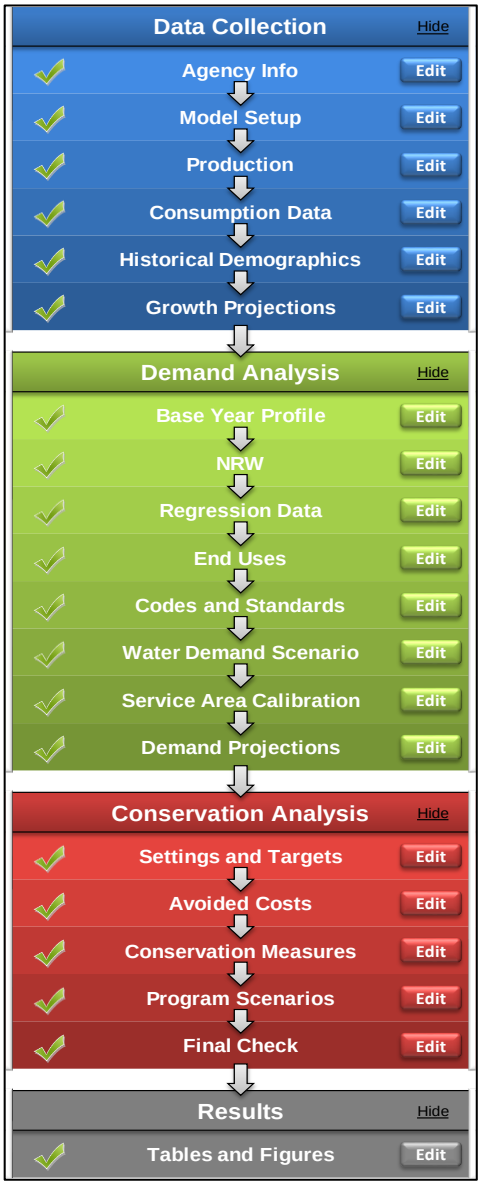


Figure B-1. DSS Model Main Page

DSS Model Overview: The Least Cost Planning Decision Support System Model (DSS Model) is used to prepare long-range, detailed demand projections. The purpose of the extra detail is to enable a more accurate assessment of the impact of water efficiency programs on demand and to provide a rigorous and defensible modeling approach necessary for projects subject to regulatory or environmental review.

Originally developed in 1999 and continuously updated, the DSS Model is an "end-use" model that breaks down total water production (water demand in the service area) to specific water end uses, such as plumbing fixtures and appliances. The model uses a bottom-up approach that allows for multiple criteria to be considered when estimating future demands, such as the effects of natural fixture replacement, plumbing codes, and conservation efforts. The DSS Model may also use a top-down approach with a utility-prepared water demand forecast.

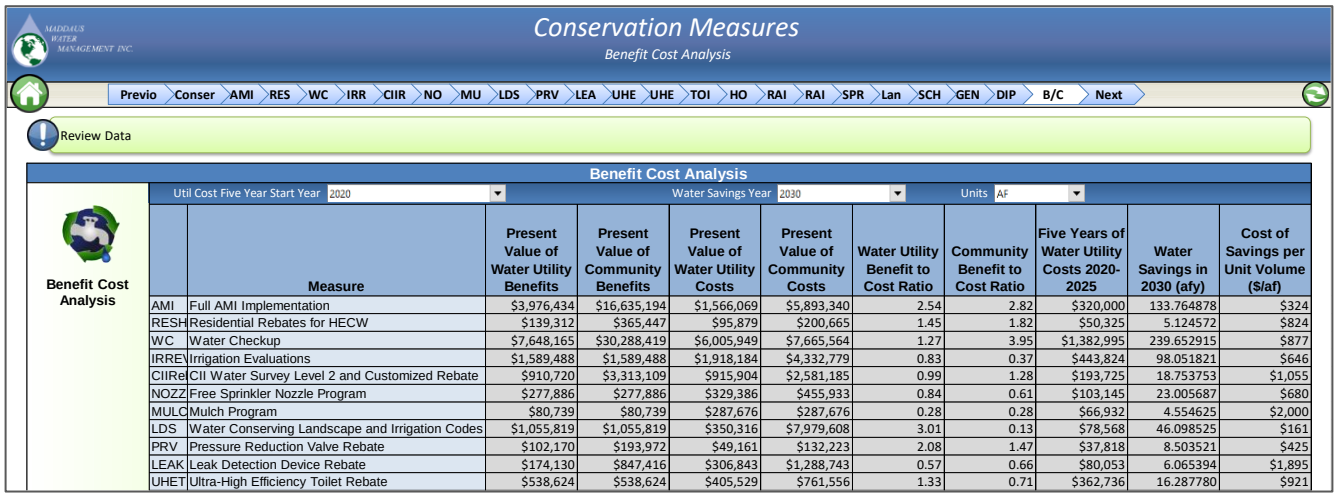
Demand Forecast Development and Model Calibration: To forecast urban water demands using the DSS Model, customer demand data is obtained from the water agency being modeled. Demand data is reconciled with available demographic data to characterize water usage for each customer category in terms of number of users per account and per capita water use. Data is further analyzed to approximate the split of indoor and outdoor water usage in each customer category. The indoor/outdoor water usage is further divided into typical end uses for each customer category. Published data on average per capita indoor water use and average per capita end use is combined with the number of water users to calibrate the volume of water allocated to specific end uses in each customer category. In other words, the DSS Model checks those social norms from end studies on water use behavior (e.g., flushes per person per day) are not exceeded or drop below reasonable use limits.

Passive Water Savings Calculations: The DSS Model is used to forecast service area water fixture use. Specific end-use type, average water use, and lifetime are compiled for each fixture. Additionally, state, and national plumbing codes and appliance standards are modeled by customer category. These fixtures and plumbing codes can be added to, edited, or deleted by the user. This process yields two demand forecasts, one with plumbing codes and one without plumbing codes.

Active Conservation Measure Analysis Using Benefit-Cost Analysis: The DSS Model evaluates active conservation measures using benefit-cost analysis with the present value of the cost of water saved ($/Million Gallons or $/Acre-Feet). Benefits are based on savings in water and wastewater facility operations and

maintenance and any deferred capital expenditures. The figures on the previous page illustrate the processes for forecasting conservation water savings, including the impacts of fixture replacement due to existing plumbing codes and standards.

Figure B-2. Sample Benefit-Cost Analysis Summary



Benefit Cost Analysis

Util Cost Five Year Start Year: 2020 | Water Savings Year: 2030 | Units: AF

Benefit Cost Analysis

	Measure	Present Value of Water Utility Benefits	Present Value of Community Benefits	Present Value of Water Utility Costs	Present Value of Community Costs	Water Utility Benefit to Cost Ratio	Community Benefit to Cost Ratio	Five Years of Water Utility Costs 2020-2025	Water Savings in 2030 (afy)	Cost of Savings per Unit Volume ($/af)
AMI	Full AMI Implementation	$3,976,434	$16,635,194	$1,566,069	$5,893,340	2.54	2.82	$320,000	133.764878	$324
RESH	Residential Rebates for HECW	$139,312	$365,447	$95,879	$200,665	1.45	1.82	$50,325	5.124572	$824
WC	Water Checkup	$7,648,165	$30,288,419	$6,005,949	$7,665,564	1.27	3.95	$1,382,995	239.652915	$877
IRRE	Irrigation Evaluations	$1,589,488	$1,589,488	$1,918,184	$4,332,779	0.83	0.37	$443,824	98.051821	$646
CIIRe	CII Water Survey Level 2 and Customized Rebate	$910,720	$3,313,109	$915,904	$2,581,185	0.99	1.28	$193,725	18.753753	$1,055
NOZZ	Free Sprinkler Nozzle Program	$277,886	$277,886	$329,386	$455,933	0.84	0.61	$103,145	23.005687	$680
MULC	Mulch Program	$80,739	$80,739	$287,676	$287,676	0.28	0.28	$66,932	4.554625	$2,000
LDS	Water Conserving Landscape and Irrigation Codes	$1,055,819	$1,055,819	$350,316	$7,979,608	3.01	0.13	$78,568	46.098525	$161
PRV	Pressure Reduction Valve Rebate	$102,170	$193,972	$49,161	$132,223	2.08	1.47	$37,818	8.503521	$425
LEAK	Leak Detection Device Rebate	$174,130	$847,416	$306,843	$1,288,743	0.57	0.66	$80,053	6.065394	$1,895
UHET	Ultra-High Efficiency Toilet Rebate	$538,624	$538,624	$405,529	$761,556	1.33	0.71	$362,736	16.287780	$921

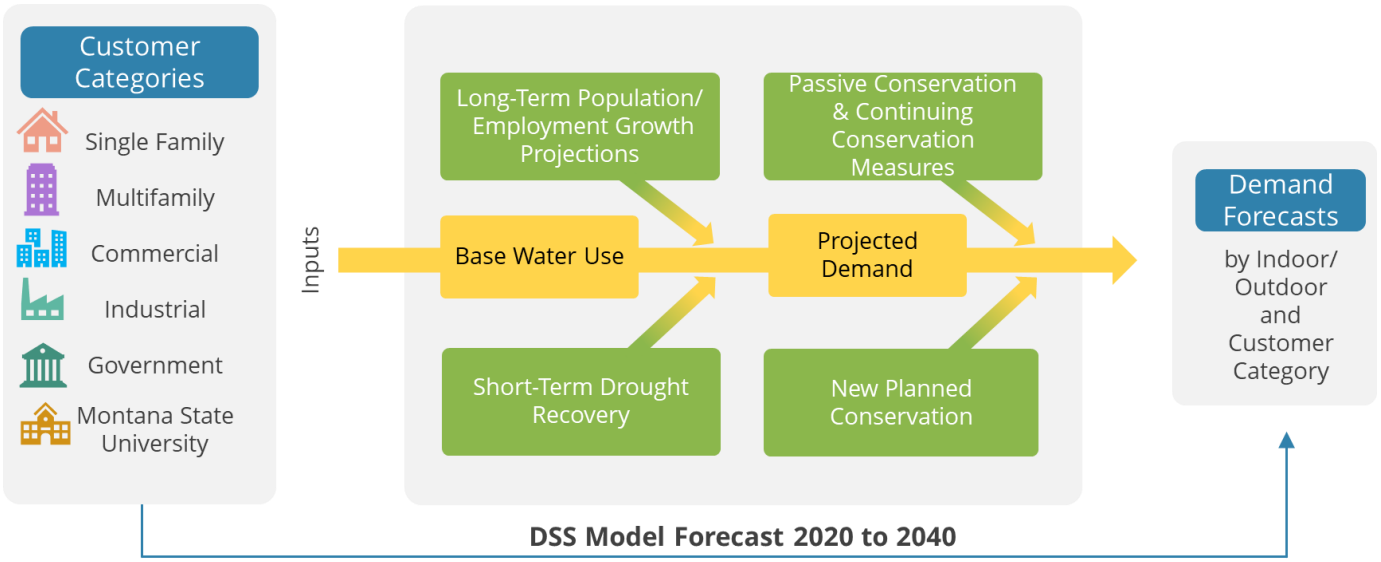
Model Use and Validation: The DSS Model has been used for over 20 years for practical applications of conservation planning in over 300 service areas representing 60 million people, including extensive efforts nationally and internationally in Australia, New Zealand, and Canada.

Figure B-3. DSS Model Analysis Locations in the U.S.

The DSS Model can use one of the following: 1) a statistical approach to forecast demands (e.g., an econometric model); 2) a forecasted increase in population and employment; 3) predicted future demands; or

4) a demand projection entered into the model from an outside source. For the City, baseline demand was developed based on an increase in residential population. The following figure presents the flow of information in the DSS Model Analysis.

Figure B-4. DSS Model Analysis Flow



APPENDIX C – PROJECTED WATER DEMANDS WITH AND WITHOUT PLUMBING CODE SAVINGS

This section presents baseline water demands with and without the plumbing code; details regarding the national and state plumbing codes; and key inputs and assumptions used in the DSS Model, which is used to prepare long-range, detailed demand projections. This rigorous modeling approach is especially important if the project will be subject to regulatory or environmental review.

C.1 Projected Baseline Demand

The assumptions having the most dramatic effect on future demands are: 1) the natural replacement rate of fixtures; 2) how residential or commercial future use is projected; and 3) the percent of estimated real water losses. As described in the previous section, baseline customer category water use was determined using 2017–2017 historical monthly water use, with the exception of industrial water use using 2018–2019 monthly water use due to data.

C.2 Estimated Plumbing Code Savings

The DSS Model forecasts service area water fixture use. In the codes and standards part of the DSS Model, specific fixture end-use type (point of use fixture or appliance), average water use, and lifetime are compiled. Additionally, state and national plumbing codes and appliance standards for toilets, urinals, showers, and clothes washers are modeled by customer category. This approach yields two distinct demand forecasts related to plumbing code savings: 1) with plumbing codes and 2) without plumbing codes. Plumbing code measures are independent of any conservation program and are based on customers following applicable local, state, and federal laws, building codes, and ordinances.

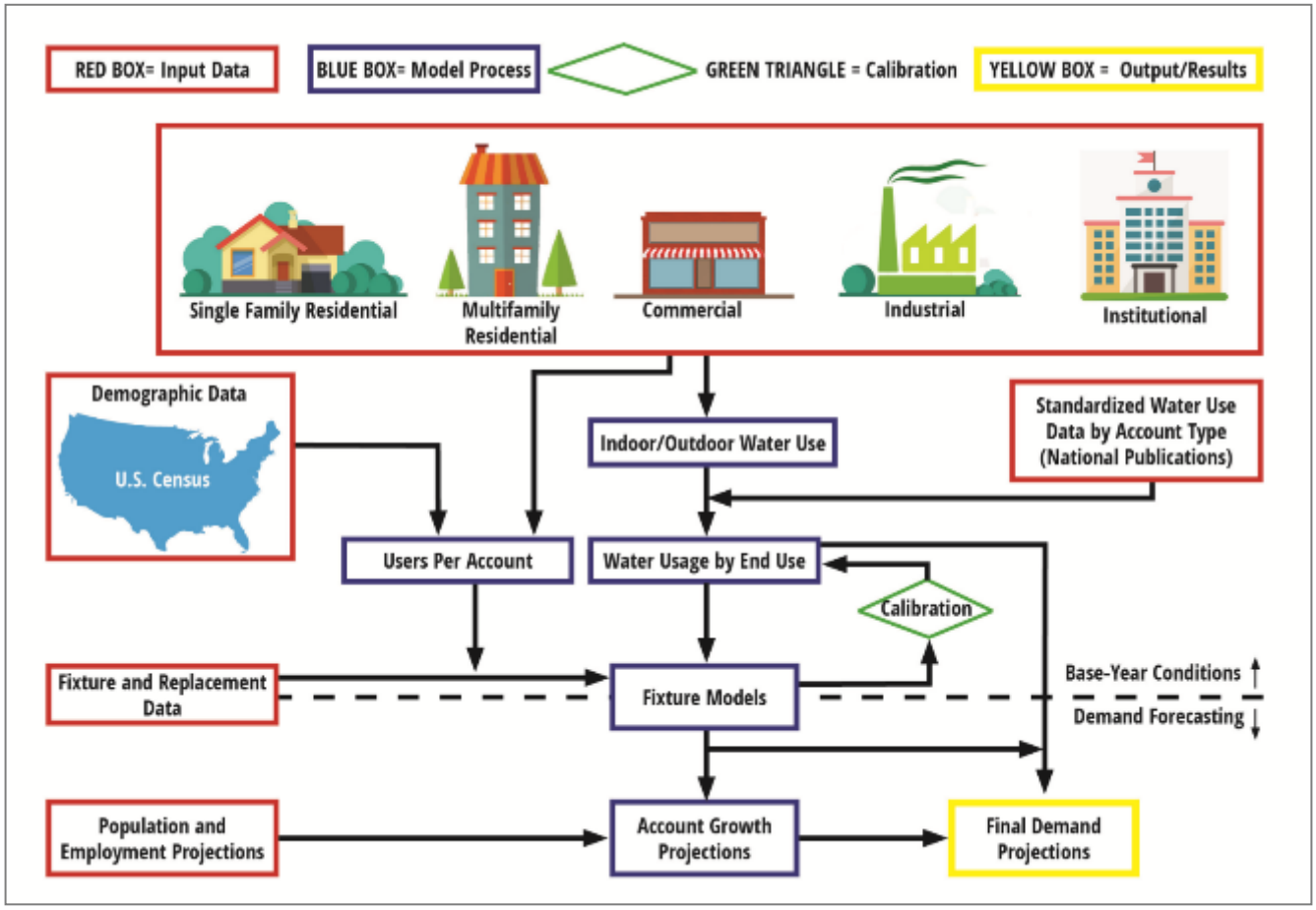
Plumbing code-related water savings are considered “passive” and reliable long-term savings and can be depended upon over time to help reduce overall system water demand. In contrast, water savings are considered “active” if a specific action unrelated to the implementation of codes and standards is taken by the utility to accomplish conservation measure savings (e.g., offering turf replacement rebates). The DSS Model incorporates the following items as a “code,” meaning that the savings are assumed to occur and therefore are “passive” savings:

- The Federal Energy Policy Act of 1992 (amended in 2005)
- 2021 Uniform Plumbing Code (UPC) (IAPMO)

The following figure conceptually describes how plumbing codes using “fixture models” are incorporated into the flow of information in the DSS Model.[10] The demand projections, including plumbing code savings, further assumes no active involvement by the water utility, and that the costs of purchasing and installing replacement equipment (and new equipment in new construction) are borne solely by the customers, occurring at no direct utility expense. The inverse of the fixture life is the natural replacement rate expressed as a percent (i.e., 10 years is a rate of 10% per year).

[10] Fixture models are used in the DSS Model to track individual plumbing devices and their water savings as they change and become more efficient over time.

Figure C-1. DSS Model Overview Used to Make Potable Water Demand Projections



The DSS Model makes water demand projections using a multi-level process.

Tables C-1 and C-2 show the water system demands for the City in acre-feet in 5-year increments over the 21-year modeling period (2020–2040). Figure C-2 illustrates demands in graphical format. Both the table and the figure include historical (baseline) demand as well as demand with and without plumbing code.

Table C-1. City of Bozeman Potable Water System Demands for Years 2025–2040 in AFY

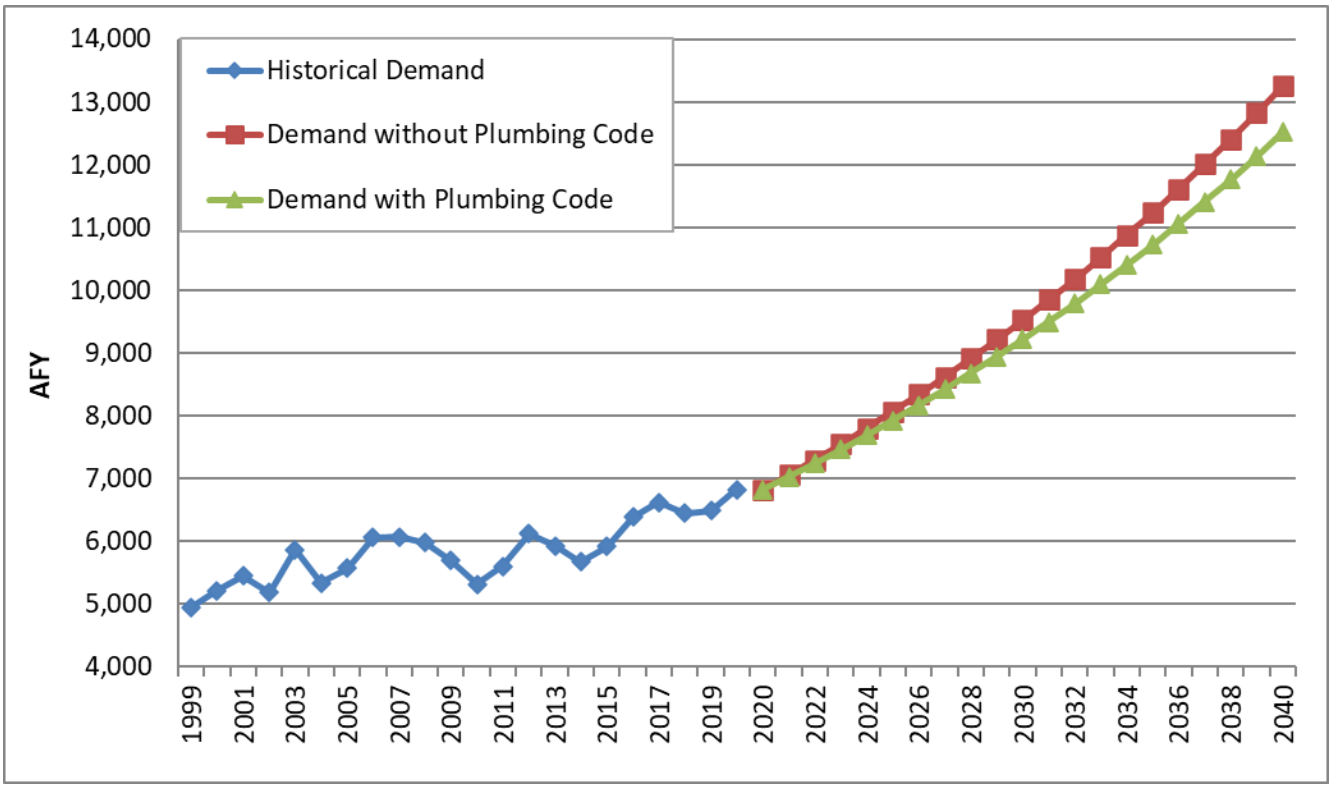
AFY	2025	2030	2035	2040
Baseline Demands	8,070	9,530	11,240	13,250
Plumbing Code Savings	140	320	510	730
Demands with Plumbing Code Savings	7,930	9,210	10,730	12,520

All numbers in the above table are rounded to the nearest 10 AFY.

Table C-2. City of Bozeman Potable Water System Demands for Years 2025–2040 in GPCD

GPCD	2025	2030	2035	2040
Baseline Demands	116	117	118	119
Plumbing Code Savings	2	4	5	7
Demands with Plumbing Code Savings	114	113	113	112

Figure C-2. City of Bozeman Potable Water System Demands



C.3 National Plumbing Code

The Federal Energy Policy Act of 1992, as amended in 2005, mandates that only fixtures meeting the following standards can be installed in new buildings:

- Toilet – 1.6 gal/flush maximum
- Urinals – 1.0 gal/flush maximum
- Showerhead – 2.5 gal/min at 80 pounds per square inch (psi)
- Residential faucets – 2.2 gal/min at 60 psi
- Public restroom faucets – 0.5 gal/min at 60 psi
- Dishwashing pre-rinse spray valves – 1.6 gal/min at 60 psi

Replacement of fixtures in existing buildings is also governed by the Federal Energy Policy Act, which mandates that only devices with the specified level of efficiency (as shown above) can be sold as of 2006. The net result of the plumbing code is that new buildings will have more efficient fixtures and old inefficient fixtures will slowly be replaced with new, more efficient models. The national plumbing code is an important piece of

legislation and must be carefully taken into consideration when analyzing the overall water efficiency of a service area.

In addition to the plumbing code, the U.S. Department of Energy regulates appliances, such as residential clothes washers, further reducing indoor water demands. Regulations to make these appliances more energy efficient have driven manufactures to dramatically reduce the amount of water these machines use. Generally, front-loading washing machines use 30-50% less water than conventional models (which are still available).

In this analysis, the DSS Model forecasts a gradual transition to high efficiency clothes washers (using 12 gallons or less) so that by the year 2025 that will be the only type of machine available for purchase. In addition to the industry becoming more efficient, rebate programs for washers have been successful in encouraging customers to buy more water efficient models. Given that machines last about 10 years, eventually all machines on the market will be the more water efficient models. Energy Star clothes washers have a water factor of 6.0 or less – the equivalent of using 3.1 cubic feet (or 23.2 gallons) of water per load. The maximum water factor for residential clothes washers under current federal standards is 6.5. The water factor equals the number of gallons used per cycle per cubic foot of capacity. Prior to the year 2000, the water factor for a typical new residential clothes washer was around 12. In March 2015, the federal standard reduced the maximum water factor for top- and front-loading machines to 8.4 and 4.7, respectively. In 2018, the maximum water factor for top-loading machines was further reduced to 6.5. For commercial washers, the maximum water factors were reduced in 2010 to 8.5 and 5.5 for top- and front-loading machines, respectively. Beginning in 2015, the maximum water factor for Energy Star certified washers was 3.7 for front-loading and 4.3 for top-loading machines. In 2011, the U.S. Environmental Protection Agency estimated that Energy Star washers comprised more that 60% of the residential market and 30% of the commercial market (Energy Star, 2011). A new Energy Star compliant washer uses about two-thirds less water per cycle than washers manufactured in the 1990s.

C.4 Key Baseline Potable Demand Inputs, Passive Savings Assumptions, and Resources

The following table presents the key assumptions and references that are used in the DSS Model in determining projected demands with plumbing code savings.

Table C-3. List of Key Assumptions

Parameter	Model Input Value, Assumptions, and Key References
Model Start Year for Analysis	2020
Water Demand Factor Year (Base Year)	Customer Category Breakdown: 2012–2017, except 2018–2019 for industrial. Indoor Basis: 2017–2018, 2018–2019 for industrial.
Population Projection Source	Based on average compound annual population growth rate (CAGR) from 2000–2020 of 3.16% Starting with 2020 actual census population
Employment Projection Source	May 2019 Bozeman Area Labor Report
Avoided Cost of Water	$1,645/AF (based on future avoided capital expansions)

Parameter	Potable Water System Base Year Water Use Profile				
Customer Categories	**Start Year Accounts**	**Total Water Use Distribution**	**Demand Factors (gpd/acct)**	**Indoor Use %**	**2020 Residential Indoor Water Use (GPCD)**
Single Family Residential	9,960	40%	214	49%	42
Multi-Family	2,503	24%	520	77%	42
Commercial	1,066	21%	1,061	71%	N/A
Commercial Special	113	2.2%	1,037	33%	N/A
Industrial	1	1.1%	57,135	71%	N/A
Government	48	1.5%	1,709	29%	N/A
Government Special	9	0.3%	1,756	41%	N/A
Montana State University	19	9%	23,983	59%	N/A
Low Income	155	0.4%	145	54%	N/A
New Single Family Residential	1	0%	292	33%	N/A
Total/Avg	**13,875**	**100%**	**N/A**	**74%**	**N/A**

Table C-4. Key Assumptions Resources

Parameter	Resource
Residential End Uses	Key Reference: AWWA Research Foundation (AWWARF) Report "Residential End Uses of Water, Version 2 - 4309" (DeOreo, 2016). Table 2-A. Water Consumption by Water-Using Plumbing Products and Appliances - 1980–2012. PERC Phase 1 Report. Plumbing Efficiency Research Coalition. 2013. http://www.map-testing.com/content/info/menu/perc.html Model Input Values are found in the "End Uses" section of the DSS Model on the "Breakdown" worksheet.
Non-Residential End Uses, percent	Key Reference: AWWARF Report "Commercial and Institutional End Uses of Water" (Dziegielewski, 2000 – Appendix D: Details of Commercial and Industrial Assumptions, by End Use). Model Input Values are found in the "End Uses" section of the DSS Model on the "Breakdown" worksheet.
Efficiency Residential Fixture Current Installation Rates	U.S. Census, Housing age by type of dwelling plus natural replacement plus rebate program (if any). Key Reference: GMP Research, Inc. (2019). 2019 U.S. WaterSense Market Penetration Industry Report. Key Reference: Consortium for Efficient Energy (www.cee1.org). Model Input Values are found in the "Codes and Standards" green section of the DSS Model by customer category fixtures.
Water Savings for Fixtures, gal/capita/day	Key Reference: AWWARF Report "Residential End Uses of Water, Version 2 - 4309" (DeOreo, 2016). The City supplied data on costs and savings; professional judgment was made where no published data was available. Key Reference: California Energy Commission, Staff Analysis of Toilets, Urinals and Faucets, Report # CEC-400-2014-007-SD, 2014. Model Input Values are found in the "Codes and Standards" green section on the "Fixtures" worksheet of the DSS Model.
Non-Residential Fixture Efficiency Current Installation Rates	Key Reference: 2010 U.S. Census, Housing age by type of dwelling plus natural replacement plus rebate program (if any). Assume commercial establishments built at same rate as housing, plus natural replacement. California Energy Commission, Staff Analysis of Toilets, Urinals and Faucets, Report # CEC-400-2014-007-SD, 2014. Model Input Values are found in the "Codes and Standards" green section of the DSS Model by customer category fixtures.
Residential Frequency of Use Data, Toilets, Showers, Faucets, Washers, Uses/user/day	Key Reference: AWWARF Report "Residential End Uses of Water, Version 2 - 4309" (DeOreo, 2016). Summary values can be found in the full report: http://www.waterrf.org/Pages/Projects.aspx?PID=4309 Key Reference: California Energy Commission, Staff Analysis of Toilets, Urinals and Faucets, Report # CEC-400-2014-007-SD, 2014. Key Reference: Alliance for Water Efficiency, The Status of Legislation, Regulation, Codes & Standards on Indoor Plumbing Water Efficiency, January 2016. Model Input Values are found in the "Codes and Standards" green section on the "Fixtures" worksheet of the DSS Model and confirmed in each "Service Area Calibration End Use" worksheet by customer category.

Parameter	Resource
Non-Residential Frequency of Use Data, Toilets, Urinals, and Faucets, Uses/user/day	Key References: Estimated based on AWWARF Report "Commercial and Institutional End Uses of Water" (Dziegielewski, 2000 – Appendix D: Details of Commercial and Industrial Assumptions, by End Use). Key Reference: California Energy Commission, Staff Analysis of Toilets, Urinals and Faucets, Report # CEC-400-2014-007-SD, 2014. Fixture uses over a 5-day work week are prorated to 7 days. Non-residential 0.5gpm faucet standards per Table 2-A. Water Consumption by Water-Using Plumbing Products and Appliances - 1980–2012. PERC Phase 1 Report. Plumbing Efficiency Research Coalition, 2012. http://www.map-testing.com/content/info/menu/perc.html Model Input Values are found in the "Codes and Standards" green section on the "Fixtures" worksheet of the DSS Model and confirmed in each "Service Area Calibration End Use" worksheet by customer category.
Natural Replacement Rate of Fixtures (percent per year)	Residential Toilets 2%-4%
	Non-Residential Toilets 2%-3%
	Residential Showers 4% (corresponds to 25-year life of a new fixture)
	Residential Clothes Washers 10% (based on 10-year washer life). Key References: "Residential End Uses of Water" (DeOreo, 2016) and "Bern Clothes Washer Study, Final Report" (Oak Ridge National Laboratory, 1998).
	Residential Faucets 10% and Non-Residential Faucets 6.7% (every 15 years). CEC uses an average life of 10 years for faucet accessories (aerators). A similar assumption can be made for public lavatories, though no hard data exists and since CII fixtures are typically replaced less frequently than residential, 15 years is assumed. CEC, Analysis of Standards Proposal for Residential Faucets and Faucet Accessories, a report prepared under CEC's Codes and Standards Enhancement Initiative, Docket #12-AAER-2C, August 2013.
	Model Input Value is found in the "Codes and Standards" green section on the "Fixtures" worksheet of the DSS Model.
Residential Future Water Use	Increases Based on Population Growth and Demographic Forecast
Non-Residential Future Water Use	Increases Based on Employment Growth and Demographic Forecast

Fixture Estimates

Determining the current level of efficient fixtures in a service area while evaluating passive savings in the DSS Model is part of the standard process and is called "initial fixture proportions." MWM reconciled water efficient fixtures and devices installed within the City of Bozeman service area and estimated the number of outstanding inefficient fixtures.

MWM used the DSS Model to perform a saturation analysis for toilets, urinals, showerheads, faucets, and clothes washers. The process included a review of age of buildings from census data, number of rebates per device, and assumed natural replacement rates. MWM presumed the fixtures that were nearing saturation and worth analysis would include residential toilets and residential clothes washers.

In 2014, the Water Research Foundation updated its 1999 Residential End Uses of Water Study (REUWS). Water utilities, industry regulators, and government planning agencies consider it the industry benchmark for single family home indoor water use. This Plan incorporates recent study results which reflect the change to the profile of water use in residential homes including adoption of more water efficient fixtures over the 15

years that transpired from 1999 to 2014. REUWS results were combined with City historical rebate and billing data to enhance and verify assumptions made for all customer accounts, including saturation levels on the above-mentioned plumbing fixtures.

The DSS Model presents the estimated current and projected proportions of these fixtures by efficiency level within the City's service area. These proportions were calculated by:

- Using standards in place at the time of building construction;
- Taking the initial proportions of homes by age (corresponding to fixture efficiency levels);
- Adding the net change due to natural replacement; then
- Adding the change due to rebate measure minus the "free rider effect."[11]

Further adjustments were made to initial proportions to account for the reduction in fixture use due to lower occupancy and based on field observations. The projected fixture proportions do **not** include any future active conservation measures implemented by the City. More information about the development of initial and projected fixture proportions can be found in the DSS Model "Codes and Standards" section.

The DSS Model is capable of modeling multiple types of fixtures, including fixtures with different designs. For example, currently toilets can be purchased that flush at a rate of <1.0 gpf, 1.28 gpf or 1.6 gpf. So, the DSS Model utilizes fixture replacement rates to determine what type of fixture should be used for a new construction installation or replacement. The replacement of the fixtures is listed as a percentage within the DSS Model. A value of 100% would indicate that all the toilets installed would be of one particular flush volume. A value of 75% means that three out of every four toilets installed would be of that particular flush volume. All the Fixture Model information and assumptions were carefully reviewed and accepted by City staff.

The DSS Model provides inputs and analysis of the number, type, and replacement rates of fixtures for each customer category (e.g., single family toilets, commercial toilets, residential clothes washers). For example, the DSS Model incorporates the effects of the 1992 Federal Energy Policy Act on toilet fixtures. A DSS Model feature determines the "saturation" of 1.6 gpf toilets as the 1992 Federal Energy Policy Act was in effect from 1992–2014 for 1.6 gpf toilet replacements. Further consideration and adjustments were made to replacement rates to account for the reduction in fixture use and wear, due to lower occupancy and based on field observations.

[11] It is important to note that in water conservation program management the "free rider effect" occurs when a customer applies for and receives a rebate on a targeted high efficiency fixture that they would have purchased even without a rebate. In this case, the rebate was not the incentive for their purchase but a "bonus." Rebate measures are designed to target customers needing financial incentive to install the more efficient fixture.

APPENDIX D – DSS MODEL MEASURE ANALYSIS, METHODOLOGY, PERSPECTIVES, AND ASSUMPTIONS

Throughout the planning process, the City and MWM conducted more than 20 meetings, primarily in an effort to complete the DSS Model, which is robust for each of the 25 measures modeled. In the model, the City identified fixture costs, applicable customer classes, time period of implementation, measure life, administrative costs, end uses, end-use savings per replacement, and a target number or percentage of accounts per program year.

D.1 Water Reduction Methodology

Each conservation measure targets a particular water use, such as indoor single family water use. Targeted water uses are categorized by water user group and by end use. Targeted water user groups include single family residential; multi-family residential; commercial, industrial, and institutional; and so forth. Measures may apply to more than one water user group. Targeted end uses include indoor and outdoor use. The targeted water use is important to identify because the water savings are generated from reductions in water use for the targeted end use. For example, a residential retrofit conservation measure targets single family and multi-family residential indoor use, and in some cases specifically shower use. When considering the water savings potential generated by a residential retrofit, one considers the water saved by installing low-flow showerheads in single family and multi-family homes.

The market penetration goal for a measure is the extent to which the product or service related to the conservation measure occupies the potential market. The market penetration goal identifies how many fixtures, rebates, surveys, and so forth that the wholesale customer would have to offer or conduct over time to reach its water savings goal for that conservation measure. This is often expressed in terms of the number of fixtures, rebates, or surveys offered or conducted per year.

The potential for error in market penetration goal estimates for each measure can be significant because the estimates are based on previous experience, chosen implementation methods, projected utility effort, and funds allocated to implement the measure. The potential error can be corrected through reevaluation of the measure as the implementation of the measure progresses. For example, if the market penetration required to achieve specific water savings turns out to be different than predicted, adjustments to the implementation efforts can be made. Larger rebates or additional promotions are often used to increase the market penetration. The process is iterative to reflect actual conditions and helps to ensure that market penetration and needed savings are achieved regardless of future variances between estimates and actual conditions.

In contrast, market penetration for mandatory ordinances can be more predictable with the greatest potential for error occurring in implementing the ordinance change. For example, requiring dedicated irrigation meters for new accounts through an ordinance can assure an almost 100% market penetration for affected properties.

The City is constantly examining when a measure might reach saturation. Baseline surveys are the best approach to having the most accurate information on market saturation. This was considered when analyzing individual conservation measures where best estimates were made. MWM was not provided with any baseline surveys for this analysis, but discussions were held with the City regarding what the saturation best estimates were within its service area.

D.2 Present Value Analysis and Perspectives on Benefits and Costs

The determination of the economic feasibility of water conservation programs involves comparing the costs of the programs to the benefits provided using the DSS Model, which calculates the cost effectiveness of conservation measure savings at the end-use level. For example, the model determines the amount of water a toilet rebate program saves in daily toilet use for each single-family account.

Present value analysis using present day dollars and a real discount rate of 3% is used to discount costs and benefits to the base year. From this analysis, benefit-cost ratios of each measure are computed. When measures are put together in programs, the model is set up to avoid double counting savings from multiple measures that act on the same end use of water. For example, multiple measures in a program may target toilet replacements. The model includes assumptions to apportion water savings between the multiple measures.

Economic analysis can be performed from several perspectives, based on which party is affected. For planning water use efficiency programs for utilities, perspectives most used for benefit-cost analyses are the "utility" perspective and the "community" perspective. The "utility" benefit-cost analysis is based on the benefits and costs to the water provider. The "community" benefit-cost analysis includes the utility benefit and costs together with account owner/customer benefits and costs. These include customer energy and other capital or operating cost benefits plus costs of implementing the measure beyond what the utility pays.

The utility perspective offers two advantages. First, it considers only the program costs that will be directly borne by the utility. This enables the utility to fairly compare potential investments for saving versus supplying increased quantities of water. Second, revenue shifts are treated as transfer payments, which means program participants will have lower water bills and non-participants will have slightly higher water bills so that the utility's revenue needs continue to be met. Therefore, the analysis is not complicated with uncertainties associated with long-term rate projections and retail rate design assumptions. It should be noted that there is a significant difference between the utility's savings from the avoided cost of procurement and delivery of water and the reduction in retail revenue that results from reduced water sales due to water use efficiency. This budget impact occurs slowly and can be accounted for in water rate planning. Because it is the water provider's role in developing a water use efficiency plan that is vital in this study, the utility perspective was primarily used to evaluate elements of this report.

The community perspective is defined to include the utility and the customer costs and benefits. Costs incurred by customers striving to save water while participating in water use efficiency programs are considered, as well as benefits received in terms of reduced energy bills (from water heating costs) and wastewater savings, among others. Water bill savings are not a customer benefit in aggregate for reasons described previously. Other factors external to the utility, such as environmental effects, are often difficult to quantify or are not necessarily under the control of the utility. They are therefore frequently excluded from economic analyses, including this one.

The time value of money is explicitly considered. Typically, the costs to save water occur early in the planning period whereas the benefits usually extend to the end of the planning period. For this reason, a planning period of 10 years or longer is used because costs and benefits that occur beyond 10 years have little influence on the total present value of costs and benefits. The value of all future costs and benefits is discounted to the first year in the DSS Model (the base year) at the real interest rate of 3.01%. The DSS Model calculates this real interest rate, adjusting the current nominal interest rate (assumed to be approximately 6.1%) by the assumed rate of inflation (3.0%).

The formula to calculate the real interest rate is:

(nominal interest rate – assumed rate of inflation) / (1 + assumed rate of inflation)

Cash flows discounted in this manner are herein referred to as "Present Value" sums.

D.3 Measure Cost and Water Savings Assumptions

Appendix E presents more detail on the assumptions and inputs used in the City's DSS Model to evaluate each water conservation measure. Assumptions regarding the following variables were made for each measure:

- **Targeted Water User Group End Use** – Water user group (e.g., single family residential) and end use (e.g., indoor or outdoor water use).

- **Utility Unit Cost** – Cost of rebates, incentives, and contractors hired to implement measures. The assumed dollar values for the measure unit costs were closely reviewed by staff and are found to be adequate for each individual measure. The values in most cases are in the range of what is offered by other water utilities in the region.
- **Retail Customer Unit Cost** – Cost for implementing measures that is paid by retail customers (i.e., the remainder of a measure's cost that is not covered by a utility rebate or incentive).
- **Utility Administration and Marketing Cost** – The cost to the utility for administering the measure, including consultant contract administration, marketing, and participant tracking. The mark-up is sufficient (in total) to cover conservation staff time, general expenses, and overhead.

Costs are determined for each of the measures based on industry knowledge, experience, and data provided by the City. Costs may include incentive costs, usually determined on a per-participant basis; fixed costs, such as marketing; variable costs, such as the cost to staff the measures and to obtain and maintain equipment; and a one-time set-up cost. The set-up cost is for measure design by staff or consultants, any required pilot testing, and preparation of materials that are used in marketing the measure. Measure costs are estimated each year through 2040. Costs are spread out depending on the length of the implementation period for the measure and estimated voluntary customer participation levels.

Lost revenue due to reduced water sales is not included as a cost because the water use conservation measures evaluated herein generally take effect over a long span of time. This span is sufficient to enable timely rate adjustments, if necessary, to meet fixed cost obligations and savings on variable costs such as energy and chemicals.

The unit costs vary according to the type of customer account and implementation method being addressed. For example, a measure might have a different cost for a residential single-family account than for a residential multi-family account, or for a rebate versus an ordinance requirement or a direct installation implementation method. Typically, water utilities have found there are increased costs associated with achieving higher market saturation, such as more water efficiency surveys per year. The DSS Model calculates the annual costs based on the number of participants each year. The general formula for calculating annual utility costs is:

- Annual Utility Cost = Annual market penetration rate x total accounts in category x unit cost per account x (1+administration and marketing markup percentage)
- Annual Customer Cost = Annual number of participants x unit customer cost
- Annual Community Cost = Annual utility cost + annual customer cost

Data necessary to forecast water savings of measures include specifics on water use, demographics, market penetration, and unit water savings. Savings normally develop at a measured and predetermined pace, reaching full maturity after full market penetration is achieved. This may occur 3–10 years after the start of implementation, depending upon the implementation schedule.

For every water use efficiency activity or replacement with more efficient devices, there is a useful life. The useful life is called the "Measure Life" and is defined to be how long water use conservation measures stay in place and continue to save water. It is assumed that measures implemented because of codes, standards, or ordinances (e.g., toilets) would be "permanent" and not revert to an old inefficient level of water use if the device needed to be replaced. However, some measures that are primarily behavior-based, such as residential surveys, are assumed to need to be repeated on an ongoing basis to retain the water savings (e.g., homeowners move away, and the new homeowners may have less efficient water using practices). Surveys typically have a measure life of about five years.

APPENDIX E – INDIVIDUAL CONSERVATION MEASURE DESIGN INPUTS AND RESULTS

Water Loss

Water Loss

Overview	
Name	Water Loss
Abbr	1
Category	Default
Measure Type	Water Loss Measure

Time Period	
First Year	2022

Backlog Costs	
Total Backlog Work Costs	$500,000
Years to Complete Backlog	20

Maintenance Costs	
Annual Maintenance Costs	$25,000

Target	
Total GPCD Reduction	3.0

Description

In conjunction with system accounting (maintaining a thorough annual accounting of water production, sales by customer class and quantity of water produced but not sold), include audits that identify and quantify known legitimate uses of non-revenue water in order to determine remaining non-revenue water losses. Goal would be to lower the Infrastructure Leakage Index (ILI) and non-revenue water every year by a pre-determined amount based on cost-effectiveness. These programs typically pay for themselves based on savings in operational costs (and saved rate revenue can be directed more to system repairs/replacement and other costs).

Results	
Units	AF
Average Water Savings (afy)	
126.565576	
Lifetime Savings - Present Value ($)	
Utility	$3,431,066
Community	$3,431,066
Lifetime Costs - Present Value ($)	
Utility	$391,935
Community	$391,935
Benefit to Cost Ratio	
Utility	8.75
Community	8.75
Cost of Savings per Unit Volume ($/af)	
Utility	$147

Comments

- Start Year: 2022
- Annual Target is <10% leakage, decreasing ILI
- Annual Budget: $25,000 for professional audit services
- The $25k for professional services will come from the conservation budget. Additional funding to implement infrastructure improvements will come from the operations budget.

Costs		Targets		Water Savings (afy)	
	Utility		Projected NRW Percent		Total Savings
2020	$0	2020	12.6%	2020	0.000000
2021	$0	2021	12.6%	2021	0.000000
2022	$25,000	2022	12.5%	2022	9.535745
2023	$25,000	2023	12.3%	2023	19.674150
2024	$25,000	2024	12.2%	2024	30.443780
2025	$25,000	2025	12.1%	2025	41.874404
2026	$25,000	2026	11.9%	2026	53.997044
2027	$25,000	2027	11.8%	2027	66.844021
2028	$25,000	2028	11.7%	2028	80.449008
2029	$25,000	2029	11.5%	2029	94.847081
2030	$25,000	2030	11.4%	2030	110.074780
2031	$25,000	2031	11.3%	2031	126.170159
2032	$25,000	2032	11.1%	2032	143.172850
2033	$25,000	2033	11.0%	2033	161.124122
2034	$25,000	2034	10.9%	2034	180.066948
2035	$25,000	2035	10.7%	2035	200.046069
2036	$25,000	2036	10.6%	2036	221.108062
2037	$25,000	2037	10.5%	2037	243.301415
2038	$25,000	2038	10.3%	2038	266.676599
2039	$25,000	2039	10.2%	2039	291.286143
2040	$25,000	2040	10.1%	2040	317.184717

Tiered Rate Structure for MF

Tiered Rate Structure for MF

Overview	
Name	Tiered Rate Structure for MF
Abbr	2
Category	Default
Measure Type	Pricing Measure

Customer Class	
Customer Class	Multi Family

Time Period	
First Year	2035

Description

Tiered rates for MF customers. Existing rates would be changed to create an incentive to use less water. Modifications could include adjusting the tiers, or adjusting the rates in the upper tiers, to increase the incentive to reduce landscape watering.

Comments

> Start year 2035
> Per Bozeman 2019 COSA/rate study, MF price elasticity peak and off-peak overall avg @ -0.075. Indoor elasticity of -0.05 based on Washington County Water Conservancy District, Utah (WCWCD) 2021 rate study. Likely NOT accurate since Bozeman uses unmetered wells for MF irrigation.
> $20K rate study per Bozeman staff and previous rate study costs and $9K/yr. maintenance per WCWCD 2021 rate study costs.
> Bozeman would enact rate increases annually, but for design purposes assume average increase every year. An average 1.9% increase for MF rates from 2019-2024 was assumed above annual inflation. Adjusting future price increase is based off of known current information for potential future rate increase.

Planned Rate Increases

Add Rate Increase

Change Year	Price Incr (%)	Price Incr Adjusting for Inflation	
2035	3.9%	1.9%	Delete
2036	3.9%	1.9%	Delete
2037	3.9%	1.9%	Delete
2038	3.9%	1.9%	Delete
2039	3.9%	1.9%	Delete
2040	3.9%	1.9%	Delete

Results

Units: AF

Average Water Savings (afy)	
3.940306	
Lifetime Savings - Present Value ($)	
Utility	$44,808
Community	$44,808
Lifetime Costs - Present Value ($)	
Utility	$68,754
Community	$68,754
Benefit to Cost Ratio	
Utility	0.65
Community	0.65
Cost of Savings per Unit Volume ($/af)	
Utility	$831

Price Elasticity

Overall	Indoor	Outdoor
-0.08	-0.05	-0.16

Utility Costs

Rate Study Cost	$20,000
Rate Study Frequency (every # yrs.)	5
First Year of Rate Study	2035
Annual Maintenance Cost	$9,000

Consumer Price Index

First Year Index	1.0
Annual Increase	2%

Costs

	Utility	Customer	Total (Community)
2020	$0	$0	$0
2021	$0	$0	$0
2022	$0	$0	$0
2023	$0	$0	$0
2024	$0	$0	$0
2025	$0	$0	$0
2026	$0	$0	$0
2027	$0	$0	$0
2028	$0	$0	$0
2029	$0	$0	$0
2030	$0	$0	$0
2031	$0	$0	$0
2032	$0	$0	$0
2033	$0	$0	$0
2034	$0	$0	$0
2035	$29,000	$0	$29,000
2036	$9,000	$0	$9,000
2037	$9,000	$0	$9,000
2038	$9,000	$0	$9,000
2039	$9,000	$0	$9,000
2040	$29,000	$0	$29,000

Projected Price Index

	Price Index	Cumulative Index Increase
2020	0.0	0%
2021	0.0	0%
2022	0.0	0%
2023	0.0	0%
2024	0.0	0%
2025	0.0	0%
2026	0.0	0%
2027	0.0	0%
2028	0.0	0%
2029	0.0	0%
2030	0.0	0%
2031	0.0	0%
2032	0.0	0%
2033	0.0	0%
2034	0.0	0%
2035	1.0	0%
2036	1.0	2%
2037	1.0	4%
2038	1.1	6%
2039	1.1	8%
2040	1.1	10%

Water Savings

	Total Savings (afy)
2020	0.000000
2021	0.000000
2022	0.000000
2023	0.000000
2024	0.000000
2025	0.000000
2026	0.000000
2027	0.000000
2028	0.000000
2029	0.000000
2030	0.000000
2031	0.000000
2032	0.000000
2033	0.000000
2034	0.000000
2035	3.739146
2036	7.594935
2037	11.571351
2038	15.672493
2039	19.902572
2040	24.265922

AMI and Customer Water Use Portal

AMI and Customer Water Use Portal

Overview

Name	AMI and Customer Water Use Portal
Abbr	3
Category	Default
Measure Type	Standard Measure

Time Period	
First Year	2020
Last Year	2040
Measure Length	21

Measure Life	
Permanent	
Years	15
Repeat	

Fixture Cost per Device

	Utility	Customer	Fix/Acct
R	$225.00	$500.00	1
MF	$225.00	$500.00	1
C	$225.00	$500.00	1
CS	$225.00	$500.00	1
IN	$225.00	$500.00	1
G	$225.00	$500.00	1
GS	$225.00	$500.00	1
MSU	$225.00	$500.00	1
LI	$225.00	$500.00	1
New_SF	$225.00	$500.00	1

Administration Costs

Method: Percent

Markup Percentage	10%

Customer Classes

R	MF	C	CS	IN	G	GS	MSU	LI	New_SF
☑	☑	☑	☑	☑	☑	☑	☑	☑	☑

End Uses

	R	MF	C	CS	IN	G	GS	MSU	LI	New_SF
Toilets	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Urinals			☐	☐	☐	☐	☐	☐		
Lavatory Faucets	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Showers	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Dishwashers	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Clothes Washers	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Process			☐	☐	☐					
Kitchen Spray Rinse			☐	☐		☐	☐	☐		
Internal Leakage	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
Baths	☐	☐							☐	☐
Other	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Non-Lavatory/Kitchen Faucets	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Irrigation	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
Pools	☐	☐						☐	☐	☐
Wash Down	☐	☐							☐	☐
Car Washing	☐	☐							☐	☐
External Leakage	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
Outdoor										
Cooling			☐	☐	☐	☐	☐	☐		

Results

Units: AF

Average Water Savings (afy)	
	46.859732
Lifetime Savings - Present Value ($)	
Utility	$1,338,233
Community	$2,461,181
Lifetime Costs - Present Value ($)	
Utility	$481,541
Community	$1,454,351
Benefit to Cost Ratio	
Utility	2.78
Community	1.69
Cost of Savings per Unit Volume ($/af)	
Utility	$489

End Use Savings Per Replacement

Method: Percent

	% Savings/Acct	Avg GPD/Acct
R Internal Leakage	90.0%	14.1
MF Internal Leakage	90.0%	53.9
C Internal Leakage	90.0%	45.0
CS Internal Leakage	90.0%	34.7
IN Internal Leakage	90.0%	4,077.4
G Internal Leakage	90.0%	50.1
GS Internal Leakage	90.0%	72.2
MSU Internal Leakage	90.0%	1,403.7
LI Internal Leakage	90.0%	10.6
R Irrigation	5.0%	91.2
MF Irrigation	5.0%	99.8
C Irrigation	5.0%	242.4
CS Irrigation	5.0%	537.9
IN Irrigation	5.0%	11,943.3
G Irrigation	5.0%	942.1
GS Irrigation	5.0%	806.6
MSU Irrigation	5.0%	7,260.7
LI Irrigation	5.0%	54.9
R External Leakage	90.0%	7.7
MF External Leakage	90.0%	8.4
C External Leakage	90.0%	21.7
CS External Leakage	90.0%	48.3
IN External Leakage	90.0%	1,145.2
G External Leakage	90.0%	84.5
GS External Leakage	90.0%	72.4
MSU External Leakage	90.0%	696.2
LI External Leakage	90.0%	4.6
New_SF Internal Leakage	90.0%	13.0
New_SF Irrigation	5.0%	162.3
New_SF External Leakage	90.0%	13.7

Targets

Target Method: Percentage

% of Accts Targeted/Yr.	0.600%
Only Affects New Accts	☐

Description

> Retrofit system with AMI meters and associated network capable of providing continuous consumption data to Utility offices. Improved identification of system and customer leaks is a major conservation benefit. Some of the costs of these systems are offset by operational efficiencies and reduced staffing, as regular meter reading and those for opening and closing accounts are accomplished without the need for physical or drive-by meter reading. Also enables enhanced billing options and ability to monitor unauthorized use (such as use/tampering with closed accounts or irrigation if time of day or days per week are regulated). Customer service is improved as staff can quickly access continuous usage records to address customer inquiries. Optional features include online customer access to their use, which has been shown to improve accountability and reduce water use. A ten year change-out would be a reasonable objective.

> Dropcountr water use portal which shows water use at an hourly timescale for customers with AMI meters, as well as sends leak alerts, allows for customers to set billing thresholds, and see how water use compares to neighbors and efficient neighbors. Customers without AMI capability can also see water use in Dropcountr, however it will only be displayed at a monthly timescale - these customers will not benefit from leak alerts nor will they benefit from setting billing thresholds.

Comments

• Utility Cost: Based on Dept. measure annual cost of ~$19.2K. Though Bozeman pays $1.35 per meter for Dropcountr, with a total budget of $36,000/year, with a start year of 14,230 accounts, the cost is ~$19.2K. Utility cost per meter increase, as the targets are only assumed accounts that have and fix leaks. Not included in the cost: $170 per AMI Meter upgrade with 800 retrofits a year. This is $136k/year through 2025. However this is coming from operations budget, therefore not included in the utility cost. Costs for AMI infrastructure, such as additional gateways to transmit water use data, will come from operations budget.

• Admin Markup: Per Dropcountr data provided by Bozeman, admin time includes customer Dropcountr inquiries, water use research, QAQC, and meeting preparation. Average time spent in summer is ~25-35 hours/month, and the average time spent in winter is ~20-25 hours/month. With an average annual time spent of ~60 hours. Fully staff burden rate is $29.92/hr. Average annual admin cost if 60 hours X $29.92 = $1,795.20.
Admin cost updated to be a percentage to represent 1 hour of staff time per account.

• Customer Cost: Assumed average cost for leak repair

• End Use Water Savings: AMI savings based on significant reductions to leakage and irrigation end uses. Savings based on San Francisco Public Utilities Commission (SFPUC) case study per Julie Ortiz ppt at 2019 Peer-to-Peer "AMI: Everything you need to know to run a successful program." Savings are estimated to be 20%-50% on leakage, assumes average of 30% (internal and external) with a potential additional 5% savings on all other end uses due to behavioral changes, 5% savings to irrigation. For this measure, water savings increased to 90% on leak end use since ONLY leaking customers are targeted, not all.

• Targets: Approx. based off of Dropcountr/Neptune meter data leak alerts and adjusted to meter data backfilling/meter communication lag.

Costs

View: Utility Detail

	Fixture Costs	Admin Costs	Util Total
2020	$18,731	$1,873	$20,604
2021	$19,260	$1,926	$21,186
2022	$19,805	$1,981	$21,786
2023	$20,368	$2,037	$22,405
2024	$20,949	$2,095	$23,044
2025	$21,548	$2,155	$23,703
2026	$22,167	$2,217	$24,384
2027	$22,805	$2,281	$25,086
2028	$23,464	$2,346	$25,811
2029	$24,144	$2,414	$26,559
2030	$24,846	$2,485	$27,330
2031	$25,570	$2,557	$28,127
2032	$26,317	$2,632	$28,949
2033	$27,088	$2,709	$29,797
2034	$27,884	$2,788	$30,672
2035	$28,705	$2,870	$31,575
2036	$29,552	$2,955	$32,507
2037	$30,427	$3,043	$33,469
2038	$31,329	$3,133	$34,462
2039	$32,260	$3,226	$35,486
2040	$33,221	$3,322	$36,544

Targets

View: Accounts

	R	MF	C	CS	IN	G	GS	MSU	LI	New_SF	Total
2020	60	15	6	1	0	0	0	0	1	0	83
2021	60	15	7	1	0	0	0	0	1	2	86
2022	60	16	7	1	0	0	0	0	1	3	88
2023	60	16	7	1	0	0	0	0	1	5	91
2024	60	17	7	1	0	0	0	0	1	7	93
2025	60	18	8	1	0	0	0	0	1	8	96
2026	60	18	8	1	0	0	0	0	1	10	99
2027	60	19	8	1	0	0	0	0	1	12	101
2028	60	19	8	1	0	0	0	0	1	14	104
2029	60	20	9	1	0	0	0	0	1	16	107
2030	60	20	9	1	0	0	0	0	1	18	110
2031	60	21	9	1	0	0	0	0	1	20	114
2032	60	22	10	1	0	0	0	0	1	23	117
2033	60	23	10	1	0	0	0	0	1	25	120
2034	60	23	10	1	0	0	0	0	1	27	124
2035	60	24	11	1	0	0	0	0	1	30	128
2036	60	25	11	1	0	0	0	0	2	32	131
2037	60	25	11	1	0	0	0	0	2	35	135
2038	60	26	12	1	0	1	0	0	2	38	139
2039	60	27	12	1	0	1	0	0	2	40	143
2040	60	28	13	1	0	1	0	0	2	43	148

Water Savings

Units: afy

	Total Savings (afy)
2020	3.647609
2021	7.418447
2022	11.316483
2023	15.345813
2024	19.510668
2025	23.815413
2026	28.264554
2027	32.862744
2028	37.614784
2029	42.525633
2030	47.600407
2031	52.844389
2032	58.263030
2033	63.861961
2034	69.646992
2035	71.976511
2036	74.381091
2037	76.863155
2038	79.425204
2039	82.069818
2040	84.799664

Capital Project – Retrofit City Medians with Drought Tolerant Landscaping and Efficient Irrigation

Capital Project - Retrofit City Medians with Drought Tolerant Landscaping and Efficient Irrigation

Overview

Name	Capital Project - Retrofit City Media
Abbr	4
Category	Default
Measure Type	Standard Measure

Time Period

First Year	2027
Last Year	2027
Measure Length	1

Measure Life

Permanent ☑

Fixture Cost per Device

	Utility	Customer	Fix/Acct
GS	$15,000.00	$0.00	1

Administration Costs

Method: Percent

Markup Percentage	1%

Description

Retrofit turfgrass street medians with drought tolerant landscaping and efficient irrigation to serve as an example of Best Management Practices (BMPs) to the community and reduce water use.

Customer Classes

	R	MF	C	CS	IN	G	GS	MSU	LI	New_SF
	☐	☐	☐	☐	☐	☐	☑	☐	☐	☐

End Uses

	R	MF	C	CS	IN	G	GS	MSU	LI	New_S
Toilets							☐			
Urinals							☐			
Lavatory Faucets							☐			
Showers							☐			
Dishwashers							☐			
Clothes Washers							☐			
Process										
Kitchen Spray Rinse							☐			
Internal Leakage							☐			
Baths										
Other							☐			
Non-Lavatory/Kitchen Faucets							☐			
Irrigation							☑			
Pools										
Wash Down										
Car Washing										
External Leakage							☐			
Outdoor										
Cooling							☐			

Comments

• Utility Cost: Costs for installation of project will likely come from Streets budget, therefore not included in the utility cost.
Per Bozeman staff, a budget of approx. ~$15k for design cost for the Valley Center median project.
• Admin Markup: Assumes 1% admin cost
• Customer Cost: No customer costs
• End Use Water Savings: Savings assumes measure targets GS account with only irrigation end use. Assume the median project will be approximately 28,619 square feet to yield an average annual savings of 20.7 gal/sq.ft. x 28,619 sq.ft. =592,393 gal/yr/site on average (or 1,622 gpd/site).
• Targets: Only City water median project is the Valley Center project. Therefore only one project. Not including well irrigated sites as model is potable water only.

Results

Units: AF

Average Water Savings (afy)	
	1.212077
Lifetime Savings - Present Value ($)	
Utility	$33,510
Community	$33,510
Lifetime Costs - Present Value ($)	
Utility	$13,365
Community	$13,365
Benefit to Cost Ratio	
Utility	2.51
Community	2.51
Cost of Savings per Unit Volume ($/af)	
Utility	$525

End Use Savings Per Replacement

Method: Fixed

	Savings GPD/Acct	Avg GPD/Acct
GS Irrigation	1,622.0	806.6

Targets

Target Method: Count

# of Accts Targeted/Yr.	1

Costs

View: Utility Detai

	Fixture Costs	Admin Costs	Util Total
2020	$0	$0	$0
2021	$0	$0	$0
2022	$0	$0	$0
2023	$0	$0	$0
2024	$0	$0	$0
2025	$0	$0	$0
2026	$0	$0	$0
2027	$15,000	$150	$15,150
2028	$0	$0	$0
2029	$0	$0	$0
2030	$0	$0	$0
2031	$0	$0	$0
2032	$0	$0	$0
2033	$0	$0	$0
2034	$0	$0	$0
2035	$0	$0	$0
2036	$0	$0	$0
2037	$0	$0	$0
2038	$0	$0	$0
2039	$0	$0	$0
2040	$0	$0	$0

Targets

View: Accounts

	GS	Total
2020	0	0
2021	0	0
2022	0	0
2023	0	0
2024	0	0
2025	0	0
2026	0	0
2027	1	1
2028	0	0
2029	0	0
2030	0	0
2031	0	0
2032	0	0
2033	0	0
2034	0	0
2035	0	0
2036	0	0
2037	0	0
2038	0	0
2039	0	0
2040	0	0

Water Savings

Units: afy

	Total Savings (afy)
2020	0.000000
2021	0.000000
2022	0.000000
2023	0.000000
2024	0.000000
2025	0.000000
2026	0.000000
2027	1.818115
2028	1.818115
2029	1.818115
2030	1.818115
2031	1.818115
2032	1.818115
2033	1.818115
2034	1.818115
2035	1.818115
2036	1.818115
2037	1.818115
2038	1.818115
2039	1.818115
2040	1.818115

Capital Project – Upgrade City Facility Irrigation Systems

Capital Project - Upgrade City Facility Irrigation Systems

Overview

Name	Capital Project - Upgrade City Facility Irrigat
Abbr	5
Category	Default
Measure Type	Standard Measure

Time Period

First Year	2024
Last Year	2027
Measure Length	4

Measure Life

Permanent ☑

Fixture Cost per Device

	Utility	Customer	Fix/Acct
G	$10,500.00	$0.00	1
GS	$10,500.00	$0.00	1

Administration Costs

Method: Percent

Markup Percentage	3%

Description

Perform irrigation system audits to document existing irrigation system components and retrofit with MSMT nozzles, weather based irrigation controllers, soil moisture sensors etc. as needed. Include recommended watering schedule to reduce overwatering.

Customer Classes

R	MF	C	CS	IN	G	GS	MSU	LI	New_SF
☐	☐	☐	☐	☐	☑	☑	☐	☐	☐

End Uses

	R	MF	C	CS	IN	G	GS	MSU	LI	New_SF
Toilets						☐	☐			
Urinals						☐	☐			
Lavatory Faucets						☐	☐			
Showers						☐	☐			
Dishwashers						☐	☐			
Clothes Washers						☐	☐			
Process										
Kitchen Spray Rinse						☐	☐			
Internal Leakage						☐	☐			
Baths										
Other						☐	☐			
Non-Lavatory/Kitchen Faucets						☐	☐			
Irrigation						☑	☑			
Pools										
Wash Down										
Car Washing										
External Leakage						☑	☑			
Outdoor										
Cooling						☐	☐			

Results

Units: AF

Average Water Savings (afy)	
	1.215147
Lifetime Savings - Present Value ($)	
Utility	$34,097
Community	$34,097
Lifetime Costs - Present Value ($)	
Utility	$78,495
Community	$78,495
Benefit to Cost Ratio	
Utility	0.43
Community	0.43
Cost of Savings per Unit Volume ($/af)	
Utility	$3,076

End Use Savings Per Replacement

Method: Percent

	% Savings/Acct	Avg GPD/Acct
GS Irrigation	20.1%	806.6
GS External Leakage	10.0%	72.4
G Irrigation	20.1%	942.1
G External Leakage	10.0%	84.5

Targets

Target Method: Count

# of Accts Targeted/Yr.	1

Comments

• Utility Cost: $8k per system to complete all upgrades identified in an audit and convert to CICS. Plus $20k total for labor (~ $2,500 per site). Total Utility cost of $10,500
• Admin Markup: Assumes an average of 11 hours per project, with approx. 6 hours for field audit and 5 hours for office time. Assumes admin time is at the Water Conservation Technician fully burdened rate of $29.92. This is ~$330 per project and can vary (less time/more time) depending on the project.
• Customer Cost: No cost to customer
• End Use Water Savings: The water savings are based on the following from the 2018 Landscape Rebate Water Savings Study from Valley Water:
> The annual water savings for replacing timer-based automatic irrigation controllers with weather-based irrigation controllers with rain shut-off devices were statistically significant each year following conversion, incrementally increased each year following conversion, and were on average 9 gal/ft2/yr. or an average of 27%
> The annual water savings for replacing old sprinklers with high-efficiency nozzles was 1,243 gal/unit/yr. on average or an average of 15.3%
>Annual savings for replacing old sprinklers with high-efficiency nozzles including pressure regulation and/or check valves were significant in the first year following conversion, saving 1,661 gal/unit/yr. on average, or an average of 18%.
> Total average irrigation savings is 20.1%
> Soil moisture sensor savings may be 20% of irrigation use based on more than 10 California site water use reports conducted over multiple months in years 2015-2017 as provided by Brian Holland www.sustainablewatersavings.com. Studies show a range of 20%-60% savings for trained soil moisture sensor device installation and site management. A lower savings estimate is assumed for layperson usage and non-drought normal planning years. The manufacturer claims device batteries last 10-12 years.
> Leakage: assumes 10% leakage savings from updating and monitoring of equipment.
• Targets: total of 8 facilities in time period.
• Start year: 2024 based on availability of funding.

Costs

View: Utility Detai

	Fixture Costs	Admin Costs	Util Total
2020	$0	$0	$0
2021	$0	$0	$0
2022	$0	$0	$0
2023	$0	$0	$0
2024	$21,000	$651	$21,651
2025	$21,000	$651	$21,651
2026	$21,000	$651	$21,651
2027	$21,000	$651	$21,651
2028	$0	$0	$0
2029	$0	$0	$0
2030	$0	$0	$0
2031	$0	$0	$0
2032	$0	$0	$0
2033	$0	$0	$0
2034	$0	$0	$0
2035	$0	$0	$0
2036	$0	$0	$0
2037	$0	$0	$0
2038	$0	$0	$0
2039	$0	$0	$0
2040	$0	$0	$0

Targets

View: Accounts

	G	GS	Total
2020	0	0	0
2021	0	0	0
2022	0	0	0
2023	0	0	0
2024	1	1	2
2025	1	1	2
2026	1	1	2
2027	1	1	2
2028	0	0	0
2029	0	0	0
2030	0	0	0
2031	0	0	0
2032	0	0	0
2033	0	0	0
2034	0	0	0
2035	0	0	0
2036	0	0	0
2037	0	0	0
2038	0	0	0
2039	0	0	0
2040	0	0	0

Water Savings

Units: afy

	Total Savings (afy)
2020	0.000000
2021	0.000000
2022	0.000000
2023	0.000000
2024	0.411582
2025	0.823164
2026	1.234746
2027	1.646328
2028	1.646328
2029	1.646328
2030	1.646328
2031	1.646328
2032	1.646328
2033	1.646328
2034	1.646328
2035	1.646328
2036	1.646328
2037	1.646328
2038	1.646328
2039	1.646328
2040	1.646328

Dedicated Irrigation Meters & Irrigation Account Rate Structure

Dedicated Irrigation Meters & Irrigation Account Rate Structure

Overview

Name	Dedicated Irrigation Meters & Irrigation Account Rate Structure
Abbr	6
Category	Default
Measure Type	Standard Measure

Time Period	
First Year	2030
Last Year	2040
Measure Length	11

Measure Life	
Permanent	☑

Fixture Cost per Device

	Utility	Customer	Fix/Acct
MF	$52.00	$200.00	1
C	$52.00	$200.00	1
CS	$52.00	$200.00	1
IN	$52.00	$200.00	1
G	$52.00	$200.00	1
GS	$52.00	$200.00	1

Administration Costs

Method: Percent

Markup Percentage	18%

Description

This measure would require that dedicated irrigation meters be installed for all new customer classes except R, NEW SF, MSU, and LI. An irrigable area threshold would be set indicating when an account would be required to have a separate irrigation meter.

Customer Classes

R	MF	C	CS	IN	G	GS	MSU	LI	New_SF
☐	☑	☑	☑	☑	☑	☑	☐	☐	☐

End Uses

	R	MF	C	CS	IN	G	GS	MSU	LI	New_SF
Toilets		☐	☐	☐	☐	☐	☐			
Urinals			☐	☐	☐	☐	☐			
Lavatory Faucets		☐	☐	☐	☐	☐	☐			
Showers		☐	☐	☐	☐	☐	☐			
Dishwashers		☐	☐	☐	☐	☐	☐			
Clothes Washers		☐	☐	☐	☐	☐	☐			
Process			☐	☐	☐					
Kitchen Spray Rinse			☐	☐		☐	☐			
Internal Leakage		☐	☐	☐	☐	☐	☐			
Baths		☐								
Other		☐	☐	☐	☐	☐	☐			
Non-Lavatory/Kitchen Faucets		☐	☐	☐	☐	☐	☐			
Irrigation		☑	☑	☑	☑	☑	☑			
Pools		☐								
Wash Down		☐								
Car Washing		☐								
External Leakage		☑	☑	☑	☑	☑	☑			
Outdoor										
Cooling			☐	☐	☐	☐	☐			

Comments

• Utility Cost: Cost for the meter will come from the operations department budget, not water conservation. This measure will only be targeting new accounts and not retrofitting. Because a rate study would be included as part of this measure, an assumed conservation dept. utility cost of $15,000 is included for the rate study. Assumes rate study would be every 5 years, therefore $15k x 3 (2030, 2035, 2040) = $45k over time period of the measure - distributed annually. This breaks outs to an annual cost of ~$4,100 for the 11 year time period.

• Admin Markup: minimal for water conservation dept. tracking only (occasional). Assumes approx. 200 hours of staff time to set up an average rate of $38.39/hr. which is an average between Water conservation manager (fully burdened cost = $46.86/hr.) and water conservation technician (fully burdened cost = $29.92/hr.).
Most of the staff time is assumed to be during the start up of the program. This time is spread out through the length of the measure.

• Customer Cost: Cost for checking leaks, etc. There will be no cost to customer for the meter.

• End Use Water Savings: Using variance program and Aurora program estimates that, on average, customers are 15% over budget or "expected" water use. Customers will become slightly more efficient on average due to the cost of being inefficient so assume 1.5%-3% savings. Minimal savings are assumed to avoid a double count with the Landscape Ordinance measure.

• Targets: This measure is not a retrofit measure and is only targeting new accounts. 45% of new development is targeted.

Results

Units: AF

Average Water Savings (afy)	
	1.581744
Lifetime Savings - Present Value ($)	
Utility	$41,168
Community	$41,168
Lifetime Costs - Present Value ($)	
Utility	$44,601
Community	$189,974
Benefit to Cost Ratio	
Utility	0.92
Community	0.22
Cost of Savings per Unit Volume ($/af)	
Utility	$1,343

End Use Savings Per Replacement

Method: Percent

	% Savings/Acct	Avg GPD/Acct
MF Irrigation	3.0%	99.8
C Irrigation	3.0%	242.4
CS Irrigation	3.0%	537.9
IN Irrigation	3.0%	11,943.3
G Irrigation	3.0%	942.1
GS Irrigation	3.0%	806.6
MF External Leakage	1.5%	8.4
C External Leakage	1.5%	21.7
CS External Leakage	1.5%	48.3
IN External Leakage	1.5%	1,145.2
G External Leakage	1.5%	84.5
GS External Leakage	1.5%	72.4

Targets

Target Method: Percentage

% of Accts Targeted/Yr.	45.000%
Only Affects New Accts.	☑

Costs

View: Utility Detai

	Fixture Costs	Admin Costs	Util Total
2020	$0	$0	$0
2021	$0	$0	$0
2022	$0	$0	$0
2023	$0	$0	$0
2024	$0	$0	$0
2025	$0	$0	$0
2026	$0	$0	$0
2027	$0	$0	$0
2028	$0	$0	$0
2029	$0	$0	$0
2030	$3,822	$688	$4,510
2031	$3,947	$710	$4,657
2032	$4,076	$734	$4,810
2033	$4,210	$758	$4,968
2034	$4,348	$783	$5,131
2035	$4,491	$808	$5,299
2036	$4,638	$835	$5,473
2037	$4,790	$862	$5,652
2038	$4,947	$890	$5,837
2039	$5,109	$920	$6,029
2040	$5,277	$950	$6,226

Targets

View: Accounts

	MF	C	CS	IN	G	GS	Total
2020	0	0	0	0	0	0	0
2021	0	0	0	0	0	0	0
2022	0	0	0	0	0	0	0
2023	0	0	0	0	0	0	0
2024	0	0	0	0	0	0	0
2025	0	0	0	0	0	0	0
2026	0	0	0	0	0	0	0
2027	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0
2030	47	23	2	0	1	0	73
2031	49	24	3	0	1	0	76
2032	50	25	3	0	1	0	78
2033	52	25	3	0	1	0	81
2034	53	26	3	0	1	0	84
2035	55	27	3	0	1	0	86
2036	57	28	3	0	1	0	89
2037	59	29	3	0	1	0	92
2038	60	30	3	0	1	0	95
2039	62	31	3	0	1	0	98
2040	64	32	3	0	1	0	101

Water Savings

Units: afy

	Total Savings (afy)
2020	0.000000
2021	0.000000
2022	0.000000
2023	0.000000
2024	0.000000
2025	0.000000
2026	0.000000
2027	0.000000
2028	0.000000
2029	0.000000
2030	0.449142
2031	0.913326
2032	1.393057
2033	1.888857
2034	2.401266
2035	2.930842
2036	3.478160
2037	4.043817
2038	4.628429
2039	5.232634
2040	5.857088

Impact Fee Credit

Impact Fee Credit

Overview

Name	Impact Fee Credit
Abbr	7
Category	Default
Measure Type	Standard Measure

Time Period

First Year	2025
Last Year	2033
Measure Length	9

Measure Life

Permanent	☐
Years	15
Repeat	☐

Fixture Cost per Device

	Utility	Customer	Fix/Acct
MF	$0.01	$5,521.98	1
C	$0.01	$7,907.46	1
CS	$0.01	$7,907.46	1
LI	$0.01	$5,521.98	1
New_SF	$0.01	$5,521.98	1

Administration Costs

Method: Fixed

Annual Admin Costs	$9,086

Description

The purpose of an impact fee credit is to promote non-turf landscaping in some area of a customer's property - might be the front yard of residential homes. It is also designed to promote more water efficient device installation indoors. A credit amount would be established to offset any cost a developer might incur from installing the more expensive landscaping or fixtures. Any plants would come off the utility's recommended xeriscape/low water plant list. This measure also includes indoor water use.

Comments

- Utility Cost: No conservation department cost. There would be an impact fee credit, likely the same amount as the customer cost to install the more efficient fixtures and landscaping (warranting the credit).
- Admin Markup: Admin of the program is ~4 staff hrs. per account for compliance ($29.92/hr. is the fully burdened water conservation cost, assuming 15% of new MF, C, and CS, LI, and NEW_SF accounts are participating).
- Customer Cost: Customer cost represents the impact fee with 20% "credit" removed. The average 2020 impact fee for residential properties (SF, RES, Duplexes, Townhomes, and ADUs) was $6,902. The average 2020 impact fee for commercial properties was $9,884. The customer cost displayed in this model is the impact fee MINUS 20% assumed credit.
- End Use Water Savings: Overall savings across all end uses is 20%
- Targets: Assumes 15% of new accounts would participate.
- Time Period: As this measure sunsets, the "Mandatory Offsets" measure will begin. Start year 2025 - hiring/conducting an impact fee study fiscal year 2022, so a credit would likely be adopted by 2025.

Customer Classes

R	MF	C	CS	IN	G	GS	MSU	LI	New_SF
☐	☑	☑	☑	☐	☐	☐	☐	☑	☑

End Uses

	R	MF	C	CS	IN	G	GS	MSU	LI	New_SF
Toilets		☑	☑	☑					☑	☑
Urinals			☑	☑						
Lavatory Faucets		☑	☑	☑					☑	☑
Showers		☑	☑	☑					☑	☑
Dishwashers		☑	☑	☑					☑	☑
Clothes Washers		☑	☑	☑					☑	☑
Process			☑	☑						
Kitchen Spray Rinse			☑	☑						
Internal Leakage		☑	☑	☑					☑	☑
Baths		☑							☑	☑
Other		☑	☑	☑					☑	☑
Non-Lavatory/Kitchen Faucets		☑	☑	☑					☑	☑
Irrigation		☑	☑	☑					☑	☑
Pools		☑							☑	☑
Wash Down		☑							☑	☑
Car Washing		☑							☑	☑
External Leakage		☑	☑	☑					☑	☑
Outdoor										
Cooling			☑	☑						

Results

Units: AF

Average Water Savings (afy)	
34.204107	
Lifetime Savings - Present Value ($)	
Utility	$957,338
Community	$1,220,446
Lifetime Costs - Present Value ($)	
Utility	$69,679
Community	$3,396,050
Benefit to Cost Ratio	
Utility	13.74
Community	0.36
Cost of Savings per Unit Volume ($/af)	
Utility	$97

End Use Savings Per Replacement

Method: Percent

	% Savings/Acct	Avg GPD/Acct		% Savings/Acct	Avg GPD/Acct
MF Toilets	20.0%	96.8	MF Wash Down	20.0%	4.8
C Toilets	20.0%	150.1	MF Car Washing	20.0%	4.8
CS Toilets	20.0%	52.1	MF External Lea	20.0%	8.4
C Urinals	20.0%	45.0	C External Leaka	20.0%	21.7
CS Urinals	20.0%	20.8	CS External Leal	20.0%	48.3
MF Lavatory Faucets	20.0%	26.5	C Cooling	20.0%	46.6
C Lavatory Faucets	20.0%	56.8	CS Cooling	20.0%	103.4
CS Lavatory Faucets	20.0%	26.3	LI Toilets	20.0%	19.1
MF Showers	20.0%	75.7	New_SF Toilets	20.0%	23.3
C Showers	20.0%	67.6	LI Lavatory Fauc	20.0%	5.2
CS Showers	20.0%	31.3	New_SF Lavatory	20.0%	6.4
MF Dishwashers	20.0%	4.8	LI Showers	20.0%	14.9
C Dishwashers	20.0%	45.0	New_SF Shower	20.0%	18.2
CS Dishwashers	20.0%	20.8	LI Dishwashers	20.0%	0.9
MF Clothes Washers	20.0%	65.5	New_SF Dishwa	20.0%	1.2
C Clothes Washers	20.0%	112.6	LI Clothes Wash	20.0%	12.9
CS Clothes Washers	20.0%	52.1	New_SF Clothes	20.0%	15.8
C Process	20.0%	105.1	LI Internal Leaka	20.0%	10.6
CS Process	20.0%	48.6	New_SF Internal	20.0%	13.0
C Kitchen Spray Rinse	20.0%	37.5	LI Baths	20.0%	2.0
CS Kitchen Spray Rinse	20.0%	17.4	New_SF Baths	20.0%	2.5
MF Internal Leakage	20.0%	53.9	LI Other	20.0%	3.4
C Internal Leakage	20.0%	45.0	New_SF Other	20.0%	4.1
CS Internal Leakage	20.0%	34.7	LI Non-Lavatory/K	20.0%	9.7
MF Baths	20.0%	10.2	New_SF Non-Lav	20.0%	11.9
MF Other	20.0%	17.0	LI Irrigation	20.0%	54.9
C Other	20.0%	37.5	New_SF Irrigatio	20.0%	162.3
CS Other	20.0%	20.8	LI Pools	20.0%	1.3
MF Non-Lavatory/Kitchen	20.0%	49.2	New_SF Pools	20.0%	3.9
C Non-Lavatory/Kitchen F	20.0%	48.3	LI Wash Down	20.0%	2.6
CS Non-Lavatory/Kitchen	20.0%	22.4	New_SF Wash D	20.0%	7.8
MF Irrigation	20.0%	99.8	LI Car Washing	20.0%	2.6
C Irrigation	20.0%	242.4	New_SF Car Wa	20.0%	7.8
CS Irrigation	20.0%	537.9	LI External Leaka	20.0%	4.6
MF Pools	20.0%	2.4	New_SF Externa	20.0%	13.7

Targets

Target Method: Percentage

% of Accts Targeted/Yr.	15.000%
Only Affects New Accts	☑

Costs

View: Utility Detail

	Fixture Costs	Admin Costs	Util Total
2020	$0	$0	$0
2021	$0	$0	$0
2022	$0	$0	$0
2023	$0	$0	$0
2024	$0	$0	$0
2025	$1	$9,086	$9,087
2026	$1	$9,086	$9,087
2027	$1	$9,086	$9,087
2028	$1	$9,086	$9,087
2029	$1	$9,086	$9,087
2030	$1	$9,086	$9,087
2031	$1	$9,086	$9,087
2032	$1	$9,086	$9,087
2033	$1	$9,086	$9,087
2034	$0	$0	$0
2035	$0	$0	$0
2036	$0	$0	$0
2037	$0	$0	$0
2038	$0	$0	$0
2039	$0	$0	$0
2040	$0	$0	$0

Targets

View: Accounts

	MF	C	CS	LI	New_SF	Total
2020	0	0	0	0	0	0
2021	0	0	0	0	0	0
2022	0	0	0	0	0	0
2023	0	0	0	0	0	0
2024	0	0	0	0	0	0
2025	13	6	1	1	45	66
2026	14	7	1	1	46	68
2027	14	7	1	1	48	70
2028	15	7	1	1	49	73
2029	15	7	1	1	51	75
2030	16	8	1	1	52	77
2031	16	8	1	1	54	80
2032	17	8	1	1	56	83
2033	17	8	1	1	57	85
2034	0	0	0	0	0	0
2035	0	0	0	0	0	0
2036	0	0	0	0	0	0
2037	0	0	0	0	0	0
2038	0	0	0	0	0	0
2039	0	0	0	0	0	0
2040	0	0	0	0	0	0

Water Savings

Units: afy

	Total Savings (afy)
2020	0.000000
2021	0.000000
2022	0.000000
2023	0.000000
2024	0.000000
2025	6.123842
2026	12.413842
2027	18.875319
2028	25.513772
2029	32.334875
2030	39.344478
2031	46.548602
2032	53.958776
2033	61.583076
2034	61.444875
2035	61.312480
2036	61.185411
2037	61.063232
2038	60.945547
2039	60.831997
2040	54.806135

Financial Incentives for Irrigation and Landscape Upgrades

Financial Incentives for Irrigation and Landscape Upgrades

Overview

Name	Financial Incentives for Irrigation and Landscape Upgrades
Abbr	8
Category	Default
Measure Type	Standard Measure

Time Period

First Year	2020
Last Year	2040
Measure Length	21

Measure Life

Permanent	
Years	10
Repeat	

Fixture Cost per Device

	Utility	Customer	Fix/Acct
R	$200.00	$100.00	1
MF	$300.00	$300.00	1
CS	$300.00	$300.00	1
IN	$300.00	$300.00	1
LI	$200.00	$100.00	1

Administration Costs

Method: Percent

Markup Percentage	27%

Description

For SF, MF, CII customers with landscape, provide a Smart Landscape Rebate Program with rebates for substantive landscape retrofits or installation of water efficient upgrades; Rebates contribute towards the purchase of selected types of irrigation equipment upgrades (weather-based irrigation controllers, MSMT nozzles, rain sensors, drip irrigation). Rebate for residential accounts and up to 50% more for commercial customers. Landscape conversion and turf removal is not part of this measure.

Customer Classes

R	MF	C	CS	IN	G	GS	MSU	LI	New_SF
☑	☑	☐	☑	☑	☐	☐	☐	☑	☐

End Uses

	R	MF	C	CS	IN	G	GS	MSU	LI	New_SF
Toilets	☐	☐		☐	☐				☐	
Urinals				☐	☐					
Lavatory Faucets	☐	☐		☐	☐				☐	
Showers	☐	☐		☐	☐				☐	
Dishwashers	☐	☐		☐	☐				☐	
Clothes Washers	☐	☐		☐	☐				☐	
Process				☐	☐					
Kitchen Spray Rinse				☐						
Internal Leakage	☐	☐		☐	☐				☐	
Baths	☐	☐							☐	
Other	☐	☐		☐	☐				☐	
Non-Lavatory/Kitchen Faucets	☐	☐		☐	☐				☐	
Irrigation	☑	☑		☑	☑				☑	
Pools	☐	☐							☐	
Wash Down	☐	☐							☐	
Car Washing	☐	☐							☐	
External Leakage	☐	☐		☐	☐				☐	
Outdoor										
Cooling				☐	☐					

Results

Units: AF

Average Water Savings (afy)	
	11.873091
Lifetime Savings - Present Value ($)	
Utility	$336,346
Community	$336,346
Lifetime Costs - Present Value ($)	
Utility	$348,144
Community	$532,466
Benefit to Cost Ratio	
Utility	0.97
Community	0.63
Cost of Savings per Unit Volume ($/af)	
Utility	$1,396

End Use Savings Per Replacement

Method: Percent

	% Savings/Acct	Avg GPD/Acct
R Irrigation	20.1%	91.2
MF Irrigation	20.1%	99.8
CS Irrigation	20.1%	537.9
IN Irrigation	20.1%	11,943.3
LI Irrigation	20.1%	54.9

Targets

Target Method: Percentage

% of Accts Targeted/Yr.	0.500%
Only Affects New Accts	☐

Comments

• Utility Cost: The City's outdoor rebate amount is dependent on if the account is new construction or a retrofit.
> WBIC: up to $250 for retrofit and up to $150 for new construction
> HE Nozzles: up to $5/nozzle (min of 5) for retrofit and up to $3/nozzle (min of 5) for new construction
> Rain Sensors: Up to $50 for retrofit and up to $30 for new construction
> Drip irrigation equipment: Up to $250 for both retrofit and new construction
> Utility unit cost is derived by average number of annual rebates from 2017 - 2020, with a higher utility cost for CII/MF, assuming that they would purchase more HE nozzles and sq. ft. of drip area.
• Admin Markup: Assumes admin time spent processing outdoor rebates is 2.5 hours/week. This is ~130 staff hours annually processing outdoor rebates. Admin time assumes 130 hours a year at fully burdened rate for water conservation technician ($29.92/hr.). 130 x $29.92 = ~$3,900 annually.
• Customer Cost: Customer costs per account will vary significantly based on devices.
• End Use Water Savings: The water savings are based on the following from the 2018 Landscape Rebate Water Savings Study from Valley Water:
> The annual water savings for replacing timer-based automatic irrigation controllers with weather-based irrigation controllers with rain shut-off devices were statistically significant each year following conversion, incrementally increased each year following conversion, and were on average 9 gal/ft2/yr. or an average of 27%
> The annual water savings for replacing old sprinklers with high-efficiency nozzles were 1,243 gal/unit/yr. on average. or an average of 15.3%
>Annual savings for replacing old sprinklers with high-efficiency nozzles including pressure regulation and/or check valves were significant in the first year following conversion, saving 1,661 gal/unit/yr. on average, or an average of 18%.
> Total average irrigation savings is 20.1%
> Soil moisture sensor savings may be 20% of irrigation use is based on more than 10 California site water use reports conducted over multiple months in years 2015-2017 as provided by Brian Holland www.sustainablewatersavings.com. Studies show a range of 20%-60% savings for trained soil moisture sensor device installation and site management. A lower savings estimate is assumed for layperson usage and non-drought normal planning years. The manufacturer claims device batteries last 10-12 years.
• Targets: Per historical outdoor rebate data provided by Bozeman staff, annual average number of outdoor rebates for both retrofit and new build from 2017 - 2020 is ~50. This excludes HE nozzles, as it is assumed accounts that get one set of outdoor rebate devices will likely get nozzles as well. Targets increased in the model, as the City would like to target more accounts. NEW_SF accounts not included as they should already have proper landscape and irrigation equipment per the landscape ordinance measures.

Costs

View: Utility Detai

	Fixture Costs	Admin Costs	Util Total
2020	$14,041	$3,791	$17,831
2021	$14,170	$3,826	$17,996
2022	$14,304	$3,862	$18,166
2023	$14,442	$3,899	$18,341
2024	$14,584	$3,938	$18,521
2025	$14,731	$3,977	$18,708
2026	$14,882	$4,018	$18,900
2027	$15,038	$4,060	$19,099
2028	$15,199	$4,104	$19,303
2029	$15,366	$4,149	$19,515
2030	$15,537	$4,195	$19,733
2031	$15,715	$4,243	$19,957
2032	$15,897	$4,292	$20,189
2033	$16,086	$4,343	$20,429
2034	$16,280	$4,396	$20,676
2035	$16,481	$4,450	$20,931
2036	$16,688	$4,506	$21,194
2037	$16,901	$4,563	$21,465
2038	$17,122	$4,623	$21,745
2039	$17,349	$4,684	$22,034
2040	$17,584	$4,748	$22,332

Targets

View: Accounts

	R	MF	CS	IN	LI	Total
2020	50	13	1	0	1	64
2021	50	13	1	0	1	64
2022	50	13	1	0	1	65
2023	50	14	1	0	1	65
2024	50	14	1	0	1	66
2025	50	15	1	0	1	66
2026	50	15	1	0	1	67
2027	50	16	1	0	1	67
2028	50	16	1	0	1	68
2029	50	17	1	0	1	68
2030	50	17	1	0	1	69
2031	50	18	1	0	1	69
2032	50	18	1	0	1	70
2033	50	19	1	0	1	71
2034	50	19	1	0	1	71
2035	50	20	1	0	1	72
2036	50	21	1	0	1	73
2037	50	21	1	0	1	73
2038	50	22	1	0	1	74
2039	50	23	1	0	1	75
2040	50	23	1	0	1	76

Water Savings

Units: afy

	Total Savings (afy)
2020	1.396290
2021	2.804643
2022	4.225451
2023	5.659117
2024	7.106057
2025	8.566702
2026	10.041497
2027	11.530900
2028	13.035384
2029	14.555439
2030	14.695279
2031	14.839652
2032	14.988706
2033	15.142593
2034	15.301469
2035	15.465497
2036	15.634844
2037	15.809683
2038	15.990193
2039	16.176557
2040	16.368966

Landscape Conversion or Turf Removal Rebate

Landscape Conversion or Turf Removal Rebate

Overview

Name	Landscape Conversion or Turf Removal Rebate
Abbr	9
Category	Default
Measure Type	Standard Measure

Time Period	
First Year	2022
Last Year	2040
Measure Length	19

Measure Life	
Permanent	☐
Years	20
Repeat	☐

Fixture Cost per Device

	Utility	Customer	Fix/Acct
R	$450.00	$2,000.00	1
MF	$2,000.00	$18,000.00	1
C	$2,000.00	$18,000.00	1
CS	$2,000.00	$18,000.00	1
IN	$2,000.00	$18,000.00	1
LI	$450.00	$2,000.00	1

Administration Costs

Method:	Percent
Markup Percentage	10%

Description

Provide a per square foot incentive to remove turf and replace with low water use plants or permeable hardscape. Landscape conversion could include conversion of turf to lower-water-using turf varieties. Rebate based on dollars per square foot removed, and capped at an upper limit for SF, MF and CII.

Customer Classes

R	MF	C	CS	IN	G	GS	MSU	LI	New_SF
☑	☑	☑	☑	☑	☐	☐	☐	☑	☐

End Uses

	R	MF	C	CS	IN	G	GS	MSU	LI	New_SF
Toilets	☐	☐	☐	☐	☐				☐	
Urinals			☐	☐	☐					
Lavatory Faucets	☐	☐	☐	☐	☐				☐	
Showers	☐	☐	☐	☐	☐				☐	
Dishwashers	☐	☐	☐	☐	☐				☐	
Clothes Washers	☐	☐	☐	☐	☐				☐	
Process			☐	☐	☐					
Kitchen Spray Rinse			☐	☐						
Internal Leakage	☐	☐	☐	☐	☐				☐	
Baths	☐	☐							☐	
Other	☐	☐	☐	☐	☐				☐	
Non-Lavatory/Kitchen Faucets	☐	☐	☐	☐	☐				☐	
Irrigation	☑	☑	☑	☑	☑				☑	
Pools	☐	☐							☐	
Wash Down	☐	☐							☐	
Car Washing	☐	☐							☐	
External Leakage	☐	☐	☐	☐	☐				☐	
Outdoor										
Cooling			☐	☐	☐					

Comments

- Utility Cost: Assume rebate of $1/sq. foot of turf removed which equates to approximately 25% of total project cost. Assume MF/CII utility costs ($2,000) and SF costs ($450) are based on average irrigable area of 4,033 sq ft from the low size assumptions workbook for landscape ordinance measures). Assume large sites have more than one meter, therefore large sites can qualify for multiple rebates to make it a worthwhile effort with a higher total site incentive value.
- Admin Markup: Assumes staff time to run the measure (including pre and post site inspections).
- Customer Cost: Remaining cost to update landscape site
- End Use Water Savings: Water savings based Bozeman analysis that a typical participant in this program removes 1,000 SF of turf and replaces it with drought tolerant vegetation, they will reduce total outdoor water use by ~20%. If they remove 1,500 SF, they will reduce use by 30%.
- Targets: NEW_SF accounts not included as they should already have proper landscape and irrigation equipment per the landscape ordinance measures.

Results

Units	AF
Average Water Savings (afy)	
	42.716168
Lifetime Savings - Present Value ($)	
Utility	$1,167,822
Community	$1,167,822
Lifetime Costs - Present Value ($)	
Utility	$2,596,488
Community	$20,569,483
Benefit to Cost Ratio	
Utility	0.45
Community	0.06
Cost of Savings per Unit Volume ($/af)	
Utility	$2,895

End Use Savings Per Replacement

Method:	Percent	
	% Savings/Acct	Avg GPD/Acct
R Irrigation	25.0%	91.2
MF Irrigation	25.0%	99.8
CS Irrigation	25.0%	537.9
IN Irrigation	25.0%	11,943.3
LI Irrigation	25.0%	54.9
C Irrigation	25.0%	242.4

Targets

Target Method:	Percentage
% of Accts Targeted/Yr.	1.000%
Only Affects New Accts	☐

Costs

View: Utility Detai

	Fixture Costs	Admin Costs	Util Total
2020	$0	$0	$0
2021	$0	$0	$0
2022	$124,117	$12,412	$136,529
2023	$126,709	$12,671	$139,380
2024	$129,385	$12,939	$142,324
2025	$132,150	$13,215	$145,365
2026	$135,005	$13,500	$148,505
2027	$137,953	$13,795	$151,748
2028	$140,998	$14,100	$155,098
2029	$144,143	$14,414	$158,557
2030	$147,391	$14,739	$162,130
2031	$150,745	$15,075	$165,820
2032	$154,210	$15,421	$169,631
2033	$157,788	$15,779	$173,567
2034	$161,483	$16,148	$177,631
2035	$165,300	$16,530	$181,829
2036	$169,241	$16,924	$186,165
2037	$173,312	$17,331	$190,643
2038	$177,516	$17,752	$195,268
2039	$181,859	$18,186	$200,044
2040	$186,343	$18,634	$204,978

Targets

View: Accounts

	R	MF	C	CS	IN	LI	Total
2020	0	0	0	0	0	0	0
2021	0	0	0	0	0	0	0
2022	100	27	11	1	0	2	141
2023	100	27	12	1	0	2	142
2024	100	28	12	1	0	2	143
2025	100	29	13	1	0	2	145
2026	100	30	13	1	0	2	146
2027	100	31	14	1	0	2	148
2028	100	32	14	1	0	2	149
2029	100	33	15	2	0	2	151
2030	100	34	15	2	0	2	153
2031	100	35	16	2	0	2	154
2032	100	36	16	2	0	2	156
2033	100	38	17	2	0	2	158
2034	100	39	17	2	0	2	160
2035	100	40	18	2	0	2	162
2036	100	41	18	2	0	3	164
2037	100	42	19	2	0	3	166
2038	100	44	20	2	0	3	168
2039	100	45	20	2	0	3	170
2040	100	47	21	2	0	3	173

Water Savings

Units: afy

	Total Savings (afy)
2020	0.000000
2021	0.000000
2022	4.309874
2023	8.678877
2024	13.108994
2025	17.602281
2026	22.160859
2027	26.786923
2028	31.482741
2029	36.250658
2030	41.093098
2031	46.012565
2032	51.011651
2033	56.093031
2034	61.259474
2035	66.513839
2036	71.859085
2037	77.298267
2038	82.834546
2039	88.471188
2040	94.211569

Capital Project – HE Fixture Installation in Gov't Bldg.

Capital Project - HE Fixture Installation in Gov't Bldg.

Overview

Name	Capital Project - HE Fixture Installatio
Abbr	10
Category	Default
Measure Type	Standard Measure

Time Period

First Year	2025
Last Year	2034
Measure Length	10

Measure Life

Permanent ☑

Fixture Cost per Device

	Utility	Customer	Fix/Acct
G	$3,000.00	$0.00	1

Administration Costs

Method: Percent

Markup Percentage	10%

Description

Direct install high efficiency faucets, toilets, urinals and showerheads in City facilities.

Customer Classes

R	MF	C	CS	IN	G	GS	MSU	LI	New_SF
☐	☐	☐	☐	☐	☑	☐	☐	☐	☐

End Uses

	R	MF	C	CS	IN	G	GS	MSU	LI	New_SF
Toilets						☑				
Urinals						☑				
Lavatory Faucets						☑				
Showers						☑				
Dishwashers						☐				
Clothes Washers						☐				
Process										
Kitchen Spray Rinse						☐				
Internal Leakage						☐				
Baths										
Other						☐				
Non-Lavatory/Kitchen Faucets						☑				
Irrigation						☐				
Pools										
Wash Down										
Car Washing										
External Leakage						☐				
Outdoor										
Cooling						☐				

Results

Units: AF

Average Water Savings (afy)	
	2.362438
Lifetime Savings - Present Value ($)	
Utility	$67,522
Community	$79,816
Lifetime Costs - Present Value ($)	
Utility	$83,620
Community	$83,620
Benefit to Cost Ratio	
Utility	0.81
Community	0.95
Cost of Savings per Unit Volume ($/af)	
Utility	$1,686

End Use Savings Per Replacement

Method: Percent

	% Savings/Acct	Avg GPD/Acct
G Toilets	31.0%	100.2
G Urinals	88.0%	30.1
G Lavatory Faucets	80.0%	43.3
G Showers	28.0%	50.1
G Non-Lavatory/Kitchen Faucets	60.0%	36.9

Targets

Target Method: Count

# of Accts Targeted/Yr.	3

Comments

• Utility Cost: Per "Facility Park Indoor" worksheet provided by City of Bozeman (9-22-2021), average number of toilets and urinals to be upgraded across facilities is ~4 toilets, and ~1 urinal. Per the Senior Center Retrofit Cost worksheet in the updated file (dated 11/23/2021), the project cost $9,359 for 15 toilets, 2 urinals, toilet seats, and installation material, labor, diagnostic fee and permit. Scaled cost to average number of toilets/urinals to be replaced comes out to $2,717. Rounded utility cost to $3,000 to account for addition of showerheads and faucets.
• Admin Markup: 10% admin time for conservation staff to facilitate this measure (inventory, checking, etc.) Approx. 10 hours of water conservation technician staff time per project.
• Customer Cost: No cost to customers.
• End Use Water Savings: Savings based off of Water Savings from Senior Center Plumbing Fixture Retrofit Project (toilets, urinals, faucets) provided by the City of Bozeman. Percent change from pre- to post- retrofit was 41.44% savings.
> Toilets: Assumes 25% of old toilets are high flow (3.5 gpf) and 75% are 1.6 gpf. All toilets getting replaced with 1.28 gpf. (25% of toilets have 63% savings and 75% of toilets have 20% savings, for total savings of 30%)
> Urinals: Assumes 1.0 gpf urinals replaced with pint urinals.
> Lavatory Faucets: Assumes 2.5 gpm faucets replaced with 0.5 gpm faucets.
> Showerheads: Assumes 2.5 gpm showerheads replaced with 1.8 gpm showerheads.
> Kitchen/Non-Lavatory faucets: Assumes 2.5 gpm faucets replaced with 1.0 gpm faucets.
• Targets: Based on the "Facility Park Indoor" worksheet provided by City of Bozeman (9-22-2021), approximately 30 City Owned indoor sites to be retrofitted over a 10 year period. Can target 3 sites per year.

Costs

View: Utility Detai

	Fixture Costs	Admin Costs	Util Total
2020	$0	$0	$0
2021	$0	$0	$0
2022	$0	$0	$0
2023	$0	$0	$0
2024	$0	$0	$0
2025	$9,000	$900	$9,900
2026	$9,000	$900	$9,900
2027	$9,000	$900	$9,900
2028	$9,000	$900	$9,900
2029	$9,000	$900	$9,900
2030	$9,000	$900	$9,900
2031	$9,000	$900	$9,900
2032	$9,000	$900	$9,900
2033	$9,000	$900	$9,900
2034	$9,000	$900	$9,900
2035	$0	$0	$0
2036	$0	$0	$0
2037	$0	$0	$0
2038	$0	$0	$0
2039	$0	$0	$0
2040	$0	$0	$0

Targets

View: Accounts

	G	Total
2020	0	0
2021	0	0
2022	0	0
2023	0	0
2024	0	0
2025	3	3
2026	3	3
2027	3	3
2028	3	3
2029	3	3
2030	3	3
2031	3	3
2032	3	3
2033	3	3
2034	3	3
2035	0	0
2036	0	0
2037	0	0
2038	0	0
2039	0	0
2040	0	0

Water Savings

Units: afy

	Total Savings (afy)
2020	0.000000
2021	0.000000
2022	0.000000
2023	0.000000
2024	0.000000
2025	0.431402
2026	0.862803
2027	1.294205
2028	1.725607
2029	2.157009
2030	2.588410
2031	3.019812
2032	3.451214
2033	3.882616
2034	4.314017
2035	4.314017
2036	4.314017
2037	4.314017
2038	4.314017
2039	4.314017
2040	4.314017

School Building Retrofit

School Building Retrofit

Overview	
Name	School Building Retrofit
Abbr	11
Category	Default
Measure Type	Standard Measure

Time Period	
First Year	2030
Last Year	2040
Measure Length	11

Measure Life	
Permanent	☑

Fixture Cost per Device	Utility	Customer	Fix/Acct
C	$5,000.00	$5,000.00	1

Administration Costs	
Method:	Percent
Markup Percentage	3%

Description

School retrofit program wherein school receives a grant to replace fixtures and upgrade irrigation systems.

Customer Classes	R	MF	C	CS	IN	G	GS	MSU	LI	New_S
	☐	☐	☑	☐	☐	☐	☐	☐	☐	☐

End Uses	R	MF	C	CS	IN	G	GS	MSU	LI	New_S
Toilets			☑							
Urinals			☑							
Lavatory Faucets			☑							
Showers			☑							
Dishwashers			☑							
Clothes Washers			☑							
Process			☑							
Kitchen Spray Rinse			☑							
Internal Leakage			☑							
Baths										
Other			☑							
Non-Lavatory/Kitchen Faucets			☑							
Irrigation			☑							
Pools										
Wash Down										
Car Washing										
External Leakage			☑							
Outdoor										
Cooling			☑							

Comments

- Utility Cost: $5,000 utility cost assumes replacement of high use toilets and some irrigation system improvement (where applicable).
- Admin Markup: Assumes 3-5 hours of staff time, at the water conservation technician's full burdened rate of $29.92/hr. This would include pre- and post- inspections and paperwork.
- Customer Cost: Assumes cost of installation and remainder of devices.
- End Use Water Savings: Savings similar to CII survey and incentive measures combined.
- Targets: Per Public Schools file provided by City of Bozeman staff, there are 13 public schools in the service area. Assumes 1 school targeted per year.

Results	
Units	AF
Average Water Savings (afy)	
0.528181	
Lifetime Savings - Present Value ($)	
Utility	$14,264
Community	$19,049
Lifetime Costs - Present Value ($)	
Utility	$43,372
Community	$85,481
Benefit to Cost Ratio	
Utility	0.33
Community	0.22
Cost of Savings per Unit Volume ($/af)	
Utility	$3,910

End Use Savings Per Replacement

Method: Percent

	% Savings/Acct	Avg GPD/Acct
C Toilets	15.0%	150.1
C Urinals	15.0%	45.0
C Lavatory Faucets	15.0%	56.8
C Showers	15.0%	67.6
C Dishwashers	15.0%	45.0
C Clothes Washers	15.0%	112.6
C Process	15.0%	105.1
C Kitchen Spray Rinse	15.0%	37.5
C Internal Leakage	15.0%	45.0
C Other	15.0%	37.5
C Non-Lavatory/Kitchen Faucets	15.0%	48.3
C Irrigation	15.0%	242.4
C External Leakage	15.0%	21.7
C Cooling	15.0%	46.6

Targets	
Target Method:	Count
# of Accts Targeted/Yr.	1

Costs

View: Utility Detail

	Fixture Costs	Admin Costs	Util Total
2020	$0	$0	$0
2021	$0	$0	$0
2022	$0	$0	$0
2023	$0	$0	$0
2024	$0	$0	$0
2025	$0	$0	$0
2026	$0	$0	$0
2027	$0	$0	$0
2028	$0	$0	$0
2029	$0	$0	$0
2030	$5,000	$150	$5,150
2031	$5,000	$150	$5,150
2032	$5,000	$150	$5,150
2033	$5,000	$150	$5,150
2034	$5,000	$150	$5,150
2035	$5,000	$150	$5,150
2036	$5,000	$150	$5,150
2037	$5,000	$150	$5,150
2038	$5,000	$150	$5,150
2039	$5,000	$150	$5,150
2040	$5,000	$150	$5,150

Targets

View: Accounts

	C	Total
2020	0	0
2021	0	0
2022	0	0
2023	0	0
2024	0	0
2025	0	0
2026	0	0
2027	0	0
2028	0	0
2029	0	0
2030	1	1
2031	1	1
2032	1	1
2033	1	1
2034	1	1
2035	1	1
2036	1	1
2037	1	1
2038	1	1
2039	1	1
2040	1	1

Water Savings

Units: afy

	Total Savings (afy)
2020	0.000000
2021	0.000000
2022	0.000000
2023	0.000000
2024	0.000000
2025	0.000000
2026	0.000000
2027	0.000000
2028	0.000000
2029	0.000000
2030	0.171412
2031	0.341651
2032	0.510804
2033	0.678948
2034	0.846153
2035	1.012482
2036	1.177993
2037	1.342734
2038	1.506753
2039	1.670091
2040	1.832783

CII High Efficiency Washer Rebate

CII High Efficiency Washer Rebate

Overview	
Name	CII High Efficiency Washer Rebate
Abbr	12
Category	Default
Measure Type	Standard Measure

Time Period	
First Year	2028
Last Year	2037
Measure Length	10

Measure Life	
Permanent	☑

Fixture Cost per Device

	Utility	Customer	Fix/Acct
C	$500.00	$1,500.00	4

Administration Costs	
Method:	Percent
Markup Percentage	3%

Description

Offer rebate for commercial grade clothes washers. Target high-use facilities such as laundromats, hotels, etc.

Customer Classes

	R	MF	C	CS	IN	G	GS	MSU	LI	New_S
	☐	☐	☑	☐	☐	☐	☐	☐	☐	☐

End Uses

	R	MF	C	CS	IN	G	GS	MSU	LI	New_S
Toilets			☐							
Urinals			☐							
Lavatory Faucets			☐							
Showers			☐							
Dishwashers			☐							
Clothes Washers			☑							
Process			☐							
Kitchen Spray Rinse			☐							
Internal Leakage			☐							
Baths										
Other			☐							
Non-Lavatory/Kitchen Faucets			☐							
Irrigation			☐							
Pools										
Wash Down										
Car Washing										
External Leakage			☐							
Outdoor										
Cooling			☐							

Comments

- Utility Cost: Rebated value of $500 per washer. Up to 4 washers rebated per site to include laundromats in the service area. There are approx. 5. Assumes laundromats would get more than 4, and other sites 4 or less.
- Admin Markup: Staff time to run program. Assumes ~2 hours per account rebate at conservation technician fully burdened rate of $29.92/hr.
- Customer Cost: Commercial clothes washers cost between $900- $2,500. Customer cost assumes average cost of $2,000. Therefore the remainder of cost after $500 rebate is $1,500.
- End Use Water Savings: Water savings between conventional and Energy Star machines is 45% from Energy Star commercial clothes washer website. https://www.energystar.gov/products/commercial_clothes_washers
- Targets: targeting 1% of CI accounts.

Results

Units	AF
Average Water Savings (afy)	3.659664
Lifetime Savings - Present Value ($)	
Utility	$101,734
Community	$177,152
Lifetime Costs - Present Value ($)	
Utility	$270,166
Community	$1,057,055
Benefit to Cost Ratio	
Utility	0.38
Community	0.17
Cost of Savings per Unit Volume ($/af)	
Utility	$3,515

End Use Savings Per Replacement

Method:	Percent	
	% Savings/Acct	Avg GPD/Acct
C Clothes Washers	45.0%	112.6

Targets

Target Method:	Percentage
% of Accts Targeted/Yr.	1.000%
Only Affects New Accts	☐

Costs

View: Utility Detail

	Fixture Costs	Admin Costs	Util Total
2020	$0	$0	$0
2021	$0	$0	$0
2022	$0	$0	$0
2023	$0	$0	$0
2024	$0	$0	$0
2025	$0	$0	$0
2026	$0	$0	$0
2027	$0	$0	$0
2028	$28,074	$842	$28,917
2029	$29,057	$872	$29,929
2030	$30,074	$902	$30,976
2031	$31,127	$934	$32,060
2032	$32,216	$966	$33,182
2033	$33,344	$1,000	$34,344
2034	$34,511	$1,035	$35,546
2035	$35,718	$1,072	$36,790
2036	$36,969	$1,109	$38,078
2037	$38,262	$1,148	$39,410
2038	$0	$0	$0
2039	$0	$0	$0
2040	$0	$0	$0

Targets

View: Accounts

	C	Total
2020	0	0
2021	0	0
2022	0	0
2023	0	0
2024	0	0
2025	0	0
2026	0	0
2027	0	0
2028	14	14
2029	15	15
2030	15	15
2031	16	16
2032	16	16
2033	17	17
2034	17	17
2035	18	18
2036	18	18
2037	19	19
2038	0	0
2039	0	0
2040	0	0

Water Savings

Units: afy

	Total Savings (afy)
2020	0.000000
2021	0.000000
2022	0.000000
2023	0.000000
2024	0.000000
2025	0.000000
2026	0.000000
2027	0.000000
2028	0.797280
2029	1.622464
2030	2.476530
2031	3.360489
2032	4.275385
2033	5.222304
2034	6.202364
2035	7.216726
2036	8.266592
2037	9.353202
2038	9.353202
2039	9.353202
2040	9.353202

Water Budget-Based Billing and Water Budgeting

Water Budget-Based Billing and Water Budgeting

Overview

Name	Water Budget-Based Billing and Water Budge
Abbr	13
Category	Default
Measure Type	Standard Measure

Time Period	
First Year	2028
Last Year	2040
Measure Length	13

Measure Life	
Permanent	☐
Years	8
Repeat	☐

Fixture Cost per Device

	Utility	Customer	Fix/Acct
R	$500.00	$50.00	1
MF	$500.00	$50.00	1
New_SF	$500.00	$50.00	1

Administration Costs

Method: Percent

Markup Percentage	7%

Description

This measure would develop individualized monthly water budgets for all customers. Water budgets are linked to a rate schedule where rates per unit of water increase when a customer goes above their budget, or decreases if they are below their budget. Budgets are based on size of the irrigated area and average indoor use estimates. These rates have been shown to be effective in reducing landscape irrigation demand (AWWARF Reports). Would require rate study and capable billing software.

Customer Classes

R	MF	C	CS	IN	G	GS	MSU	LI	New_SF
☑	☑	☐	☐	☐	☐	☐	☐	☐	☑

End Uses

	R	MF	C	CS	IN	G	GS	MSU	LI	New_S
Toilets	☐	☐								☐
Urinals										
Lavatory Faucets	☐	☐								☐
Showers	☐	☐								☐
Dishwashers	☐	☐								☐
Clothes Washers	☐	☐								☐
Process										
Kitchen Spray Rinse										
Internal Leakage	☐	☐								☐
Baths	☐	☐								☐
Other	☐	☐								☐
Non-Lavatory/Kitchen Faucets	☐	☐								☐
Irrigation	☑	☑								☑
Pools	☐	☐								☐
Wash Down	☐	☐								☐
Car Washing	☐	☐								☐
External Leakage	☐	☐								☐
Outdoor										
Cooling										

Comments

• Utility Cost: Water Budgeting software like Waterfluence at $50 per site. Assuming a five-year investment per site, unit cost is set at $500 per 10 year site monitoring fee. Monitoring fee is adjusted to account for accounts coming online over the program duration.

• Admin Markup: ~1 hr. staff time per SF/MF/CII meter targeted to run program ($38/hr. is average burdened rate of Water Conservation Manager ($46.86/hr.) and Water Conservation Technician ($29.92/hr.)).

• Customer Cost: Customer cost represents average cost to implement any water savings actions done by customers as a result of their budget.

• End Use Water Savings: Using variance program and Aurora program estimates, on average, customers are 15% over budget or "expected" water use. Customers will become slightly more efficient on average due to the cost of being inefficient.

• Targets: 1% of accounts targeted annually will have water savings

Results

Units: AF

Average Water Savings (afy)	
	6.518884
Lifetime Savings - Present Value ($)	
Utility	$173,161
Community	$173,161
Lifetime Costs - Present Value ($)	
Utility	$996,508
Community	$1,089,640
Benefit to Cost Ratio	
Utility	0.17
Community	0.16
Cost of Savings per Unit Volume ($/af)	
Utility	$7,279

End Use Savings Per Replacement

Method: Percent

	% Savings/Acct	Avg GPD/Acct
R Irrigation	10.0%	91.2
MF Irrigation	10.0%	99.8
New_SF Irrigation	5.0%	162.3

Targets

Target Method: Percentage

% of Accts Targeted/Yr.	1.000%
Only Affects New Accts	☐

Costs

View: Utility Detai

	Fixture Costs	Admin Costs	Util Total
2020	$0	$0	$0
2021	$0	$0	$0
2022	$0	$0	$0
2023	$0	$0	$0
2024	$0	$0	$0
2025	$0	$0	$0
2026	$0	$0	$0
2027	$0	$0	$0
2028	$77,654	$5,436	$83,090
2029	$79,853	$5,590	$85,443
2030	$82,122	$5,749	$87,871
2031	$84,462	$5,912	$90,375
2032	$86,877	$6,081	$92,958
2033	$89,367	$6,256	$95,623
2034	$91,937	$6,436	$98,372
2035	$94,587	$6,621	$101,208
2036	$97,322	$6,813	$104,134
2037	$100,142	$7,010	$107,152
2038	$103,052	$7,214	$110,266
2039	$106,054	$7,424	$113,478
2040	$109,151	$7,641	$116,791

Targets

View: Accounts

	R	MF	New_SF	Total
2020	0	0	0	0
2021	0	0	0	0
2022	0	0	0	0
2023	0	0	0	0
2024	0	0	0	0
2025	0	0	0	0
2026	0	0	0	0
2027	0	0	0	0
2028	100	32	24	155
2029	100	33	27	160
2030	100	34	30	164
2031	100	35	34	169
2032	100	36	38	174
2033	100	38	42	179
2034	100	39	46	184
2035	100	40	50	189
2036	100	41	54	195
2037	100	42	58	200
2038	100	44	63	206
2039	100	45	67	212
2040	100	47	72	218

Water Savings

Units: afy

	Total Savings (afy)
2020	0.000000
2021	0.000000
2022	0.000000
2023	0.000000
2024	0.000000
2025	0.000000
2026	0.000000
2027	0.000000
2028	1.592137
2029	3.226405
2030	4.904136
2031	6.626705
2032	8.395526
2033	10.212063
2034	12.077822
2035	13.994360
2036	14.371144
2037	14.759835
2038	15.160808
2039	15.574452
2040	16.001167

Efficient Fixture Giveaway

Efficient Fixture Giveaway

Overview

Name	Efficient Fixture Giveaway
Abbr	14
Category	Default
Measure Type	Standard Measure

Time Period

First Year	2020
Last Year	2040
Measure Length	21

Measure Life

Permanent	☑

Fixture Cost per Device

	Utility	Customer	Fix/Acct
R	$10.05	$15.00	1
MF	$10.05	$15.00	4
C	$35.00	$15.00	1
LI	$10.05	$15.00	1
New_SF	$10.05	$15.00	1

Administration Costs

Method: Percent

Markup Percentage	1%

Description

> Provide free 1.15 gpm (or lower) spray nozzles for commercial and possibly free installation for the rinse and clean operation in restaurants and other commercial kitchens. Thousands have been replaced in California going door to door; very cost-effective because saves hot water.
> Utility would buy high efficiency showerheads and faucets, aerators in bulk and give them away at Utility office or community events.
> Utility would provide free high efficiency fixtures for. This may include: HE showerheads, aerators, pre-rinse spray valves, soil moisture sensors, hose nozzles

Customer Classes

R	MF	C	CS	IN	G	GS	MSU	LI	New_SF
☑	☑	☑	☐	☐	☐	☐	☐	☑	☑

End Uses

	R	MF	C	CS	IN	G	GS	MSU	LI	New_SF
Toilets	☐	☐	☐						☐	☐
Urinals			☐							
Lavatory Faucets	☑	☑	☑						☑	☑
Showers	☑	☑	☑						☑	☑
Dishwashers	☐	☐	☐						☐	☐
Clothes Washers	☐	☐	☐						☐	☐
Process			☐							
Kitchen Spray Rinse			☑							
Internal Leakage	☐	☐	☐						☐	☐
Baths	☐	☐							☐	☐
Other	☐	☐	☐						☐	☐
Non-Lavatory/Kitchen Faucets	☑	☑	☑						☑	☑
Irrigation	☑	☑	☑						☑	☑
Pools	☐	☐							☐	☐
Wash Down	☐	☐							☐	☐
Car Washing	☐	☐							☐	☐
External Leakage	☐	☐	☐						☐	☐
Outdoor										
Cooling			☐							

Comments

• Utility Cost: Based on the "Free Products" worksheet provided by City of Bozeman (9-22-2021), a Leak Detection Kit costs $12.05, a Summer Savings Tool Kit cost $9.65, a Shower Better Kit costs $4.23, and a Brush Better Kit costs $10.79. Per the breakdown of the Leak Detection Kit, faucet aerator costs $1.66. Utility Unit Cost is based on weighted average of kits. See "Free Products" sheet. Increased cost for COM and MSU to account for PRSV (~$25). 1.5 nozzles can be found per CII account per Tso & Koehler 2005 report "Pre-rinse Spray Valve Programs: How are they really doing?"
• Admin Markup: Admin time for this measure is included in survey and outreach measures.
• Customer Cost: Assumes minimal cost for installation.
• End Use Water Savings:
> Lavatory Faucets: SF/MF/LI: Assumes 2.2 gpm aerators are replaced with 1.2 gpm aerators. Assumes only 25% are installed.
COM: Assumes 2.2 gpm aerators are replaced with 0.5 gpm. Fixture analysis in green section, 60% of lavatory commercial aerators are already at 0.5 gpm, but a remaining 32% are at 2.2 gpm. Therefore, it is assumed 32% of the savings is taken in and that only 25% of those are actually installed.
> Kitchen Faucets: R, MF, LI, and COM assumes a 2.2 gpm aerator is replaced with a 1.8 aerator. Assumes only 25% are installed.
> Showerheads: City gives away and "SWAP"s showerheads. They provide 1.5 gpm showerheads. Per the end uses in green section of model, majority of showerheads in service area are 2.5 gpm. Therefore assumed savings for showerheads is 40% with 100% installation rate. Assumes all are installed as part of the SWAP program.
> City provides free "summer savings kit" which includes a hose spray nozzle, rain gauge, drip gauge, and soil moisture sensor. Assumes conservative savings from kit for irrigation.
> NEW_SF: New homes would only be required to have the flow rates required by the state-adopted uniform plumbing code installed (1.6 gpf toilets, 2.5 gpm SH, 2.2 gpm faucets), so there would still be opportunity to see water savings and include participation from new SF homes. Therefore same savings applied as RES and LI.
• Targets: based on the weighted average of what was given away in 2020 and 2021. Assumes the Sprinkler Kit was only given away to SF and LI accts in the weighted average, and all other kits were giveaways to SF, MF, and LI. See "Free Products" sheet. NEW_SF homes would only be required to have the flow rates required by the state-adopted uniform plumbing code installed (1.6 gpf toilets, 2.5 gpm SH, 2.2 gpm faucets), therefore there will still be an opportunity to see water savings and include participation from new SF homes.

Results

Units: AF

Average Water Savings (afy)	
15.363863	
Lifetime Savings - Present Value ($)	
Utility	$440,160
Community	$695,484
Lifetime Costs - Present Value ($)	
Utility	$20,682
Community	$47,689
Benefit to Cost Ratio	
Utility	21.28
Community	14.58
Cost of Savings per Unit Volume ($/af)	
Utility	$64

End Use Savings Per Replacement

Method: Percent

	% Savings/Acct	Avg GPD/Acct
R Lavatory Faucets	11.0%	6.9
MF Lavatory Faucets	11.0%	26.5
C Lavatory Faucets	6.1%	56.8
LI Lavatory Faucets	11.0%	5.2
R Showers	40.0%	19.8
MF Showers	40.0%	75.7
C Showers	40.0%	67.6
LI Showers	40.0%	14.9
C Kitchen Spray Rinse	40.0%	37.5
R Non-Lavatory/Kitchen Faucets	5.0%	12.9
MF Non-Lavatory/Kitchen Faucets	5.0%	49.2
C Non-Lavatory/Kitchen Faucets	5.0%	48.3
LI Non-Lavatory/Kitchen Faucets	5.0%	9.7
R Irrigation	5.0%	91.2
MF Irrigation	5.0%	99.8
C Irrigation	5.0%	242.4
LI Irrigation	5.0%	54.9
New_SF Lavatory Faucets	11.0%	6.4
New_SF Showers	40.0%	18.2
New_SF Non-Lavatory/Kitchen Faucets	5.0%	11.9
New_SF Irrigation	5.0%	162.3

Targets

Target Method: Percentage

% of Accts Targeted/Yr.	0.360%
Only Affects New Accts	☐

Costs

View: Utility Detail

	Fixture Costs	Admin Costs	Util Total
2020	$863	$9	$871
2021	$888	$9	$897
2022	$915	$9	$924
2023	$943	$9	$952
2024	$971	$10	$981
2025	$1,001	$10	$1,011
2026	$1,031	$10	$1,041
2027	$1,062	$11	$1,073
2028	$1,094	$11	$1,105
2029	$1,128	$11	$1,139
2030	$1,162	$12	$1,174
2031	$1,198	$12	$1,210
2032	$1,234	$12	$1,247
2033	$1,272	$13	$1,285
2034	$1,311	$13	$1,324
2035	$1,352	$14	$1,365
2036	$1,393	$14	$1,407
2037	$1,436	$14	$1,451
2038	$1,481	$15	$1,495
2039	$1,526	$15	$1,542
2040	$1,574	$16	$1,589

Targets

View: Accounts

	R	MF	C	LI	New_SF	Total
2020	36	9	4	1	0	49
2021	36	9	4	1	1	51
2022	36	10	4	1	2	52
2023	36	10	4	1	3	54
2024	36	10	4	1	4	55
2025	36	11	5	1	5	57
2026	36	11	5	1	6	58
2027	36	11	5	1	7	60
2028	36	12	5	1	8	62
2029	36	12	5	1	10	63
2030	36	12	5	1	11	65
2031	36	13	6	1	12	67
2032	36	13	6	1	14	69
2033	36	14	6	1	15	71
2034	36	14	6	1	16	73
2035	36	14	6	1	18	75
2036	36	15	7	1	19	78
2037	36	15	7	1	21	80
2038	36	16	7	1	23	82
2039	36	16	7	1	24	85
2040	36	17	8	1	26	87

Water Savings

Units: afy

	Total Savings (afy)
2020	1.233256
2021	2.480736
2022	3.744795
2023	5.027730
2024	6.331790
2025	7.659182
2026	9.012078
2027	10.391793
2028	11.800216
2029	13.239242
2030	14.710776
2031	16.216731
2032	17.761043
2033	19.345973
2034	20.973774
2035	22.646700
2036	24.367005
2037	26.136956
2038	27.958833
2039	29.834935
2040	31.767587

Residential Efficiency Fixture Incentive Program

Residential Efficiency Fixture Incentive Program

Overview

Name	Residential Efficiency Fixture In
Abbr	15
Category	Default
Measure Type	Standard Measure

Time Period

First Year	2020
Last Year	2040
Measure Length	21

Measure Life

Permanent ☑

Fixture Cost per Device

	Utility	Customer	Fix/Acct
R	$127.50	$200.00	1
MF	$115.50	$200.00	1

Administration Costs

Method: Percent

Markup Percentage	20%

Description

> Utility would provide various rebate incentives for the installation of high efficiency indoor plumbing fixtures.
> Leak detection technology system that allows for remote shutoff with a smart phone interface. Target second homes that are vacant, which could leak for extensive periods while left unattended.
> Provide a rebate or voucher for the installation of a high efficiency toilet (HET, Toilets flushing 1.28 gpf or less). Rebate amounts would reflect the incremental purchase cost and have been at least $80 (for up to 2 toilets).
> Provide a rebate for efficient washing machines to single family homes and apartment complexes that have common laundry rooms. It is assumed that the rebates would remain consistent with relevant state and federal regulations (Department of Energy, Energy Star) and only offer the best available technology.
> Provide a rebate to encourage homeowner to purchase an efficient dishwasher (meeting certain water efficiency standards, such as a limit on the gallons/load) when replacing an existing dishwasher.

Customer Classes

R	MF	C	CS	IN	G	GS	MSU	LI	New_SF
☑	☑	☐	☐	☐	☐	☐	☐	☐	☐

End Uses

	R	MF	C	CS	IN	G	GS	MSU	LI	New_S
Toilets	☑	☑								
Urinals										
Lavatory Faucets	☐	☐								
Showers	☑	☑								
Dishwashers	☐	☐								
Clothes Washers	☑	☑								
Process										
Kitchen Spray Rinse										
Internal Leakage	☐	☐								
Baths	☐	☐								
Other	☐	☐								
Non-Lavatory/Kitchen Faucets	☐	☐								
Irrigation	☐	☐								
Pools	☐	☐								
Wash Down	☐	☐								
Car Washing	☐	☐								
External Leakage	☐	☐								
Outdoor										
Cooling										

Comments

• Utility Cost:
> Toilets: The City issues different rebate amounts depending on the age of the toilet. $125/toilet installed prior to 1996 (3.5 gpf), $50/toilet installed after 1996 (1.6 gpf), and $25 for new construction (new in 2021).
> Clothes Washers: $150 rebate for retrofits and $100 rebate for new construction.
> See "Measure 15 Calcs" sheet. Utility cost is a weighted average of previous HET and HECW rebates.
> Average SH rebate of $15, but historically there have been between 10 & 100 accounts participating in the showerhead rebate measure, so only half this cost is assumed per account targeted.
• Admin Markup: Staff time to process rebates.
• Customer Cost: Remaining cost of device
• End Use Water Savings:
> Toilets: Based on the historical toilet rebates of R and MF toilets in the last 5 years, R was 34% Post-1996, and MF was 64% Post-1996. Assumes pre-1996 rebates are a 3.5 gpf toilet being replaced by a 1.28 gpf toilet and post-1996 toilets are 1.6 gpf toilets being replaced with a 1.28 gpf toilet. See "Measure 15 Calcs" sheet
> Clothes Washers: According to their website, ENERGY STAR certified clothes washers use about 45% less water than regular washers (assumes 23 gallon per load is reduced to 13 gallon per load). Since only 1 of 4 MF units is expected to replace their washer, assume 25% of the 45% savings.
> Showers: Historically there have been between 10 & 100 accounts participating in the showerhead rebate measure, so assume 1/2 the savings from replacing >2.5 gpm showerheads with < 1.75 gpm showerheads on all targeted accounts.
• Targets: NEW_SF excluded from this measure as the new homes should already be equipped with efficient fixtures.

Results

Units: AF

Average Water Savings (afy)	
	43.313118
Lifetime Savings - Present Value ($)	
Utility	$1,265,438
Community	$1,678,094
Lifetime Costs - Present Value ($)	
Utility	$352,510
Community	$824,633
Benefit to Cost Ratio	
Utility	3.59
Community	2.03
Cost of Savings per Unit Volume ($/af)	
Utility	$388

End Use Savings Per Replacement

Method: Percent

	% Savings/Acct	Avg GPD/Acct
R Toilets	49.0%	25.3
MF Toilets	36.0%	96.8
R Showers	15.0%	19.8
MF Showers	15.0%	75.7
R Clothes Washers	45.0%	17.1
MF Clothes Washers	11.3%	65.5

Targets

Target Method: Percentage

% of Accts Targeted/Yr.	1.000%
Only Affects New Accts	☐

Costs

View: Utility Detai

	Fixture Costs	Admin Costs	Util Total
2020	$15,590	$3,118	$18,708
2021	$15,681	$3,136	$18,818
2022	$15,776	$3,155	$18,931
2023	$15,873	$3,175	$19,047
2024	$15,973	$3,195	$19,168
2025	$16,077	$3,215	$19,292
2026	$16,183	$3,237	$19,420
2027	$16,293	$3,259	$19,552
2028	$16,407	$3,281	$19,688
2029	$16,524	$3,305	$19,829
2030	$16,645	$3,329	$19,974
2031	$16,770	$3,354	$20,124
2032	$16,898	$3,380	$20,278
2033	$17,031	$3,406	$20,437
2034	$17,168	$3,434	$20,601
2035	$17,309	$3,462	$20,771
2036	$17,455	$3,491	$20,946
2037	$17,605	$3,521	$21,126
2038	$17,760	$3,552	$21,312
2039	$17,920	$3,584	$21,504
2040	$18,085	$3,617	$21,702

Targets

View: Accounts

	R	MF	Total
2020	100	25	125
2021	100	26	125
2022	100	27	126
2023	100	27	127
2024	100	28	128
2025	100	29	129
2026	100	30	130
2027	100	31	131
2028	100	32	132
2029	100	33	133
2030	100	34	134
2031	100	35	135
2032	100	36	136
2033	100	38	137
2034	100	39	138
2035	100	40	140
2036	100	41	141
2037	100	42	142
2038	100	44	143
2039	100	45	145
2040	100	47	146

Water Savings

Units: afy

	Total Savings (afy)
2020	4.083300
2021	8.148925
2022	12.194739
2023	16.218966
2024	20.220139
2025	24.197059
2026	28.148752
2027	32.072920
2028	35.968410
2029	39.834222
2030	43.669487
2031	47.473452
2032	51.265478
2033	55.048408
2034	58.824934
2035	62.597612
2036	66.368879
2037	70.141070
2038	73.916425
2039	77.697105
2040	81.485201

Residential Water Use Surveys

Residential Water Use Surveys

Overview	
Name	Residential Water Use Surveys
Abbr	16
Category	Default
Measure Type	Standard Measure

Time Period		Measure Life	
First Year	2020	Permanent	☐
Last Year	2040	Years	5
Measure Length	21	Repeat	☐

Fixture Cost per Device

	Utility	Customer	Fix/Acct
R	$10.00	$5.00	1
MF	$10.00	$5.00	5
New_SF	$10.00	$5.00	1

Administration Costs

Method:	Fixed
Annual Admin Costs	$37,000

Description

Indoor and outdoor water surveys for SF and MF residential customers. Target those with high water use and provide a customized report to owner. Includes giveaway of efficient shower heads, aerators, toilet devices. This measure is combined with sprinkler assessments.

Customer Classes

R	MF	C	CS	IN	G	GS	MSU	LI	New_SF
☑	☑	☐	☐	☐	☐	☐	☐	☐	☑

End Uses

	R	MF	C	CS	IN	G	GS	MSU	LI	New_SF
Toilets	☐	☐								☐
Urinals										
Lavatory Faucets	☑	☑								☑
Showers	☑	☑								☑
Dishwashers	☐	☐								☐
Clothes Washers	☐	☐								☐
Process										
Kitchen Spray Rinse										
Internal Leakage	☑	☑								☐
Baths	☐	☐								☐
Other	☐	☐								☐
Non-Lavatory/Kitchen Faucets	☑	☑								☑
Irrigation	☑	☑								☑
Pools	☐	☐								☐
Wash Down	☐	☐								☐
Car Washing	☐	☐								☐
External Leakage	☑	☑								☑
Outdoor										
Cooling										

Targets

Target Method:	Percentage
% of Accts Targeted/Yr.	1.250%
Only Affects New Accts	☐

Results

Units: AF

Average Water Savings (afy)	
33.104240	
Lifetime Savings - Present Value ($)	
Utility	$953,503
Community	$1,043,723
Lifetime Costs - Present Value ($)	
Utility	$719,661
Community	$752,788
Benefit to Cost Ratio	
Utility	1.32
Community	1.39
Cost of Savings per Unit Volume ($/af)	
Utility	$1,035

End Use Savings Per Replacement

Method: Percent

	% Savings/Acct	Avg GPD/Acct
R Lavatory Faucets	11.4%	6.9
MF Lavatory Faucets	11.4%	26.5
R Showers	10.0%	19.8
MF Showers	10.0%	75.7
R Internal Leakage	1.0%	14.1
MF Internal Leakage	1.0%	53.9
R Non-Lavatory/Kitchen Faucets	7.0%	12.9
MF Non-Lavatory/Kitchen Faucets	7.0%	49.2
R Irrigation	25.0%	91.2
MF Irrigation	20.0%	99.8
R External Leakage	50.0%	7.7
MF External Leakage	50.0%	8.4
New_SF Lavatory Faucets	11.4%	6.4
New_SF Showers	10.0%	18.2
New_SF Non-Lavatory/Kitchen Faucets	7.0%	11.9
New_SF Irrigation	15.0%	162.3
New_SF External Leakage	50.0%	13.7

Comments

• Utility Cost: Assume SH, aerators, toilet dye tabs, and other water-saving devices distributed per site @ ~$10/site for "kit" materials. Kits given away at these surveys include leak detection kits and summer savings tool kits.
• Admin Markup: Per 2021 staffing of a full time summer intern and partial dedicated staff time in summer, approx. 8 hrs./survey @ average combined rate of ~$23/hr. includes, prep, assessment time and follow-up.
> Late May to Early Sept (assume 3 months) = ~12 weeks. Assumes 40 intern hours/week @ short term fully burdened rate of $16.23 and 2 FTE's 20 hrs./week @ water conservation technician fully burdened rate of $29.92.
960 hours/year for 116 surveys = 8 hours/survey including prep, assessment and follow-up. Approx. admin cost per survey is $191 based on rates.
> Due to the increase in number of surveys (double than what is currently happening), City will need an increase of more staff.
• Customer Cost: Minimal for device installation and assessment follow-up actions.
• End Use Water Savings:
Outdoor Savings:
> Based on Bozeman data from 2018-2021 we found that the average home that participated in this program saved 1,776 gallons/week during peak season (July – Aug) through the implementation of the recommended watering schedule. This assumes that the participant adopted the recommended schedule. It does not include any water savings assumptions for other retrofits or repairs that were recommended
Indoor savings assumes 25% of accounts install SH and aerators and use toilet dye tabs to reduce leaky toilets.
> Assumes 2.2 gpm aerators are replaced with 1.2 gpm aerators. Assumes only 25% are installed.
> City gives away and "SWAP"s showerheads. They provide 1.5 gpm showerheads. Per the end uses in the green section of model, the majority of showerheads in the service area are 2.5 gpm. Therefore, assumed savings for showerheads is 40%. Assumes 25% are installed.
> New_SF: assumes similar savings as RES, however irrigation savings are reduced as they should already have efficient savings per landscape codes. Per Bozeman: "data show that new SF homes over-water landscapes, and these are the homeowners that generally need assistance from us."
• Annual Target: Bozeman will increase their current target to ~200/yr. Assumes some sites would receive sprinkler assessment only, some indoor survey only, and some a combination. Per 4/12/2022 email from Bozeman, target 1.25% of accounts.
• Other: Will roll indoor and outdoor together.
• Additional Notes: As of 2021 two FTE's each spend 20 hours/week for sprinkler system assessments, plus a full time summer intern. Sprinkler assessments run May-Sept. Total performed: 2016 - 24, 2017 - 42, 2018 - 65, 2019 - 61, 2020 - 91, 2021 - 116. Popular program with waitlist - need more staff support.

Costs

View: Utility Detail

	Fixture Costs	Admin Costs	Util Total
2020	$2,810	$37,000	$39,810
2021	$2,892	$37,000	$39,892
2022	$2,977	$37,000	$39,977
2023	$3,065	$37,000	$40,065
2024	$3,155	$37,000	$40,155
2025	$3,248	$37,000	$40,248
2026	$3,345	$37,000	$40,345
2027	$3,444	$37,000	$40,444
2028	$3,547	$37,000	$40,547
2029	$3,652	$37,000	$40,652
2030	$3,761	$37,000	$40,761
2031	$3,874	$37,000	$40,874
2032	$3,990	$37,000	$40,990
2033	$4,110	$37,000	$41,110
2034	$4,233	$37,000	$41,233
2035	$4,360	$37,000	$41,360
2036	$4,492	$37,000	$41,492
2037	$4,627	$37,000	$41,627
2038	$4,767	$37,000	$41,767
2039	$4,912	$37,000	$41,912
2040	$5,060	$37,000	$42,060

Targets

View: Accounts

	R	MF	New_SF	Total
2020	125	31	0	156
2021	125	32	3	160
2022	125	33	7	165
2023	125	34	10	169
2024	125	35	14	174
2025	125	37	18	179
2026	125	38	21	184
2027	125	39	25	189
2028	125	40	30	194
2029	125	41	34	200
2030	125	43	38	205
2031	125	44	43	211
2032	125	45	47	217
2033	125	47	52	223
2034	125	48	57	230
2035	125	50	62	236
2036	125	51	67	243
2037	125	53	73	250
2038	125	55	78	258
2039	125	57	84	265
2040	125	58	90	273

Water Savings

Units: afy

	Total Savings (afy)
2020	5.609583
2021	11.362922
2022	17.266048
2023	23.325090
2024	29.546285
2025	30.388859
2026	31.259674
2027	32.157586
2028	33.083568
2029	34.038606
2030	35.023698
2031	36.039860
2032	37.090419
2033	38.176306
2034	39.298494
2035	40.457991
2036	41.655848
2037	42.893156
2038	44.171046
2039	45.490690
2040	46.853305

Low Income Direct Installation Rebates and Leak Repair Assistance

Low Income Direct Installation Rebates and Leak Repair Assistance

Overview

Name	Low Income Direct Installation R
Abbr	17
Category	Default
Measure Type	Standard Measure

Time Period

First Year	2025
Last Year	2040
Measure Length	16

Measure Life

Permanent ☑

Fixture Cost per Device

	Utility	Customer	Fix/Acct
LI	$360.00	$0.00	1

Administration Costs

Method: Percent

Markup Percentage	33%

Description

Provide direct installation rebate program for toilets, high incentive amount for clothes washers, and leak repair assistance. Customer leaks can go uncorrected at properties where owners are least able to pay costs of repair. These programs may require that customer leaks be repaired, but either subsidize part of the repair and/or pay the cost with revolving funds that are paid back with water bills over time. Program will also include an option to replace inefficient plumbing fixtures at low-income residences.

Customer Classes

	R	MF	C	CS	IN	G	GS	MSU	LI	New_SF
	☐	☐	☐	☐	☐	☐	☐	☐	☑	☐

End Uses

	R	MF	C	CS	IN	G	GS	MSU	LI	New_S
Toilets									☑	
Urinals										
Lavatory Faucets									☑	
Showers									☑	
Dishwashers									☑	
Clothes Washers									☑	
Process										
Kitchen Spray Rinse										
Internal Leakage									☑	
Baths									☑	
Other									☑	
Non-Lavatory/Kitchen Faucets									☑	
Irrigation									☑	
Pools									☑	
Wash Down									☑	
Car Washing									☑	
External Leakage									☑	
Outdoor										
Cooling										

Comments

- Utility Cost: cost of 1 toilet (~$300), 1 SH (~$15), 4 aerators per unit ($1.5 each = $6 total) as well as site survey and fixture installation by contractor.
- Admin Markup: staff time to administer measure and conduct water use survey. Assumes approx. 4 hours of staff time at the fully burdened water conservation technician rate of $29.92/hr.
- Customer Cost: none. City would work with the customer to differ upfront costs of remaining cost of device.
- End Use Water Savings: Assumes site survey and upgrade of fixtures to HE: toilet (1.6 gpf replaced with a 1.28), SH (2.5 gpm replaced with a 1.5 gpm)and aerators (Lavatory 2.2 gpm replaced with a 1.2 gpm; Kitchen 2.2 gpm replaced with 1.8 gpm).
- Targets: 5% of LI per year yields 75% of all LI over the measure time period.

Results

Units: AF

Average Water Savings (afy)	
1.825352	
Lifetime Savings - Present Value ($)	
Utility	$50,685
Community	$71,329
Lifetime Costs - Present Value ($)	
Utility	$70,151
Community	$70,151
Benefit to Cost Ratio	
Utility	0.72
Community	1.02
Cost of Savings per Unit Volume ($/af)	
Utility	$1,830

End Use Savings Per Replacement

Method: Percent

	% Savings/Acct	Avg GPD/Acct
LI Toilets	20.0%	19.1
LI Lavatory Faucets	45.5%	5.2
LI Showers	40.0%	14.9
LI Dishwashers	5.0%	0.9
LI Clothes Washers	5.0%	12.9
LI Internal Leakage	20.0%	10.6
LI Baths	5.0%	2.0
LI Other	5.0%	3.4
LI Non-Lavatory/Kitchen Faucets	18.0%	9.7
LI Irrigation	10.0%	54.9
LI Pools	10.0%	1.3
LI Wash Down	10.0%	2.6
LI Car Washing	10.0%	2.6
LI External Leakage	10.0%	4.6

Targets

Target Method: Percentage

% of Accts Targeted/Yr.	5.000%
Only Affects New Accts	☐

Costs

View: Utility Detai

	Fixture Costs	Admin Costs	Util Total
2020	$0	$0	$0
2021	$0	$0	$0
2022	$0	$0	$0
2023	$0	$0	$0
2024	$0	$0	$0
2025	$3,260	$1,076	$4,335
2026	$3,363	$1,110	$4,472
2027	$3,469	$1,145	$4,614
2028	$3,578	$1,181	$4,759
2029	$3,692	$1,218	$4,910
2030	$3,808	$1,257	$5,065
2031	$3,929	$1,296	$5,225
2032	$4,053	$1,337	$5,390
2033	$4,181	$1,380	$5,560
2034	$4,313	$1,423	$5,736
2035	$4,449	$1,468	$5,917
2036	$4,590	$1,515	$6,104
2037	$4,735	$1,562	$6,297
2038	$4,884	$1,612	$6,496
2039	$5,039	$1,663	$6,701
2040	$5,198	$1,715	$6,913

Targets

View: Accounts

	LI	Total
2020	0	0
2021	0	0
2022	0	0
2023	0	0
2024	0	0
2025	9	9
2026	9	9
2027	10	10
2028	10	10
2029	10	10
2030	11	11
2031	11	11
2032	11	11
2033	12	12
2034	12	12
2035	12	12
2036	13	13
2037	13	13
2038	14	14
2039	14	14
2040	14	14

Water Savings

Units: afy

	Total Savings (afy)
2020	0.000000
2021	0.000000
2022	0.000000
2023	0.000000
2024	0.000000
2025	0.239469
2026	0.486504
2027	0.741346
2028	1.004241
2029	1.275444
2030	1.555216
2031	1.843830
2032	2.141563
2033	2.448705
2034	2.765553
2035	3.092413
2036	3.429602
2037	3.777446
2038	4.136281
2039	4.506456
2040	4.888329

Public Education

Public Education

Overview	
Name	Public Education
Abbr	18
Category	Default
Measure Type	Standard Measure

Time Period	
First Year	2020
Last Year	2040
Measure Length	21

Measure Life	
Permanent	☐
Years	2
Repeat	☐

Fixture Cost per Device

	Utility	Customer	Fix/Acct
R	$14.00	$5.00	1
MF	$14.00	$5.00	1
New_SF	$14.00	$5.00	1

Administration Costs

Method: Percent

Markup Percentage	10%

Description

Utilize a range of printed and digital materials to raise awareness of conservation measures available to customers, including incentive programs offered by the Utility. This can include newsletters, bill stuffers, water smart planting guides, brochures/rack cards, newspaper ads, signs at retailers, radio ads, boosted social media posts and accompanying imagery. Provide a variety of conservation information on the city web site, and production of videos. Conduct presentations at various community venues, MSU, local public schools. Have booths at community events such as famers markets, Catapalooza, etc. Also consider a focused program initiative with focused action like: "Take Control of your Controller" Campaign for a focused social media based campaign. This measure would also include educational resources that are provided for free at events (shower timers, kids activity books, kids pencils). Contract services to support public educational initiatives such as working with G3 and MOSS are also included.

Customer Classes

	R	MF	C	CS	IN	G	GS	MSU	LI	New_SF
	☑	☑	☐	☐	☐	☐	☐	☐	☐	☑

End Uses

	R	MF	C	CS	IN	G	GS	MSU	LI	New_SF
Toilets	☑	☑								☑
Urinals										
Lavatory Faucets	☑	☑								☑
Showers	☑	☑								☑
Dishwashers	☑	☑								☑
Clothes Washers	☑	☑								☑
Process										
Kitchen Spray Rinse										
Internal Leakage	☑	☑								☑
Baths	☑	☑								☑
Other	☑	☑								☑
Non-Lavatory/Kitchen Faucets	☑	☑								☑
Irrigation	☑	☑								☑
Pools	☑	☑								☑
Wash Down	☑	☑								☑
Car Washing	☑	☑								☑
External Leakage	☑	☑								☑
Outdoor										
Cooling										

Comments

- Utility Cost: $75K/yr. for advertising and marketing + $9K/yr. for green gardening classes for residents by a contractor + $7K for MOSS Project WET + $1k for public events and presentations for a total of approx. $92k/yr.
- Admin Markup: staff time to support classes, marketing, etc. Approximately 235 hours annually. Admin cost assumes average of fully burden rate for water conservation manager ($46.86/hr.). and water conservation technician($29.92/hr.) for an average of $38.39/hr. The annual admin cost comes out to ~$9,022/yr.
- Customer Cost: some since there will be green landscaping implementation costs by those customers who attend the green gardening class.
- End Use Water Savings: Public info water savings range is 0.1%-0.5% on each end use. Assumed the average of 0.25% with higher on outdoor since the green gardening classes will result in higher savings for class attendees. Since there is higher targeted outdoor education, higher irrigation savings.
- Targets: 50% of residential accounts per yr.

Results

Units: AF

Average Water Savings (afy)	
	104.446140
Lifetime Savings - Present Value ($)	
Utility	$3,008,536
Community	$3,122,408
Lifetime Costs - Present Value ($)	
Utility	$2,227,983
Community	$2,951,354
Benefit to Cost Ratio	
Utility	1.35
Community	1.06
Cost of Savings per Unit Volume ($/af)	
Utility	$1,016

End Use Savings Per Replacement

Method: Percent

	% Savings/Acct	Avg GPD/Acct
R Toilets	0.3%	25.3
MF Toilets	0.3%	96.8
R Lavatory Faucets	0.3%	6.9
MF Lavatory Faucets	0.3%	26.5
R Showers	0.3%	19.8
MF Showers	0.3%	75.7
R Dishwashers	0.3%	1.2
MF Dishwashers	0.3%	4.8
R Clothes Washers	0.3%	17.1
MF Clothes Washers	0.3%	65.5
R Internal Leakage	0.3%	14.1
MF Internal Leakage	0.3%	53.9
R Baths	0.3%	2.7
MF Baths	0.3%	10.2
R Other	0.3%	4.5
MF Other	0.3%	17.0
R Non-Lavatory/Kitchen Faucets	0.3%	12.9
MF Non-Lavatory/Kitchen Faucets	0.3%	49.2
R Irrigation	5.0%	91.2
MF Irrigation	5.0%	99.8
R Pools	0.3%	2.2
MF Pools	0.3%	2.4
R Wash Down	0.3%	4.4
MF Wash Down	0.3%	4.8
R Car Washing	0.3%	4.4
MF Car Washing	0.3%	4.8
R External Leakage	0.3%	7.7
MF External Leakage	0.3%	8.4
New_SF Toilets	0.3%	23.3
New_SF Lavatory Faucets	0.3%	6.4
New_SF Showers	0.3%	18.2
New_SF Dishwashers	0.3%	1.2
New_SF Clothes Washers	0.3%	15.8
New_SF Internal Leakage	0.3%	13.0
New_SF Baths	0.3%	2.5
New_SF Other	0.3%	4.1
New_SF Non-Lavatory/Kitchen Faucets	0.3%	11.9
New_SF Irrigation	5.0%	162.3
New_SF Pools	0.3%	3.9
New_SF Wash Down	0.3%	7.8
New_SF Car Washing	0.3%	7.8
New_SF External Leakage	0.3%	13.7

Targets

Target Method:	Percentage
% of Accts Targeted/Yr.	50.000%
Only Affects New Accts	☐

Costs

View: Utility Detai

	Fixture Costs	Admin Costs	Util Total
2020	$87,248	$8,725	$95,973
2021	$89,649	$8,965	$98,613
2022	$92,125	$9,212	$101,337
2023	$94,680	$9,468	$104,147
2024	$97,315	$9,731	$107,046
2025	$100,033	$10,003	$110,037
2026	$102,838	$10,284	$113,122
2027	$105,731	$10,573	$116,304
2028	$108,716	$10,872	$119,587
2029	$111,795	$11,179	$122,974
2030	$114,971	$11,497	$126,468
2031	$118,247	$11,825	$130,072
2032	$121,628	$12,163	$133,790
2033	$125,114	$12,511	$137,626
2034	$128,712	$12,871	$141,583
2035	$132,422	$13,242	$145,664
2036	$136,250	$13,625	$149,875
2037	$140,199	$14,020	$154,219
2038	$144,273	$14,427	$158,700
2039	$148,476	$14,848	$163,323
2040	$152,811	$15,281	$168,092

Targets

View: Accounts

	R	MF	New_SF	Total
2020	4,980	1,252	1	6,232
2021	4,980	1,291	132	6,403
2022	4,980	1,332	269	6,580
2023	4,980	1,374	409	6,763
2024	4,980	1,417	554	6,951
2025	4,980	1,462	703	7,145
2026	4,980	1,508	857	7,346
2027	4,980	1,556	1,016	7,552
2028	4,980	1,605	1,180	7,765
2029	4,980	1,656	1,349	7,985
2030	4,980	1,708	1,524	8,212
2031	4,980	1,762	1,704	8,446
2032	4,980	1,818	1,890	8,688
2033	4,980	1,875	2,081	8,937
2034	4,980	1,935	2,279	9,194
2035	4,980	1,996	2,483	9,459
2036	4,980	2,059	2,693	9,732
2037	4,980	2,124	2,910	10,014
2038	4,980	2,191	3,134	10,305
2039	4,980	2,260	3,365	10,605
2040	4,980	2,332	3,603	10,915

Water Savings

Units: afy

	Total Savings (afy)
2020	35.655199
2021	72.783780
2022	75.819066
2023	78.950003
2024	82.179664
2025	85.511210
2026	88.947894
2027	92.492107
2028	96.147348
2029	99.917211
2030	103.805388
2031	107.815681
2032	111.954342
2033	116.225298
2034	120.632612
2035	125.180482
2036	129.873244
2037	134.715379
2038	139.711517
2039	144.866436
2040	150.185072

Contractor Efficient Outdoor Use Education and Training Programs

Contractor Efficient Outdoor Use Education and Training Programs

Overview

Name	Contractor Efficient Outdoor Use Education and Trai
Abbr	19
Category	Default
Measure Type	Standard Measure

Time Period

First Year	2020
Last Year	2040
Measure Length	21

Measure Life

Permanent	☐
Years	5
Repeat	☐

Fixture Cost per Device

	Utility	Customer	Fix/Acct
R	$5.90	$0.00	1
MF	$5.90	$0.00	1
C	$5.90	$0.00	1
CS	$5.90	$0.00	1
New_SF	$5.90	$0.00	1

Administration Costs

Method: Fixed

Annual Admin Costs	$1,344

Description

Utility would offer, organize and sponsor a series of educational workshops or other means for educating landscapers and contractors in efficient landscaping and irrigation principals. Utilize guest speakers, native demonstration gardens, incentives, such as a nursery plant coupon.
Classes such as Irrigation Association classes/certifications, QWEL, etc.

Customer Classes

R	MF	C	CS	IN	G	GS	MSU	LI	New_SF
☑	☑	☑	☑	☐	☐	☐	☐	☐	☑

End Uses

	R	MF	C	CS	IN	G	GS	MSU	LI	New_S
Toilets	☐	☐	☐	☐						☐
Urinals			☐	☐						
Lavatory Faucets	☐	☐	☐	☐						☐
Showers	☐	☐	☐	☐						☐
Dishwashers	☐	☐	☐	☐						☐
Clothes Washers	☐	☐	☐	☐						☐
Process			☐	☐						
Kitchen Spray Rinse			☐	☐						
Internal Leakage	☐	☐	☐	☐						☐
Baths	☐	☐								☐
Other	☐	☐	☐	☐						☐
Non-Lavatory/Kitchen Faucets	☐	☐	☐	☐						☐
Irrigation	☑	☑	☑	☑						☑
Pools	☐	☐								☐
Wash Down	☐	☐								☐
Car Washing	☐	☐								☐
External Leakage	☐	☐	☐	☐						☐
Outdoor										
Cooling			☐	☐						

Comments

• Utility Cost: City hosts 1 class per year, and costs approx. $4,000 to host one class. Additionally City pays $500 to QWEL annually.
> Utility cost per fixture is scaled to be utility fixture cost * targeted accounts, therefore the annual cost is ~$4,500 (Class cost + QWEL cost)
• Admin Markup: Admin time includes 20 hours for the class, plus another 15 hours for class outreach, organization, etc. Assumes an average fully burdened rate for water conservation manager ($46.86/hr.) and water conservation technician($29.92/hr.) for an average of $38.39/hr. @ 35 hours = $1,344
• Customer Cost: No cost to customer.
• End Use Water Savings: 10-15% savings since this is a participatory education measure. It might be higher. Additional savings will be captured under rebate measures, assuming contractor participation in those measures.
• Targets: Assumes water savings from the educated contractors would occur in large landscape sites, such as HOAs/Multifamily Properties and Commercial Properties. Would like to reach 30 contractors annually. Assumes the 30 contractors affects 5% SF, New_SF, MF and CII Accounts annually.

Results

Units: AF

Average Water Savings (afy)	
	54.674243
Lifetime Savings - Present Value ($)	
Utility	$1,553,720
Community	$1,553,720
Lifetime Costs - Present Value ($)	
Utility	$117,749
Community	$117,749
Benefit to Cost Ratio	
Utility	13.20
Community	13.20
Cost of Savings per Unit Volume ($/af)	
Utility	$103

End Use Savings Per Replacement

Method: Percent

	% Savings/Acct	Avg GPD/Acct
MF Irrigation	10.0%	99.8
C Irrigation	10.0%	242.4
CS Irrigation	10.0%	537.9
R Irrigation	10.0%	91.2
New_SF Irrigation	10.0%	162.3

Targets

Target Method: Percentage

% of Accts Targeted/Yr.	5.000%
Only Affects New Accts	☐

Costs

View: Utility Detai

	Fixture Costs	Admin Costs	Util Total
2020	$4,025	$1,344	$5,369
2021	$4,138	$1,344	$5,482
2022	$4,255	$1,344	$5,599
2023	$4,376	$1,344	$5,720
2024	$4,500	$1,344	$5,844
2025	$4,629	$1,344	$5,973
2026	$4,761	$1,344	$6,105
2027	$4,898	$1,344	$6,242
2028	$5,040	$1,344	$6,384
2029	$5,185	$1,344	$6,529
2030	$5,336	$1,344	$6,680
2031	$5,491	$1,344	$6,835
2032	$5,651	$1,344	$6,995
2033	$5,817	$1,344	$7,161
2034	$5,987	$1,344	$7,331
2035	$6,163	$1,344	$7,507
2036	$6,345	$1,344	$7,689
2037	$6,533	$1,344	$7,877
2038	$6,726	$1,344	$8,070
2039	$6,926	$1,344	$8,270
2040	$7,132	$1,344	$8,476

Targets

View: Accounts

	R	MF	C	CS	New_SF	Total
2020	498	125	53	6	0	682
2021	498	129	55	6	13	701
2022	498	133	57	6	27	721
2023	498	137	59	6	41	742
2024	498	142	61	6	55	763
2025	498	146	63	7	70	785
2026	498	151	66	7	86	807
2027	498	156	68	7	102	830
2028	498	161	70	7	118	854
2029	498	166	73	8	135	879
2030	498	171	75	8	152	904
2031	498	176	78	8	170	931
2032	498	182	81	9	189	958
2033	498	188	83	9	208	986
2034	498	193	86	9	228	1,015
2035	498	200	89	9	248	1,045
2036	498	206	92	10	269	1,075
2037	498	212	96	10	291	1,107
2038	498	219	99	10	313	1,140
2039	498	226	102	11	337	1,174
2040	498	233	106	11	360	1,209

Water Savings

Units: afy

	Total Savings (afy)
2020	8.280880
2021	16.908606
2022	25.894350
2023	35.249646
2024	44.986399
2025	46.836020
2026	48.745231
2027	50.715954
2028	52.750174
2029	54.849941
2030	57.017371
2031	59.254646
2032	61.564023
2033	63.947828
2034	66.408465
2035	68.948413
2036	71.570233
2037	74.276569
2038	77.070150
2039	79.953794
2040	82.930408

Xeriscape Demonstration Gardens

Xeriscape Demonstration Gardens

Overview

Name	Xeriscape Demonstration Garde
Abbr	20
Category	Default
Measure Type	Standard Measure

Time Period

First Year	2020
Last Year	2040
Measure Length	21

Measure Life

Permanent	☐
Years	5
Repeat	☐

Fixture Cost per Device

	Utility	Customer	Fix/Acct
R	$16.00	$100.00	1
New_SF	$16.00	$100.00	1

Administration Costs

Method: Percent

Markup Percentage	5%

Description

Provide additional demonstration gardens showcasing drought tolerant landscaping and efficient irrigation so that the community has local resources available to see these products/plants.

Customer Classes

R	MF	C	CS	IN	G	GS	MSU	LI	New_SF
☑	☐	☐	☐	☐	☐	☐	☐	☐	☑

End Uses

	R	MF	C	CS	IN	G	GS	MSU	LI	New_S
Toilets	☐									☐
Urinals										
Lavatory Faucets	☐									☐
Showers	☐									☐
Dishwashers	☐									☐
Clothes Washers	☐									☐
Process										
Kitchen Spray Rinse										
Internal Leakage	☐									☐
Baths	☐									☐
Other	☐									☐
Non-Lavatory/Kitchen Faucets	☐									☐
Irrigation	☑									☑
Pools	☐									☐
Wash Down	☐									☐
Car Washing	☐									☐
External Leakage	☐									☐
Outdoor										
Cooling										

Results

Units: AF

Average Water Savings (afy)	17.380029
Lifetime Savings - Present Value ($)	
Utility	$497,501
Community	$497,501
Lifetime Costs - Present Value ($)	
Utility	$115,505
Community	$803,036
Benefit to Cost Ratio	
Utility	4.31
Community	0.62
Cost of Savings per Unit Volume ($/af)	
Utility	$316

End Use Savings Per Replacement

Method: Percent

	% Savings/Acct	Avg GPD/Acct
R Irrigation	10.0%	91.2
New_SF Irrigation	5.0%	162.3

Targets

Target Method: Percentage

% of Accts Targeted/Yr.	3.000%
Only Affects New Accts	☐

Comments

• Utility Cost: One project every 5 years, which is approx. $75k/project for design and infrastructure. Museum garden project cost on the conservation budget is $25k. Assumes similar utility cost. Since the project is assumed every 5 years, annual cost is ~$5,000.
• Admin Markup: minimal admin time.
• Customer Cost: assumes some cost to update landscaping.
• End Use Water Savings: Savings represent irrigation savings for those participants who take action by replacing turf with xeriscape or replacing irrigation equipment. Conservative value as it is an estimate on who would be inspired. Assumes NEW_SF accounts would also be exposed, but with half the savings as they should already have efficient landscaping if the landscape ordinance is adopted.
• Targets: Per Bozeman staff, there are currently ~ 50,000 annual Bozeman residents visiting the museum garden each year. Assuming 4 people per household, this would be approx. 12,500 residential accounts visiting. Assuming in a future setting less people will be exposed to the garden, as the gardens would be standalone and not required to walkthrough to access a museum. Assuming 50% would be exposed in new gardens, so 6,250 accounts. Assume 5% of these visitors (exposed accounts) would take some sort of action which would be ~300 accounts. Including NEW_SF, but with half the savings assumption as existing accounts.

Costs

View: Utility Detai

	Fixture Costs	Admin Costs	Util Total
2020	$4,781	$239	$5,020
2021	$4,908	$245	$5,153
2022	$5,039	$252	$5,290
2023	$5,173	$259	$5,432
2024	$5,312	$266	$5,578
2025	$5,456	$273	$5,729
2026	$5,604	$280	$5,884
2027	$5,756	$288	$6,044
2028	$5,914	$296	$6,210
2029	$6,076	$304	$6,380
2030	$6,244	$312	$6,556
2031	$6,417	$321	$6,738
2032	$6,595	$330	$6,925
2033	$6,779	$339	$7,118
2034	$6,969	$348	$7,317
2035	$7,164	$358	$7,523
2036	$7,366	$368	$7,735
2037	$7,575	$379	$7,954
2038	$7,790	$389	$8,179
2039	$8,011	$401	$8,412
2040	$8,240	$412	$8,652

Targets

View: Accounts

	R	New_SF	Total
2020	299	0	299
2021	299	8	307
2022	299	16	315
2023	299	25	323
2024	299	33	332
2025	299	42	341
2026	299	51	350
2027	299	61	360
2028	299	71	370
2029	299	81	380
2030	299	91	390
2031	299	102	401
2032	299	113	412
2033	299	125	424
2034	299	137	436
2035	299	149	448
2036	299	162	460
2037	299	175	473
2038	299	188	487
2039	299	202	501
2040	299	216	515

Water Savings

Units: afy

	Total Savings (afy)
2020	3.055057
2021	6.182115
2022	9.383448
2023	12.661405
2024	16.018406
2025	16.401892
2026	16.797496
2027	17.205601
2028	17.626602
2029	18.060907
2030	18.508936
2031	18.971123
2032	19.447915
2033	19.939773
2034	20.447175
2035	20.970610
2036	21.510585
2037	22.067624
2038	22.642265
2039	23.235065
2040	23.846598

Require HE Toilets, Showerheads, Faucets, Urinals in New Development

Require HE Toilets, Showerheads, Faucets, Urinals in New Development

Overview

Name	Require HE Toilets, Showerheads, Faucets, Urinals in New Development
Abbr	21
Category	Default
Measure Type	Standard Measure

Time Period

First Year	2040
Last Year	2040
Measure Length	1

Measure Life

Permanent ☑

Fixture Cost per Device

	Utility	Customer	Fix/Acct
MF	$9.60	$250.00	3
C	$38.39	$300.00	3
IN	$38.39	$300.00	3
G	$38.39	$300.00	3
MSU	$38.39	$300.00	3
LI	$9.60	$250.00	1
New_SF	$9.60	$250.00	1

Administration Costs

Method: Percent

Markup Percentage	10%

Description

Require developers to install high-efficient toilets, lavatory faucets, kitchen faucets, and showerheads.
IAPMO Green Building Supplemental Code is 1.5 gpm for residential lavatory faucets, 0.5 gpm for non-residential lavatory faucets, 1.8 gpm for kitchen faucets and 2.0 gpm for showerheads, 1.28 gpf for toilets, 0.125 gpf for urinals.

Customer Classes

R	MF	C	CS	IN	G	GS	MSU	LI	New_SF
☐	☑	☑	☐	☑	☑	☐	☑	☑	☑

End Uses

	R	MF	C	CS	IN	G	GS	MSU	LI	New_SF
Toilets		☑	☑		☑	☑		☑	☑	☑
Urinals			☑		☑	☑		☑		
Lavatory Faucets		☑	☑		☑	☑		☑	☑	☑
Showers		☑	☑		☑	☑		☑	☑	☑
Dishwashers		☐	☐		☐	☐		☐	☐	☐
Clothes Washers		☐	☐		☐	☐		☐	☐	☐
Process			☐		☐					
Kitchen Spray Rinse			☐			☐				
Internal Leakage		☐	☐		☐	☐		☐	☐	☐
Baths		☐							☐	☐
Other		☐	☐		☐	☐		☐	☐	☐
Non-Lavatory/Kitchen Faucets		☑	☑		☑	☑		☑	☑	☑
Irrigation		☐	☐		☐	☐		☐	☐	☐
Pools		☐						☐	☐	☐
Wash Down		☐							☐	☐
Car Washing		☐							☐	☐
External Leakage		☐	☐		☐	☐		☐	☐	☐
Outdoor										
Cooling			☐		☐	☐		☐		

Comments

• Utility Cost: Represents random inspections by utility staff to ensure validity of code implementation. Assuming 1 hour for single family and 2 for MF/CII on average per site (door to door). Since only a sample will be inspected, actual utility time represents 15 minutes for SF and 1 hour for MF/CII. Assume a typical unit has 2 toilets, 1 showerhead, 2 bath aerators, and 1 kitchen aerator replaced as needed. Non-residential units are assumed to have 1 urinal. Assume multiple units per non-SF account. Average hourly rate of $38.39 is used. This is an average of the water conservation manager fully burdened rate of $46.86 and the water conservation technician fully burdened rate of $29.92
• Admin Markup: represents additional staff time to run measure (i.e. scheduling, coordinating with planning, etc.)
• Customer Cost: Represents any fixture cost to comply with standards. CII cost accounts for urinals as well. Cost is the difference in standard vs. efficient devices.
• End Use Water Savings: Savings from this code measure assume 2.2 gpm faucets, 2.5 showerheads, 1.6 gpf toilets and 1.0 gpf urinals are replaced with 1.2 gpm bathroom aerators, 1.8 gpm kitchen aerators, 1.8 gpm showerheads, 1.28 gpf toilets, and 0.125 gpf urinals.
• Targets: 100% of new accts (aka new development). Regular SF not selected, as all new SF growth is in NEW_SF category.

Results

Units: AF

Average Water Savings (afy)	
	1.278431
Lifetime Savings - Present Value ($)	
Utility	$32,967
Community	$42,766
Lifetime Costs - Present Value ($)	
Utility	$13,440
Community	$220,684
Benefit to Cost Ratio	
Utility	2.45
Community	0.19
Cost of Savings per Unit Volume ($/af)	
Utility	$501

End Use Savings Per Replacement

Method: Percent

	% Savings/Acct	Avg GPD/Acct
MF Toilets	20.0%	96.8
C Toilets	20.0%	150.1
IN Toilets	20.0%	6,116.1
C Urinals	87.5%	45.0
IN Urinals	87.5%	2,446.4
MF Lavatory Faucets	45.5%	26.5
C Lavatory Faucets	45.5%	56.8
IN Lavatory Faucets	45.5%	3,082.5
MF Showers	28.0%	75.7
C Showers	28.0%	67.6
IN Showers	28.0%	1,223.2
MF Non-Lavatory/Kitchen Faucets	18.2%	49.2
C Non-Lavatory/Kitchen Faucets	18.2%	48.3
IN Non-Lavatory/Kitchen Faucets	18.2%	2,625.8
New_SF Toilets	20.0%	23.3
New_SF Lavatory Faucets	45.5%	6.4
New_SF Showers	28.0%	18.2
New_SF Non-Lavatory/Kitchen Faucets	18.2%	11.9
G Toilets	20.0%	100.2
MSU Toilets	20.0%	2,807.3
LI Toilets	20.0%	19.1
G Urinals	87.5%	30.1
MSU Urinals	87.5%	842.2
G Lavatory Faucets	45.5%	43.3
MSU Lavatory Faucets	45.5%	1,212.8
LI Lavatory Faucets	45.5%	5.2
G Showers	28.0%	50.1
MSU Showers	28.0%	1,403.7
LI Showers	28.0%	14.9
G Non-Lavatory/Kitchen Faucets	18.2%	36.9
MSU Non-Lavatory/Kitchen Faucets	18.2%	1,033.1
LI Non-Lavatory/Kitchen Faucets	18.2%	9.7

Targets

Target Method: Percentage

% of Accts Targeted/Yr.	100.000%
Only Affects New Accts	☑

Costs

View: Utility Detail

	Fixture Costs	Admin Costs	Util Total
2020	$0	$0	$0
2021	$0	$0	$0
2022	$0	$0	$0
2023	$0	$0	$0
2024	$0	$0	$0
2025	$0	$0	$0
2026	$0	$0	$0
2027	$0	$0	$0
2028	$0	$0	$0
2029	$0	$0	$0
2030	$0	$0	$0
2031	$0	$0	$0
2032	$0	$0	$0
2033	$0	$0	$0
2034	$0	$0	$0
2035	$0	$0	$0
2036	$0	$0	$0
2037	$0	$0	$0
2038	$0	$0	$0
2039	$0	$0	$0
2040	$17,482	$1,748	$19,230

Targets

View: Accounts

	MF	C	IN	G	MSU	LI	New_SF	Total
2020	0	0	0	0	0	0	0	0
2021	0	0	0	0	0	0	0	0
2022	0	0	0	0	0	0	0	0
2023	0	0	0	0	0	0	0	0
2024	0	0	0	0	0	0	0	0
2025	0	0	0	0	0	0	0	0
2026	0	0	0	0	0	0	0	0
2027	0	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0	0
2031	0	0	0	0	0	0	0	0
2032	0	0	0	0	0	0	0	0
2033	0	0	0	0	0	0	0	0
2034	0	0	0	0	0	0	0	0
2035	0	0	0	0	0	0	0	0
2036	0	0	0	0	0	0	0	0
2037	0	0	0	0	0	0	0	0
2038	0	0	0	0	0	0	0	0
2039	0	0	0	0	0	0	0	0
2040	143	72	0	3	1	9	476	704

Water Savings

Units: afy

	Total Savings (afy)
2020	0.000000
2021	0.000000
2022	0.000000
2023	0.000000
2024	0.000000
2025	0.000000
2026	0.000000
2027	0.000000
2028	0.000000
2029	0.000000
2030	0.000000
2031	0.000000
2032	0.000000
2033	0.000000
2034	0.000000
2035	0.000000
2036	0.000000
2037	0.000000
2038	0.000000
2039	0.000000
2040	26.847044

Fixture Retrofit on Resale or Name Change on Water Account

Fixture Retrofit on Resale or Name Change on Water Account

Overview

Name	Fixture Retrofit on Resale or Nar
Abbr	22
Category	Default
Measure Type	Standard Measure

Time Period

First Year	2040
Last Year	2040
Measure Length	1

Measure Life

Permanent ☑

Fixture Cost per Device

	Utility	Customer	Fix/Acct
R	$38.39	$100.00	1
MF	$38.39	$100.00	3

Administration Costs

Method: Percent

Markup Percentage	10%

Description

Work with the real estate industry to require a certificate of compliance be submitted to the Utility verifying that a plumber has inspected the property and efficient fixtures were either already there, or were installed, before close of escrow.

Customer Classes

R	MF	C	CS	IN	G	GS	MSU	LI	New_SF
☑	☑	☐	☐	☐	☐	☐	☐	☐	☐

End Uses

	R	MF	C	CS	IN	G	GS	MSU	LI	New_SF
Toilets	☑	☑								
Urinals										
Lavatory Faucets	☑	☑								
Showers	☑	☑								
Dishwashers	☐	☐								
Clothes Washers	☐	☐								
Process										
Kitchen Spray Rinse										
Internal Leakage	☐	☐								
Baths	☐	☐								
Other	☐	☐								
Non-Lavatory/Kitchen Faucets	☑	☑								
Irrigation	☐	☐								
Pools	☐	☐								
Wash Down	☐	☐								
Car Washing	☐	☐								
External Leakage	☐	☐								
Outdoor										
Cooling										

Comments

• Utility Cost: Represents random inspections by utility staff to ensure validity of code implementation. Assuming 1 hour for single family and 2 for MF on average per site, assuming inspections are random. Assume a typical unit has 2 toilets, 1 showerhead, 2 bath aerators, and 1 kitchen aerator replaced as needed. Assume multiple units per non-SF account. Average hourly rate of $38.39 is an average of the water conservation manager fully burdened rate of $46.86 and the water conservation technician fully burdened rate of $29.92)
• Admin Markup: 10% cost represents staff time to administer the measure.
• Customer Cost: Represent any fixture cost to comply with standards.
• End Use Water Savings: Savings from this code measure assume 2.2 gpm faucets, 2.5 gpm showerheads, 1.6 gpf toilets and 1.0 gpf urinals are replaced with 1.2 gpm bathroom aerators, 1.8 gpm kitchen aerators, 1.8 gpm showerheads, 1.28 gpf toilets, and 0.125 gpf urinals.
• Targets: Target % percent of accounts is a conservative assumption for recent resale and water account change rates. Average resale rate for the service area from 2018 - 2021 is 4.21%. New_SF not included, as it is assumed new housing would already have efficient fixtures in place.

Results

Units: AF

Average Water Savings (afy)	
0.795248	
Lifetime Savings - Present Value ($)	
Utility	$20,507
Community	$27,479
Lifetime Costs - Present Value ($)	
Utility	$29,759
Community	$100,229
Benefit to Cost Ratio	
Utility	0.69
Community	0.27
Cost of Savings per Unit Volume ($/af)	
Utility	$1,782

End Use Savings Per Replacement

Method: Percent

	% Savings/Acct	Avg GPD/Acct
MF Toilets	20.0%	96.8
MF Lavatory Faucets	45.5%	26.5
MF Showers	28.0%	75.7
MF Non-Lavatory/Kitchen Faucets	18.2%	49.2
R Toilets	20.0%	25.3
R Lavatory Faucets	45.5%	6.9
R Showers	28.0%	19.8
R Non-Lavatory/Kitchen Faucets	18.2%	12.9

Targets

Target Method: Percentage

% of Accts Targeted/Yr.	4.210%
Only Affects New Accts	☐

Costs

View: Utility Detai

	Fixture Costs	Admin Costs	Util Total
2020	$0	$0	$0
2021	$0	$0	$0
2022	$0	$0	$0
2023	$0	$0	$0
2024	$0	$0	$0
2025	$0	$0	$0
2026	$0	$0	$0
2027	$0	$0	$0
2028	$0	$0	$0
2029	$0	$0	$0
2030	$0	$0	$0
2031	$0	$0	$0
2032	$0	$0	$0
2033	$0	$0	$0
2034	$0	$0	$0
2035	$0	$0	$0
2036	$0	$0	$0
2037	$0	$0	$0
2038	$0	$0	$0
2039	$0	$0	$0
2040	$38,708	$3,871	$42,579

Targets

View: Accounts

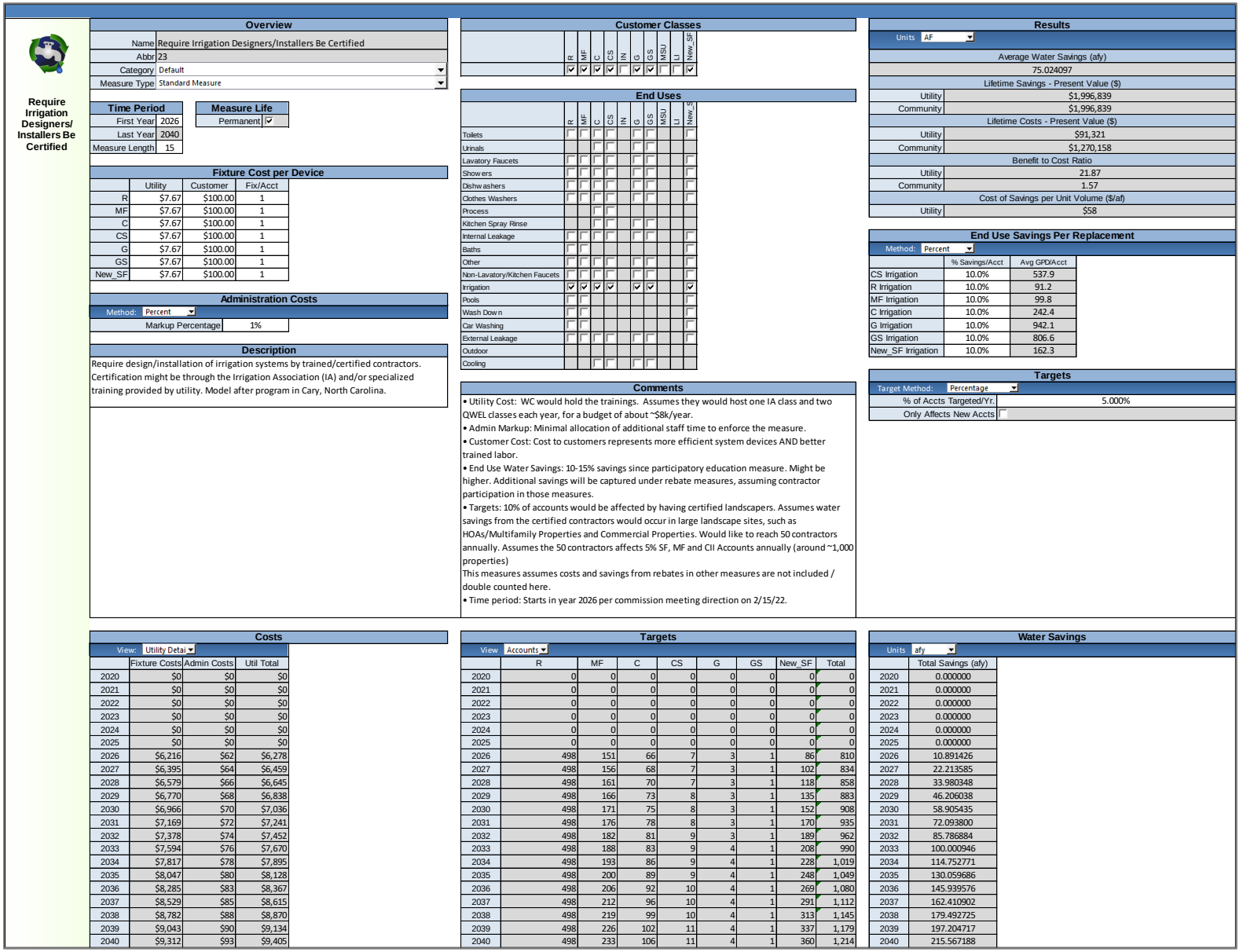
	R	MF	Total
2020	0	0	0
2021	0	0	0
2022	0	0	0
2023	0	0	0
2024	0	0	0
2025	0	0	0
2026	0	0	0
2027	0	0	0
2028	0	0	0
2029	0	0	0
2030	0	0	0
2031	0	0	0
2032	0	0	0
2033	0	0	0
2034	0	0	0
2035	0	0	0
2036	0	0	0
2037	0	0	0
2038	0	0	0
2039	0	0	0
2040	419	196	616

Water Savings

Units: afy

	Total Savings (afy)
2020	0.000000
2021	0.000000
2022	0.000000
2023	0.000000
2024	0.000000
2025	0.000000
2026	0.000000
2027	0.000000
2028	0.000000
2029	0.000000
2030	0.000000
2031	0.000000
2032	0.000000
2033	0.000000
2034	0.000000
2035	0.000000
2036	0.000000
2037	0.000000
2038	0.000000
2039	0.000000
2040	16.700204

Require Irrigation Designers/Installers Be Certified



Require Irrigation Designers/ Installers Be Certified

Overview

Name	Require Irrigation Designers/Installers Be Certified
Abbr	23
Category	Default
Measure Type	Standard Measure

Time Period

First Year	2026
Last Year	2040
Measure Length	15

Measure Life

Permanent	☑

Fixture Cost per Device

	Utility	Customer	Fix/Acct
R	$7.67	$100.00	1
MF	$7.67	$100.00	1
C	$7.67	$100.00	1
CS	$7.67	$100.00	1
G	$7.67	$100.00	1
GS	$7.67	$100.00	1
New_SF	$7.67	$100.00	1

Administration Costs

Method: Percent

Markup Percentage	1%

Description

Require design/installation of irrigation systems by trained/certified contractors. Certification might be through the Irrigation Association (IA) and/or specialized training provided by utility. Model after program in Cary, North Carolina.

Customer Classes

R	MF	C	CS	IN	G	GS	MSU	LI	New_SF
☑	☑	☑	☑	☐	☑	☑	☐	☐	☑

End Uses

	R	MF	C	CS	IN	G	GS	MSU	LI	New_SF
Toilets	☐	☐	☐	☐		☐	☐			☐
Urinals			☐	☐		☐	☐			
Lavatory Faucets	☐	☐	☐	☐		☐	☐			☐
Showers	☐	☐	☐	☐		☐	☐			☐
Dishwashers	☐	☐	☐	☐		☐	☐			☐
Clothes Washers	☐	☐	☐	☐		☐	☐			☐
Process			☐	☐						
Kitchen Spray Rinse			☐	☐		☐	☐			
Internal Leakage	☐	☐	☐	☐		☐	☐			☐
Baths	☐	☐								☐
Other	☐	☐	☐	☐		☐	☐			☐
Non-Lavatory/Kitchen Faucets	☐	☐	☐	☐		☐	☐			☐
Irrigation	☑	☑	☑	☑		☑	☑			☑
Pools	☐	☐								☐
Wash Down	☐	☐								☐
Car Washing	☐	☐								☐
External Leakage	☐	☐	☐	☐		☐	☐			☐
Outdoor										
Cooling			☐	☐		☐	☐			

Comments

- Utility Cost: WC would hold the trainings. Assumes they would host one IA class and two QWEL classes each year, for a budget of about ~$8k/year.
- Admin Markup: Minimal allocation of additional staff time to enforce the measure.
- Customer Cost: Cost to customers represents more efficient system devices AND better trained labor.
- End Use Water Savings: 10-15% savings since participatory education measure. Might be higher. Additional savings will be captured under rebate measures, assuming contractor participation in those measures.
- Targets: 10% of accounts would be affected by having certified landscapers. Assumes water savings from the certified contractors would occur in large landscape sites, such as HOAs/Multifamily Properties and Commercial Properties. Would like to reach 50 contractors annually. Assumes the 50 contractors affects 5% SF, MF and CII Accounts annually (around ~1,000 properties)

This measures assumes costs and savings from rebates in other measures are not included / double counted here.

- Time period: Starts in year 2026 per commission meeting direction on 2/15/22.

Results

Units: AF

Average Water Savings (afy)	
	75.024097
Lifetime Savings - Present Value ($)	
Utility	$1,996,839
Community	$1,996,839
Lifetime Costs - Present Value ($)	
Utility	$91,321
Community	$1,270,158
Benefit to Cost Ratio	
Utility	21.87
Community	1.57
Cost of Savings per Unit Volume ($/af)	
Utility	$58

End Use Savings Per Replacement

Method: Percent

	% Savings/Acct	Avg GPD/Acct
CS Irrigation	10.0%	537.9
R Irrigation	10.0%	91.2
MF Irrigation	10.0%	99.8
C Irrigation	10.0%	242.4
G Irrigation	10.0%	942.1
GS Irrigation	10.0%	806.6
New_SF Irrigation	10.0%	162.3

Targets

Target Method: Percentage

% of Accts Targeted/Yr.	5.000%
Only Affects New Accts	☐

Costs

View: Utility Detai

	Fixture Costs	Admin Costs	Util Total
2020	$0	$0	$0
2021	$0	$0	$0
2022	$0	$0	$0
2023	$0	$0	$0
2024	$0	$0	$0
2025	$0	$0	$0
2026	$6,216	$62	$6,278
2027	$6,395	$64	$6,459
2028	$6,579	$66	$6,645
2029	$6,770	$68	$6,838
2030	$6,966	$70	$7,036
2031	$7,169	$72	$7,241
2032	$7,378	$74	$7,452
2033	$7,594	$76	$7,670
2034	$7,817	$78	$7,895
2035	$8,047	$80	$8,128
2036	$8,285	$83	$8,367
2037	$8,529	$85	$8,615
2038	$8,782	$88	$8,870
2039	$9,043	$90	$9,134
2040	$9,312	$93	$9,405

Targets

View: Accounts

	R	MF	C	CS	G	GS	New_SF	Total
2020	0	0	0	0	0	0	0	0
2021	0	0	0	0	0	0	0	0
2022	0	0	0	0	0	0	0	0
2023	0	0	0	0	0	0	0	0
2024	0	0	0	0	0	0	0	0
2025	0	0	0	0	0	0	0	0
2026	498	151	66	7	3	1	86	810
2027	498	156	68	7	3	1	102	834
2028	498	161	70	7	3	1	118	858
2029	498	166	73	8	3	1	135	883
2030	498	171	75	8	3	1	152	908
2031	498	176	78	8	3	1	170	935
2032	498	182	81	9	3	1	189	962
2033	498	188	83	9	4	1	208	990
2034	498	193	86	9	4	1	228	1,019
2035	498	200	89	9	4	1	248	1,049
2036	498	206	92	10	4	1	269	1,080
2037	498	212	96	10	4	1	291	1,112
2038	498	219	99	10	4	1	313	1,145
2039	498	226	102	11	4	1	337	1,179
2040	498	233	106	11	4	1	360	1,214

Water Savings

Units: afy

	Total Savings (afy)
2020	0.000000
2021	0.000000
2022	0.000000
2023	0.000000
2024	0.000000
2025	0.000000
2026	10.891426
2027	22.213585
2028	33.980348
2029	46.206038
2030	58.905435
2031	72.093800
2032	85.786884
2033	100.000946
2034	114.752771
2035	130.059686
2036	145.939576
2037	162.410902
2038	179.492725
2039	197.204717
2040	215.567188

Mandatory Water Efficiency Offsets

Mandatory Water Efficiency Offsets

Overview

Name	Mandatory Water Efficiency Offsets
Abbr	24
Category	Default
Measure Type	Standard Measure

Time Period

First Year	2033
Last Year	2040
Measure Length	8

Measure Life

Permanent ☑

Fixture Cost per Device

	Utility	Customer	Fix/Acct
MF	$0.01	$3,750.00	1
C	$0.01	$3,750.00	1
CS	$0.01	$3,750.00	1
New_SF	$0.01	$3,750.00	1

Administration Costs

Method: Fixed

Annual Admin Costs	$26,986

Description

This measure is modeled after the Net Blue water offset framework. The intent of this measure is to require developers to offset a portion of their estimated water demand from new development with efficiency projects.

Customer Classes

R	MF	C	CS	IN	G	GS	MSU	LI	New_SF
☐	☑	☑	☑	☐	☐	☐	☐	☐	☑

End Uses

	R	MF	C	CS	IN	G	GS	MSU	LI	New_SF
Toilets		☑	☑	☑						☑
Urinals			☑	☑						
Lavatory Faucets		☑	☑	☑						☑
Showers		☑	☑	☑						☑
Dishwashers		☑	☑	☑						☑
Clothes Washers		☑	☑	☑						☑
Process			☑	☑						
Kitchen Spray Rinse			☑	☑						
Internal Leakage		☐	☐	☐						☐
Baths		☑								☑
Other		☑	☑	☑						☑
Non-Lavatory/Kitchen Faucets		☑	☑	☑						☑
Irrigation		☑	☑	☑						☑
Pools		☑								☑
Wash Down		☑								☑
Car Washing		☑								☑
External Leakage		☐	☐	☐						☐
Outdoor										
Cooling			☑	☑						

Results

Units: AF

Average Water Savings (afy)	
	383.902051
Lifetime Savings - Present Value ($)	
Utility	$10,070,272
Community	$12,149,589
Lifetime Costs - Present Value ($)	
Utility	$160,818
Community	$12,739,514
Benefit to Cost Ratio	
Utility	62.62
Community	0.95
Cost of Savings per Unit Volume ($/af)	
Utility	$20

Targets

Target Method:	Percentage
% of Accts Targeted/Yr	90.000%
Only Affects New Accts	☑

Comments

- Utility Cost: No cost to conservation budget.
- Admin Markup: Assumes 4 hours per account for enforcement, communication, and inspections, using an average hourly rate of $38.39, which is an average of the water conservation manager fully burdened rate of $46.86 and the water conservation technician fully burdened rate of $29.92)
- Customer Cost: Cost to developer to install net zero system (efficient fixtures and greywater devices) or offset at another location. Customer cost of $3,750 per account is derived from City's calculation of total cost to offset 1 AF of water.
- End Use Water Savings: This measure would require that 100% of demand from new development be offset through efficiency projects prior to approval - effectively eliminating demand associated with new development. This could be achieved by partially reducing use onsite, and/or completing retrofit projects offsite in order to save the amount of water equal to the demand of the new development. Therefore, the end use water savings for this measure is 100%.
- Targets: Since mandatory measure, 90% of new accounts for MF and CII properties (assumes not 100% will comply)
- Time Period: This measure is intended to start up after the "Impact Fee Credit" measure ends. Starts when demand is expected to exceed supply.

End Use Savings Per Replacement

Method: Percent

	% Savings/Acct	Avg GPD/Acct		% Savings/Acct	Avg GPD/Acct
MF Toilets	100.0%	96.8	CS Toilets	100.0%	52.1
C Toilets	100.0%	150.1	CS Urinals	100.0%	20.8
C Urinals	100.0%	45.0	CS Lavatory Fau	100.0%	26.3
MF Lavatory Faucets	100.0%	26.5	CS Showers	100.0%	31.3
C Lavatory Faucets	100.0%	56.8	CS Dishwashers	100.0%	20.8
MF Showers	100.0%	75.7	CS Clothes Was	100.0%	52.1
C Showers	100.0%	67.6	CS Process	100.0%	48.6
MF Dishwashers	100.0%	4.8	CS Kitchen Spra	100.0%	17.4
C Dishwashers	100.0%	45.0	CS Other	100.0%	20.8
MF Clothes Washers	100.0%	65.5	CS Non-Lavatory	100.0%	22.4
C Clothes Washers	100.0%	112.6	CS Irrigation	100.0%	537.9
C Process	100.0%	105.1	CS Cooling	100.0%	103.4
C Kitchen Spray Rinse	100.0%	37.5	New_SF Toilets	100.0%	23.3
MF Baths	100.0%	10.2	New_SF Lavator	100.0%	6.4
MF Other	100.0%	17.0	New_SF Shower	100.0%	18.2
C Other	100.0%	37.5	New_SF Dishwa	100.0%	1.2
MF Non-Lavatory/Kitchen	100.0%	49.2	New_SF Clothes	100.0%	15.8
C Non-Lavatory/Kitchen Fa	100.0%	48.3	New_SF Baths	100.0%	2.5
MF Irrigation	100.0%	99.8	New_SF Other	100.0%	4.1
C Irrigation	100.0%	242.4	New_SF Non-La	100.0%	11.9
MF Pools	100.0%	2.4	New_SF Irrigatio	100.0%	162.3
MF Wash Down	100.0%	4.8	New_SF Pools	100.0%	3.9
MF Car Washing	100.0%	4.8	New_SF Wash D	100.0%	7.8
C Cooling	100.0%	46.6	New_SF Car Wa	100.0%	7.8

Costs

View: Utility Detai

	Fixture Costs	Admin Costs	Util Total
2020	$0	$0	$0
2021	$0	$0	$0
2022	$0	$0	$0
2023	$0	$0	$0
2024	$0	$0	$0
2025	$0	$0	$0
2026	$0	$0	$0
2027	$0	$0	$0
2028	$0	$0	$0
2029	$0	$0	$0
2030	$0	$0	$0
2031	$0	$0	$0
2032	$0	$0	$0
2033	$5	$26,986	$26,991
2034	$5	$26,986	$26,991
2035	$5	$26,986	$26,992
2036	$6	$26,986	$26,992
2037	$6	$26,986	$26,992
2038	$6	$26,986	$26,992
2039	$6	$26,986	$26,992
2040	$6	$26,986	$26,992

Targets

View: Accounts

	MF	C	CS	New_SF	Total
2020	0	0	0	0	0
2021	0	0	0	0	0
2022	0	0	0	0	0
2023	0	0	0	0	0
2024	0	0	0	0	0
2025	0	0	0	0	0
2026	0	0	0	0	0
2027	0	0	0	0	0
2028	0	0	0	0	0
2029	0	0	0	0	0
2030	0	0	0	0	0
2031	0	0	0	0	0
2032	0	0	0	0	0
2033	103	51	5	345	504
2034	107	53	6	356	521
2035	110	54	6	367	537
2036	114	56	6	379	554
2037	117	58	6	391	572
2038	121	60	6	403	590
2039	125	62	7	416	609
2040	129	65	7	429	629

Water Savings

Units: afy

	Total Savings (afy)
2020	0.000000
2021	0.000000
2022	0.000000
2023	0.000000
2024	0.000000
2025	0.000000
2026	0.000000
2027	0.000000
2028	0.000000
2029	0.000000
2030	0.000000
2031	0.000000
2032	0.000000
2033	209.647839
2034	425.061008
2035	646.477941
2036	874.138956
2037	1108.286909
2038	1349.167790
2039	1597.031293
2040	1852.131339

Landscape Ordinance – Tier 3

Landscape Ordinance - Tier 3

Overview	
Name	Landscape Ordinance - Tier 3
Abbr	27_L_OrdT3
Category	Default
Measure Type	Standard Measure

Time Period	
First Year	2024
Last Year	2040
Measure Length	17

Measure Life	
Permanent	☑

Fixture Cost per Device

	Utility	Customer	Fix/Acct
MF	$1.00	$500.00	1
C	$1.00	$1,000.00	1
CS	$1.00	$1,000.00	1
New_SF	$1.00	$200.00	1

Administration Costs

Method:	Fixed
Annual Admin Costs	$180,819

Description

TIER 3 of a prescriptive landscape ordinance measure would:
> Restrict turfgrass installation to 35% of total landscaped area - SF
> Restrict turfgrass installation to 20% of total landscaped area - MF
> Restrict turfgrass installation to 20% of total landscaped area - COM

Additionally for SF, MF, and COM customer classes there will be the following:
> Landscape Design Standards:
• Require 6" of topsoil - tilled w/ OM (4 cu yds./1,000 sq ft. of landscape area)
• Require 3" mulch on bare soil (5% can be left uncovered for habitat)
• Require submittal of soil quality lab test documentation
• Drought tolerant vegetation requirement for parkland, ROW
> Irrigation Design Standards:
• Detailed irrigation plan required for parkland and Plan Review (PR) projects
• Head to head coverage
• Hydro zoning
• Low flow drip for trees/perennials/shrubs
• No OH spray permitted in areas less than 10 ft wide
• Irrigation O&M plan (including schedule for establishment and post-establishment)
• Irrigation performance requirement of 70% DU (verified by certified 3rd party contractor)
> Irrigation Performance Standards:
• Adequate operating pressure
• Weather based controller
• Rain/soil moisture sensor
• Nozzle max. application rate of 1.25 in/hr.
> Large Landscape Requirements:
• Irrigation submeters required
• Flow sensor required
• Separate irrigation rate structure for all irrigation submeters (more $$)

Customer Classes

R	MF	C	CS	IN	G	GS	MSU	LI	New_SF
☐	☑	☑	☑	☐	☐	☐	☐	☐	☑

End Uses

	R	MF	C	CS	IN	G	GS	MSU	LI	New_SF
Toilets	☐	☐	☐	☐						☐
Urinals			☐	☐						
Lavatory Faucets	☐	☐	☐	☐						☐
Showers	☐	☐	☐	☐						☐
Dishwashers	☐	☐	☐	☐						☐
Clothes Washers	☐	☐	☐	☐						☐
Process			☐	☐						
Kitchen Spray Rinse			☐	☐						
Internal Leakage	☐	☐	☐	☐						☐
Baths	☐									☐
Other	☐	☐	☐	☐						☐
ory/Kitchen Faucets	☐	☐	☐	☐						☐
Irrigation	☑	☑	☑	☑						☑
Pools	☐									☐
Wash Down	☐									☐
Car Washing	☐									☐
External Leakage	☐	☐	☐	☐						☐
Outdoor										
Cooling				☐						

Comments

• Utility Cost: Minimal utility cost. It is assumed utility cost would be reimbursed by developers.
• Admin Markup: Fixed annual cost represents 5,548 staff hours. Admin time assumes split 50/50 time for education and outreach, set up, and tracking effectiveness QAQC between technician rate and manager rate. Additionally, admin time includes 100% technician time for plan review, compliance inspection, and follow up for building permit for BO projects, and other building permit review and compliance inspections for BPR projects.
Fully burdened technician rate is $29.92/hr. Fully burdened water conservation manager rate is $46.86/hr. It is assumed 3.12 FTEs will be needed.
• Customer Cost: Cost to comply with ordinance by putting in proper landscaping.
• End Use Water Savings: savings are based on the estimated annual irrigation water use per account. It is assumed that MF and Commercial accounts will have a turf limit of 20% of irrigable area (~2,884 sq.ft. of area for MF and 6,551 sq.ft. of area for COM). It is assumed that New_SF accounts will have a turf limit of 35% of irrigable area (~ 1,412 sq.ft.) Water savings are calculated using the percent difference of the current average turf and non-turf area water budget to the 20% turf/ 80% non-turf irrigable area budgets for MF and COM, and 40% turf/60% non-turf irrigable area budgets. Savings inputs above the average account type irrigation use reflects the much higher irrigation use by new accounts. The average account's average irrigation use volume is based on both lower and higher water use by customer category accounts. This measure targets the higher than average water using accounts.
• Targets: Assumed 90% of new multi-family accounts and 100% of new commercial and commercial special accounts are targeted. Assumes 80% of "new" New_SF accounts are targeted.

Results

Units	AF
Average Water Savings (afy)	
504.805546	
Lifetime Savings - Present Value ($)	
Utility	$13,597,493
Community	$13,597,493
Lifetime Costs - Present Value ($)	
Utility	$2,495,120
Community	$4,805,122
Benefit to Cost Ratio	
Utility	5.45
Community	2.83
Cost of Savings per Unit Volume ($/af)	
Utility	$235

End Use Savings Per Replacement

Method: Percent

	% Savings/Acct	Avg GPD/Acct
MF Irrigation	138.7%	99.8
C Irrigation	257.2%	242.4
CS Irrigation	115.9%	537.9
New_SF Irrigation	33.0%	162.3

Targets

Target Method: Detailed

Enter Annual Targets Below

Costs

View: Utility Detai

	Fixture Costs	Admin Costs	Util Total
2020	$0	$0	$0
2021	$0	$0	$0
2022	$0	$0	$0
2023	$0	$0	$0
2024	$349	$180,819	$181,167
2025	$360	$180,819	$181,179
2026	$371	$180,819	$181,190
2027	$383	$180,819	$181,202
2028	$396	$180,819	$181,214
2029	$408	$180,819	$181,227
2030	$421	$180,819	$181,240
2031	$435	$180,819	$181,254
2032	$449	$180,819	$181,268
2033	$463	$180,819	$181,282
2034	$478	$180,819	$181,297
2035	$493	$180,819	$181,312
2036	$509	$180,819	$181,328
2037	$526	$180,819	$181,344
2038	$542	$180,819	$181,361
2039	$560	$180,819	$181,379
2040	$578	$180,819	$181,396

Targets

View: Accounts

	MF	C	CS	New_SF	Total
2020	0	0	0	0	0
2021	0	0	0	0	0
2022	0	0	0	0	0
2023	0	0	0	0	0
2024	78	41	4	225	349
2025	81	43	5	232	360
2026	83	44	5	239	371
2027	86	46	5	247	383
2028	89	47	5	255	396
2029	91	49	5	263	408
2030	94	51	5	271	421
2031	97	53	6	280	435
2032	100	54	6	288	449
2033	103	56	6	298	463
2034	107	58	6	307	478
2035	110	60	6	317	493
2036	114	63	7	327	509
2037	117	65	7	337	526
2038	121	67	7	348	542
2039	125	69	7	359	560
2040	129	72	8	370	578

Water Savings

Units afy

	Total Savings (afy)
2020	0.000000
2021	0.000000
2022	0.000000
2023	0.000000
2024	57.577510
2025	117.083155
2026	178.581671
2027	242.139968
2028	307.827211
2029	375.714891
2030	445.876908
2031	518.389650
2032	593.332074
2033	670.785799
2034	750.835191
2035	833.567458
2036	919.072745
2037	1007.444232
2038	1098.778241
2039	1193.174335
2040	1290.735434

APPENDIX F – CONSERVATION ANALYSIS RESULTS

This appendix presents benefit and cost analysis results for individual conservation measures and overall conservation programs. Table F-1 presents how much water the measures will save through 2045, how much they will cost, and the cost of saved water per unit volume *if the measures were to be implemented on a stand-alone basis (i.e., without interaction or overlap from other measures that might address the same end use or uses).* Savings from measures which address the same end use(s) are not additive; the model uses impact factors to avoid double counting in estimating the water savings from programs of measures.[12] This is why a measure like Public Education may show a distorted cost in comparison to water saved. Most, if not all, measures rely on public awareness. However, it is important to note that water savings are more directly attributable to an "active" measure, like a toilet rebate, than the less "active" public education/awareness measure that informs the community of the active measure.

Since interaction between measures has not been accounted for in Table F-1, it is not appropriate to include totals at the bottom of the table. However, the table is useful to give a close approximation of the cost effectiveness of each measure.

Cost categories are defined as follows:

- Utility Costs – Costs the City will incur, as a water utility, to operate a measure, including administrative costs.
- Utility Benefits – The avoided cost of producing water at the identified rate $1,645/AF.
- Customer (Community) Costs – Those costs customers will incur to implement a measure in the City's conservation program and maintain its effectiveness over the life of the measure.
- Customer (Community) Benefits – The additional savings, such as energy savings resulting from reduced use of hot water. These savings are additional as customers also would have reduced water bills (since the Utility Costs and Benefits transfer to the customers).
- Community Costs – Includes Utility Costs plus Customer Costs.
- Community Benefits – Includes Utility Benefits plus Customer Benefits.

The column headings in Table F-1 are defined as follows:

- Present Value (PV) of Utility and Community Costs and Benefits ($) = the present value of the 21-year time stream of annual costs or benefits, discounted to the base year.
- Utility Benefit to Cost Ratio = PV of Utility Benefits divided by PV of Utility Costs over 21 years.
- Community Benefit to Cost Ratio = (PV of Utility Benefits plus PV of customer energy savings) divided by (PV of Utility Costs plus PV of Customer Costs), over 21 years.
- Five Years of Water Utility Costs ($) = sum of annual Utility Costs for 2023–2028. Measures start in the years as specified for each measure shown in Appendix E. Utility costs include administrative costs and staff labor.
- Water Savings in 2040 (AFY) = water saved in acre-feet per year.
- Cost of Savings per Unit Volume ($/AF) = PV of Utility Costs over 21 years divided by the 21-year water savings. The analysis period is 2020–2040. This value is compared to the utility's avoided cost of water as one indicator of the cost effectiveness of conservation efforts. Note that this value somewhat minimizes the cost of savings because program costs are discounted to present value, but water benefits are not.

[12] For example, if two measures are planned to address the same end use and both save 10% of the prior water use, then the net effect is not the simple sum of 20%. Rather, it is the cumulative impact of the first measure reducing the use to 90% of what it was originally, without the first measure in place. Then, the revised use of 90% is reduced by another 10% (10% x 90% = 9%) to result in the use being 81% (90% - 9% = 81%). In this example, the net savings is 19%, not 20%. Using impact factors, the model computes the reduction as follows, 0.9 x 0.9 = 0.81 or 19% water savings.

Table F-1. Estimated Conservation Measure Costs and Savings

Measure	Present Value of Water Utility Benefits	Present Value of Community Benefits	Present Value of Water Utility Costs	Present Value of Community Costs	Water Utility Benefit to Cost Ratio	Community Benefit to Cost Ratio	Five Years of Water Utility Costs 2023 2028	Water Savings in 2040 (AFY)	Water Savings in 2040 (GPCD)	Cost of Savings per Unit Volume ($/AF)
Commercial										
Capital Project HE Fixture Installation in Gov t Bldg.	$67,522								0.04	$1,686
School Building Retrofit	$14,264	$19,049	$43,372	$85,481	0.33	0.22	$0	1.83	0.02	$3,910
CII High Efficiency Washer Rebate	$101,734	$177,152	$270,166	$1,057,055	0.38	0.17	$0	9.35	0.08	$3,515
Require HE Toilets, Showerheads, Faucets, Urinals in New Development	$32,967	$42,766	$13,440	$220,684	2.45	0.19	$0	26.85	0.24	$501
Mandatory Water Efficiency Offsets	$10,070,272	$12,149,589	$160,818	$12,739,514	62.62	0.95	$0	1,852.13	16.64	$20
Irrigation										
Capital Project Retrofit City Medians with Drought Tolerant Landscaping and Efficient Irrigation	$33,510	$33,510	$13,365	$13,365	2.51	2.51	$15,150	1.82	0.02	$525
Capital Project Upgrade City	$34,097	$34,097	$78,495	$78,495	0.43	0.43	$86,604	1.65	0.01	$3,076

Measure	Present Value of Water Utility Benefits	Present Value of Community Benefits	Present Value of Water Utility Costs	Present Value of Community Costs	Water Utility Benefit to Cost Ratio	Community Benefit to Cost Ratio	Five Years of Water Utility Costs 2023 2028	Water Savings in 2040 (AFY)	Water Savings in 2040 (GPCD)	Cost of Savings per Unit Volume ($/AF)
Facility Irrigation Systems										
Dedicated Irrigation Meters & Irrigation Account Rate Structure	$41,168	$41,168	$44,601	$189,974	0.92	0.22	$0	5.86	0.05	$1,343
Impact Fee Credit	$957,338	$1,220,446	$69,679	$3,396,050	13.74	0.36	$27,260	54.81	0.49	$97
Financial Incentives for Irrigation and Landscape Upgrades	$336,346	$336,346	$348,144	$532,466	0.97	0.63	$93,569	16.37	0.15	$1,396
Landscape Conversion or Turf Removal Rebate	$1,167,822	$1,167,822	$2,596,488	$20,569,483	0.45	0.06	$727,322	94.21	0.85	$2,895
Contractor Efficient Outdoor Use Education and Training Programs	$1,553,720	$1,553,720	$117,749	$117,749	13.20	13.20	$29,884	82.93	0.75	$103
Xeriscape Demonstration Gardens	$497,501	$497,501	$115,505	$803,036	4.31	0.62	$28,667	23.85	0.21	$316
Require Irrigation Designers/Installers Be Certified	$1,996,839	$1,996,839	$91,321	$1,270,158	21.87	1.57	$12,737	215.57	1.94	$58

Measure	Present Value of Water Utility Benefits	Present Value of Community Benefits	Present Value of Water Utility Costs	Present Value of Community Costs	Water Utility Benefit to Cost Ratio	Community Benefit to Cost Ratio	Five Years of Water Utility Costs 2023 2028	Water Savings in 2040 (AFY)	Water Savings in 2040 (GPCD)	Cost of Savings per Unit Volume ($/AF)
Landscape Ordinance Tier 3	$13,597,493	$13,597,493	$2,495,120	$4,805,122	5.45	2.83	$724,738	1,290.74	11.60	$235
Residential										
Tiered Rate Structure for MF	$44,808	$44,808	$68,754	$68,754	0.65	0.65	$0	24.27	0.22	$831
AMI and Customer Water Use Portal	$1,338,233	$2,461,181	$481,541	$1,454,351	2.78	1.69	$118,622	84.80	0.76	$489
Water Budget Based Billing and Water Budgeting	$173,161	$173,161	$996,508	$1,089,640	0.17	0.16	$0	16.00	0.14	$7,279
Efficient Fixture Giveaway	$440,160	$695,484	$20,682	$47,689	21.28	14.58	$5,057	31.77	0.29	$64
Residential Efficiency Fixture Incentive Program	$1,265,438	$1,678,094	$352,510	$824,633	3.59	2.03	$96,479	81.49	0.73	$388
Residential Water Use Surveys	$953,503	$1,043,723	$719,661	$752,788	1.32	1.39	$201,257	46.85	0.42	$1,035
Low Income Direct Installation Rebates and Leak Repair Assistance	$50,685	$71,329	$70,151	$70,151	0.72	1.02	$13,421	4.89	0.04	$1,830
Fixture Retrofit on Resale or Name Change on Water Account	$20,507	$27,479	$29,759	$100,229	0.69	0.27	$0	16.70	0.15	$1,782

Measure	Present Value of Water Utility Benefits	Present Value of Community Benefits	Present Value of Water Utility Costs	Present Value of Community Costs	Water Utility Benefit to Cost Ratio	Community Benefit to Cost Ratio	Five Years of Water Utility Costs 2023 2028	Water Savings in 2040 (AFY)	Water Savings in 2040 (GPCD)	Cost of Savings per Unit Volume ($/AF)
	Community & Education									
Public Education	$3,008,536	$3,122,408	$2,227,983	$2,951,354	1.35	1.06	$550,657	150.19	1.35	$1,016
	System									
Water Loss	$3,431,066	$3,431,066	$391,935	$391,935	8.75	8.75	$125,000	317.18	2.85	$147

Additional information about the water reduction methodology, perspectives on benefits and costs, and assumptions about present value parameters and measure costs/savings can be found earlier in this Plan in Appendix D.

The following table shows each conservation program's present value of water savings and utility costs, as well as cost of water saved. See Appendix D for a more detailed explanation of present value.

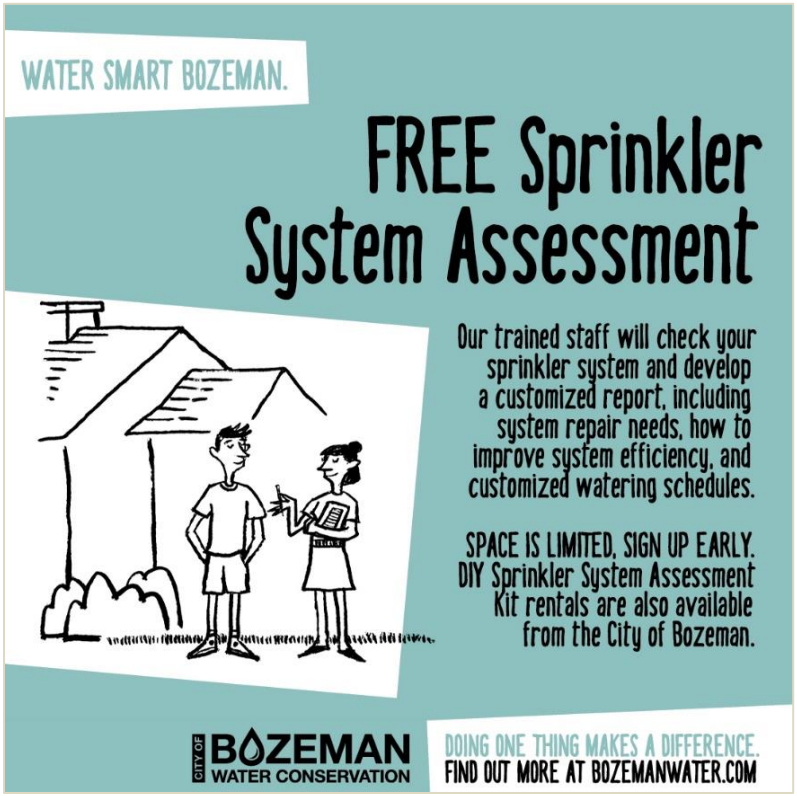
Table F-2. Conservation Program Estimated Costs and Water Savings

Conservation Program	Water Utility Present Value of Water Savings	Water Utility Present Value of Utility Costs	Water Utility Cost of Water Saved ($/AF)
Program A with Plumbing Code	$13,699,000	$7,451,000	$730
Program B with Plumbing Code	$36,469,000	$10,621,000	$380
Program C with Plumbing Code	$36,816,000	$11,901,000	$420

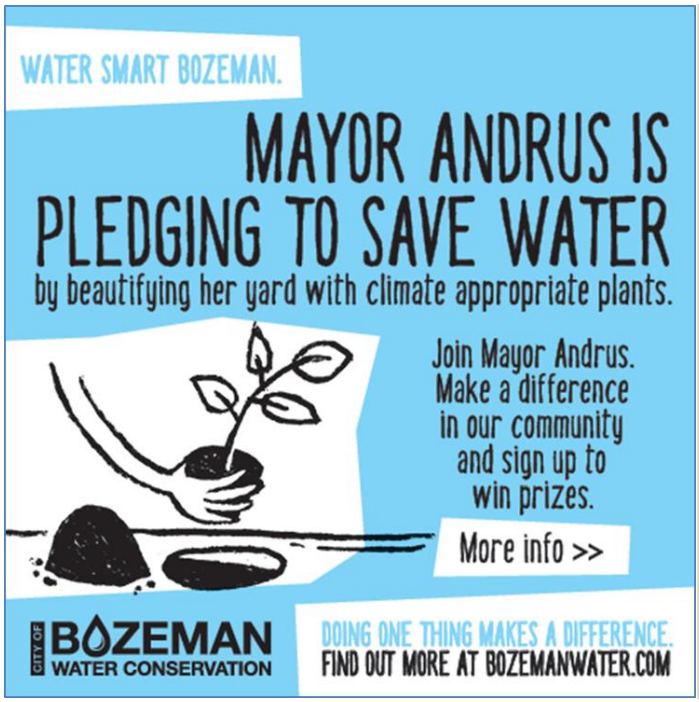
Costs presented in the table above are directly attributable to the City's conservation department only. Present value costs and savings are rounded to nearest $1,000.

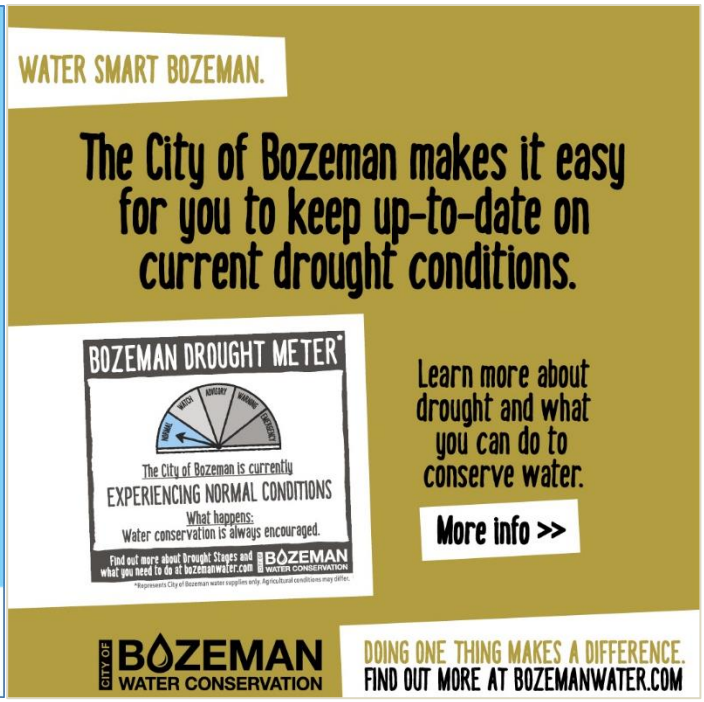
APPENDIX G – EXAMPLES OF LOCAL OUTREACH INITIATIVES

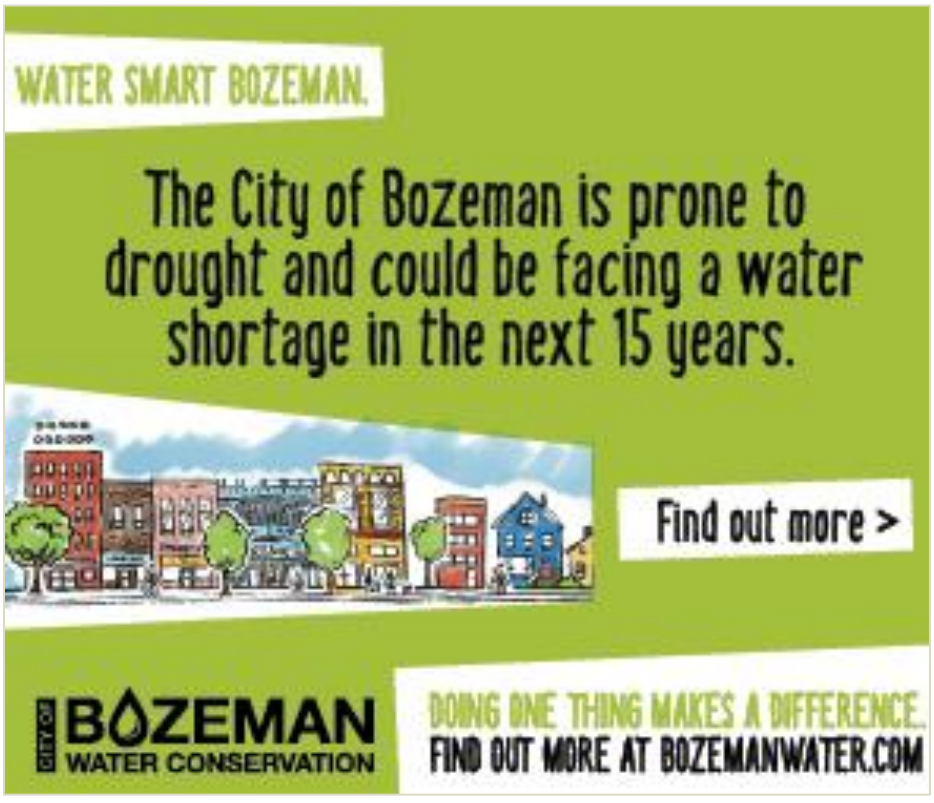
Social Media Examples



Online Examples

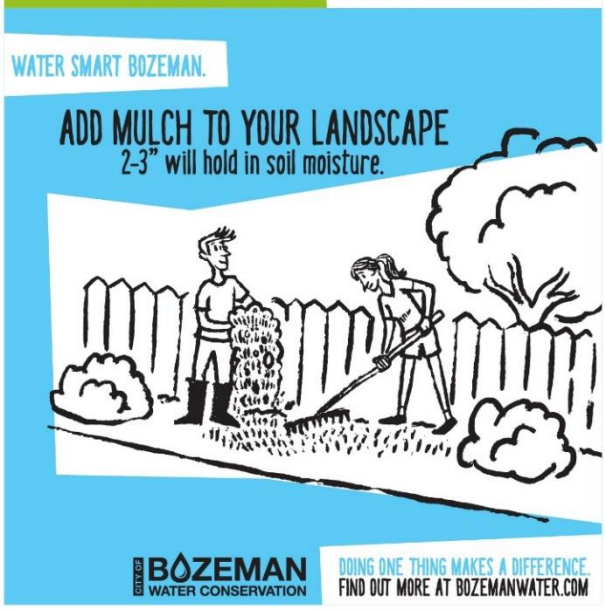

WATER SMART BOZEMAN.
MAYOR ANDRUS IS PLEDGING TO SAVE WATER
by beautifying her yard with climate appropriate plants.
Join Mayor Andrus. Make a difference in our community and sign up to win prizes.
More info >>
CITY OF BOZEMAN WATER CONSERVATION
DOING ONE THING MAKES A DIFFERENCE.
FIND OUT MORE AT BOZEMANWATER.COM

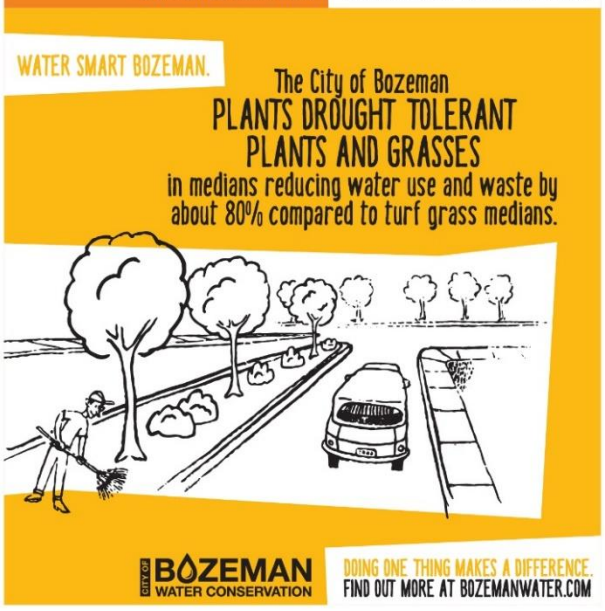

WATER SMART BOZEMAN.
The City of Bozeman makes it easy for you to keep up-to-date on current drought conditions.
BOZEMAN DROUGHT METER
The City of Bozeman is currently
EXPERIENCING NORMAL CONDITIONS
What happens:
Water conservation is always encouraged.
Learn more about drought and what you can do to conserve water.
More info >>
CITY OF BOZEMAN WATER CONSERVATION
DOING ONE THING MAKES A DIFFERENCE.
FIND OUT MORE AT BOZEMANWATER.COM


WATER SMART BOZEMAN.
The City of Bozeman is prone to drought and could be facing a water shortage in the next 15 years.
Find out more >
CITY OF BOZEMAN WATER CONSERVATION
DOING ONE THING MAKES A DIFFERENCE.
FIND OUT MORE AT BOZEMANWATER.COM

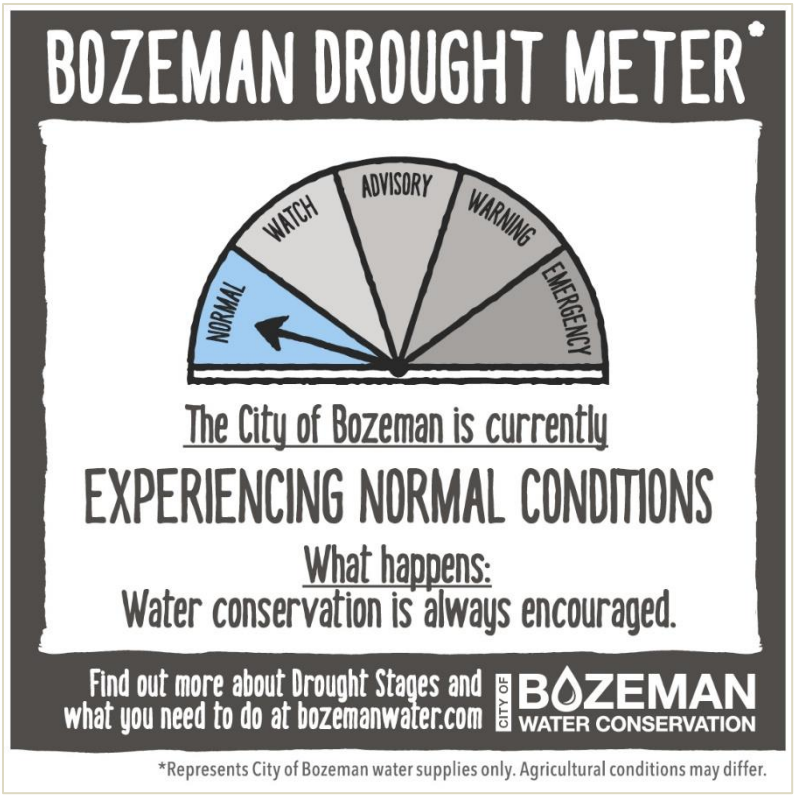

WATER SMART BOZEMAN.
CHECK YOUR SPRINKLERS
for obstructions, leaks, and broken or misaligned nozzles. Repair as needed.
CITY OF BOZEMAN WATER CONSERVATION
DOING ONE THING MAKES A DIFFERENCE.
FIND OUT MORE AT BOZEMANWATER.COM

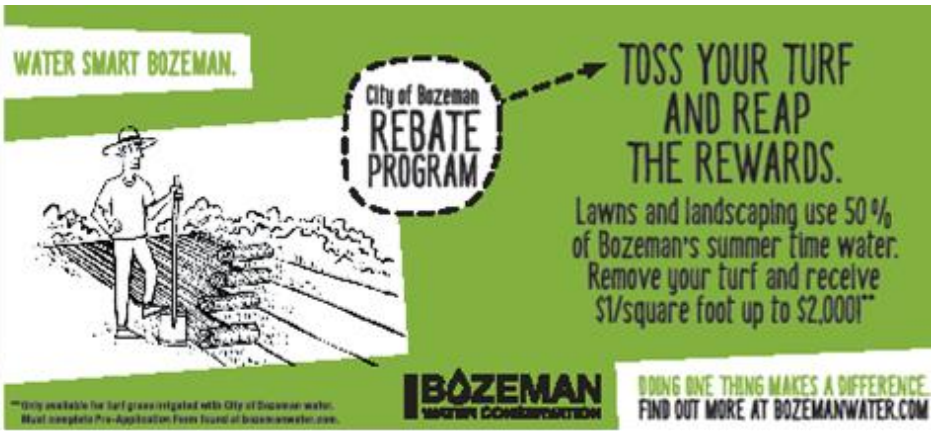

WATER SMART BOZEMAN.
City of Bozeman
REBATE PROGRAM
INSTALL DROUGHT TOLERANT PLANTS
in your landscape and use 50-75 % less water.
CITY OF BOZEMAN WATER CONSERVATION
DOING ONE THING MAKES A DIFFERENCE.
FIND OUT MORE AT BOZEMANWATER.COM


WATER SMART BOZEMAN.
ADD MULCH TO YOUR LANDSCAPE
2-3" will hold in soil moisture.
CITY OF BOZEMAN WATER CONSERVATION
DOING ONE THING MAKES A DIFFERENCE.
FIND OUT MORE AT BOZEMANWATER.COM


WATER SMART BOZEMAN.
The City of Bozeman
PLANTS DROUGHT TOLERANT PLANTS AND GRASSES
in medians reducing water use and waste by about 80% compared to turf grass medians.
CITY OF BOZEMAN WATER CONSERVATION
DOING ONE THING MAKES A DIFFERENCE.
FIND OUT MORE AT BOZEMANWATER.COM

Print Ad Examples





APPENDIX H – COMMUNITY STAKEHOLDER CONSERVATION MEASURE SURVEYS SUMMARY AND RESULTS

Water Conservation and Efficiency Plan Community Engagement Summary

Program Measure Evaluation and Selection Process

To develop this Plan, a series of program measures were evaluated in collaboration with the City of Bozeman. This evaluation was specific to the factors that were unique to the City's service area, such as water use characteristics, economies of scale, and demographics. The overall initial list of more than 140 potential water conservation measures was drawn from MWM and the City's experience, and a review of what other water agencies with innovative and effective conservation programs were implementing at the time.

The City scored and evaluated each of these measures based on quantifiable water savings, technology availability and market maturity, service area match, customer acceptance, equity, and additional service area benefits. Through this process, the list was reduced to 49 measures.

After shortening the original list from 140 to 49 program measures, the City solicited input from the community. Engaging the community during this portion of the Plan development process was crucial to ensuring that the City develops programs that would be supported and widely adopted within the community.

Engage Bozeman and the Survey Development Process

In 2021, the City of Bozeman adopted and launched a community engagement initiative called Engage Bozeman to gather input from the community. Engage Bozeman strives to create opportunities and pathways for residents to interact with the City by taking part in finding solutions and contributing to decisions that affect them.

The first step of the Engage Bozeman process is to define the decision-making process. This means identifying what decisions need to me made, who will make them, and what information will be considered. To start the community engagement process, the City evaluated these questions and came to the following conclusions:

- The decision that needs to be made is what program measures will undergo a detailed economic analysis and then be added into the Plan.
- The decision makers will be City staff, MWM, City Management, and the City Commission.
- To make this decision, input from the public will be crucial to selecting program measures that will be well received and widely adopted within the community.

The next step in the community engagement process was to define the level of engagement. To do this the City utilized the International Association for Public Participation (IAP2) engagement spectrum.[13] The IA2P engagement spectrum outlines the levels of engagement and helps determine how the community will contribute to the process and what the expectations are for achieving a given level of engagement.

[13] https://www.bozeman.net/home/showpublisheddocument/11461/637622797246270000

Increasing Impact on the Decision

	CONSULT	INVOLVE	COLLABORATE	EMPOWER
PUBLIC PARTICIPATION GOAL	To obtain public feedback on analysis, alternatives and/or decisions.	To work directly with the public throughout the process to ensure that public concerns and aspirations are consistently understood and considered.	To partner with the public in each aspect of the decision including the development of alternatives and the identification of the preferred solution.	To place final decision making in the hands of the public.
PROMISE TO THE PUBLIC	We will keep you informed and listen to and acknowledge concerns & aspirations and provide feedback on how public input influenced the decision.	We will work with you to ensure that your concerns & aspirations are directly reflected in the alternatives developed and provide feedback on how public input influenced the decision.	We will look to you for advice & innovation in formulating solutions and incorporate your advice and recomm-endations into the decisions to the maximum extent possible.	We will implement what you decide.

Inform/Communicate

To provide the public with balanced and objective information to assist them in understanding the problem, alternatives, opportunities, and/or solutions.

Example Tools and Techniques

	CONSULT	INVOLVE	COLLABORATE	EMPOWER
SELECT BASED ON LEVEL OF ENGAGEMENT	• Surveys • Interviews • Focus groups • Public meetings • Public comment • Open houses (where there is an opportunity for the public to give input) • Public engagement platforms	• Charrettes • Focused conversations • Community liaisons • World cafes/table talks • Open space meetings (self directed meetings) • Card storming (using sticky notes to generate ideas, identify priorities)	• Appreciative inquiry processes • Deliberative forums • Advisory groups • Study circles • Workshops	• Citizen juries • Deliberative polling process

The City decided that somewhere between "consult" and "involve" was the desired level of public participation. This was chosen on the basis that the public is not ultimately making the decision, but their input is still valued and will be considered in the decision-making process. To get the public's input, a suite of surveys was developed to share with various stakeholders.

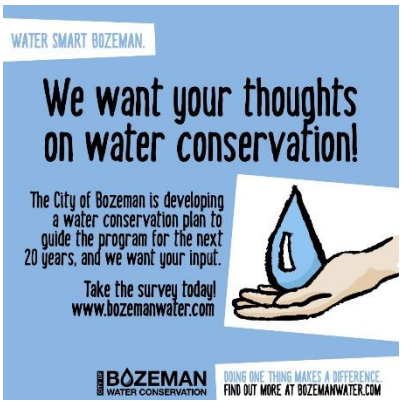
Developing the Surveys

The first step in developing the surveys was to identify key stakeholder groups that would be directly impacted by the outcome of the Plan. The groups identified were residents, businesses, landscape and irrigation contractors, developers, and property management companies.

The next step was to take the list of program measures being evaluated and identify which stakeholder groups would either be impacted by the measure or would potentially be interested in voicing their opinion about the measure. Once all the measures were aligned with corresponding groups, a customized survey was developed

for each stakeholder group. Each survey question was strategically and mindfully created to ensure that every stakeholder would understand the measure. Each question corresponded directly with one or more program measures. At the end of each survey, participants could elect to stay updated on the progress of the Plan.

Outreach and Results



To distribute the surveys to the various stakeholder groups the City utilized existing stakeholder email lists and a variety of outreach methods. The surveys were publicly available for 18 days (June 29–July 16, 2021). Direct email lists were utilized for businesses, landscape and irrigation contractors, developers, and property managers.

The survey targeting residents was advertised more heavily to include a more diverse group of respondents. To accomplish this, the City utilized its eNotification tool, which includes email lists for various City topics and departments. The survey was also released on social media and through word-of-mouth at local events such as the farmer's market.

Coincidentally, the survey was made public as the City declared a stage 2 drought. This brought more attention to water conservation in general, and the local newspaper, the Bozeman Daily Chronicle, wrote an article about the Plan development and linked the survey. After this was published, there was a spike in resident survey submissions. In total, 453 people completed the surveys.

Information gathered from survey submissions was used to shorten the list of program measures from 49 to 25. These 25 program measures were selected for inclusion in the Plan and underwent a detailed benefit-cost analysis.

Table H-1. Community Stakeholder Conservation Measure Surveys Overview

Stakeholder Group	Residents	Businesses	Landscape & Irrigation Contractors	Developers	Property Managers
# of Survey Participants	354	16	22	47	14
# of Survey Questions	11	9	9	10	9
Outreach Method(s)	Direct email to City email list members, social media, article in the Bozeman Daily Chronicle, word-of-mouth	Direct email, local business list serve groups	Direct email	Direct email	Direct email

The following pages contain the results from the suite of surveys.

City of Bozeman Water Conservation Plan Survey Results

The City of Bozeman is currently developing a water conservation plan that will guide the water conservation program for the next 20 years. Input and feedback from local stakeholders is important to ensure that the plan aligns with the goals and needs of the community. To obtain this input the City developed surveys for various stakeholder groups. **We appreciate you taking the time to take the resident survey and provide us with your input.**

The next step of the water conservation plan development process is evaluating program measures to determine which measures will be included in the plan. The survey results will be utilized during this process by providing valuable insight on which program measures the local community supports and opposes. However, the survey results will not solely determine which measures are included in the plan. Other criteria such as achievable water savings, available technology/market maturity, service area match, customer equity, etc. will all be considered in determining which measures are included in the plan. A summary of the residents' survey results is included below.

Resident Survey Details

Number of Survey Participants: 354

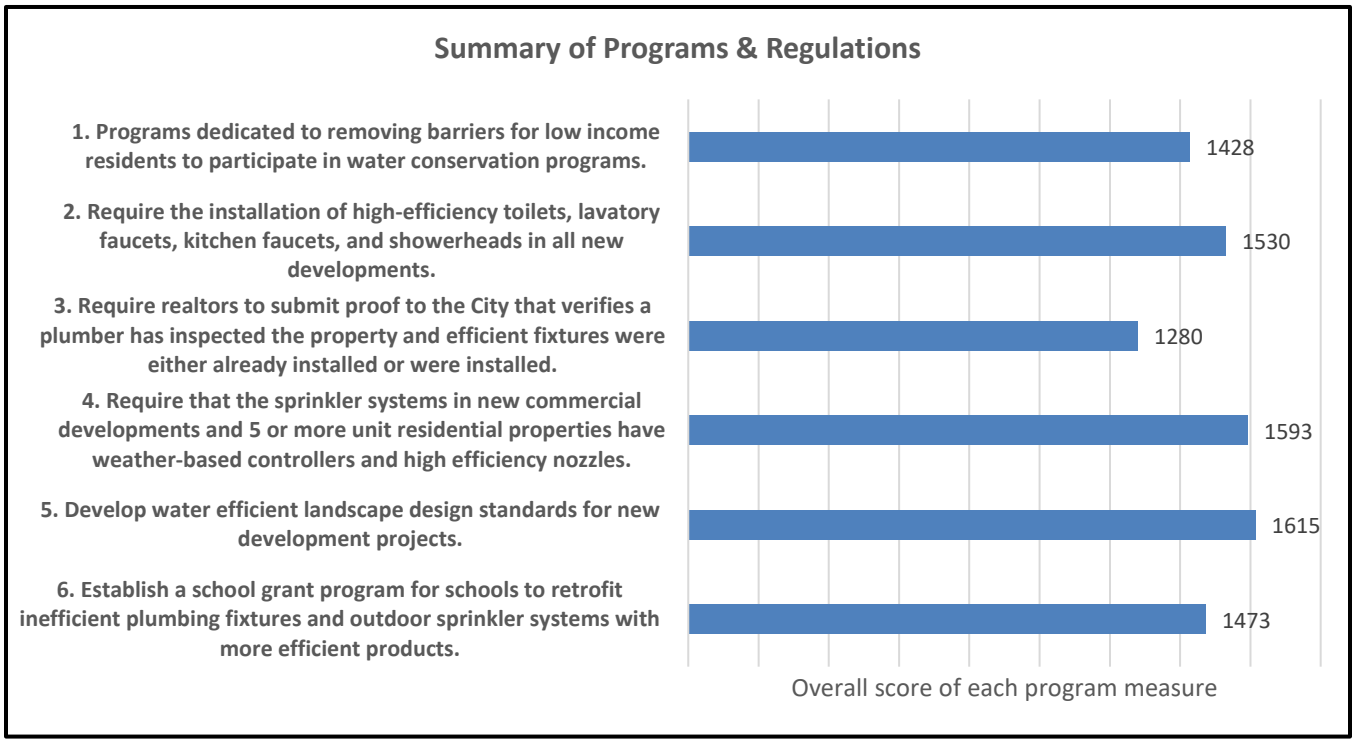
Outreach Methods: Direct email to City email list members, social media, article in the Bozeman Daily Chronicle, word of mouth

Survey Dates: 6/29/2021 – 7/16/2021

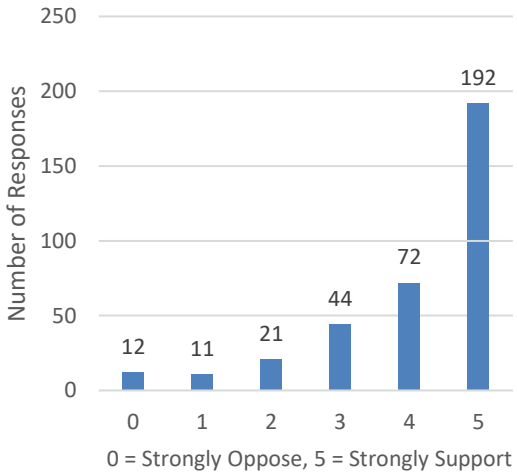
Part 1: Programs and Regulations

The water conservation plan will include recommendations for regulatory change, new programs and initiatives, water rate changes, etc. Your input will help prioritize which of these initiatives are included in the plan. Of the following, please indicate the level you would support or oppose the following programs and regulations.

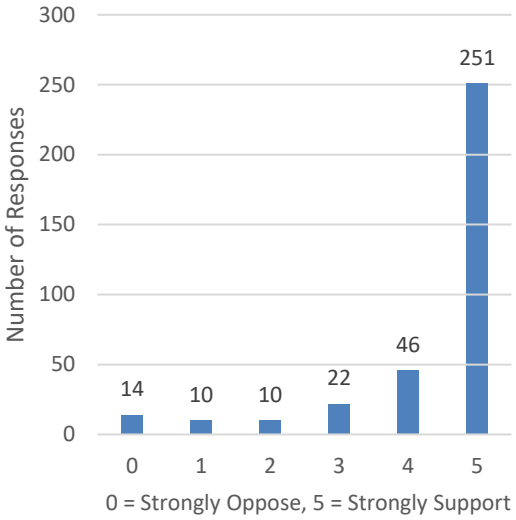
(0 = Strongly Oppose, 5 = Strongly Support)



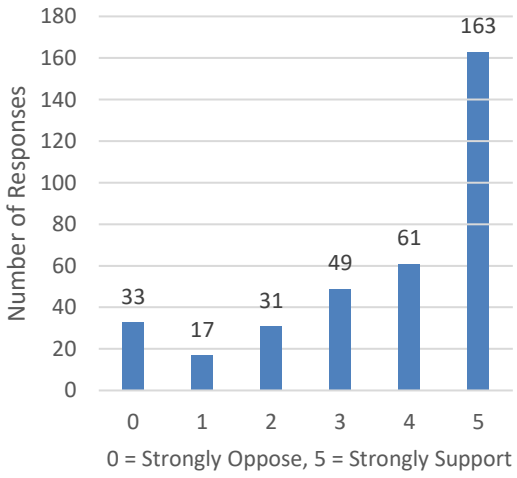
1. Programs dedicated to removing barriers for low income residents to participate in water conservation programs. For example, some best practice programs to be considered include: direct installation toilet rebate program, higher rebate amount for clot



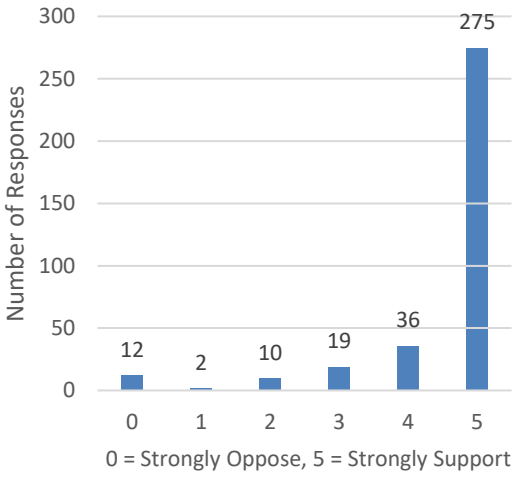
2. Require the installation of high-efficiency toilets, lavatory faucets, kitchen faucets, and showerheads in all new developments.

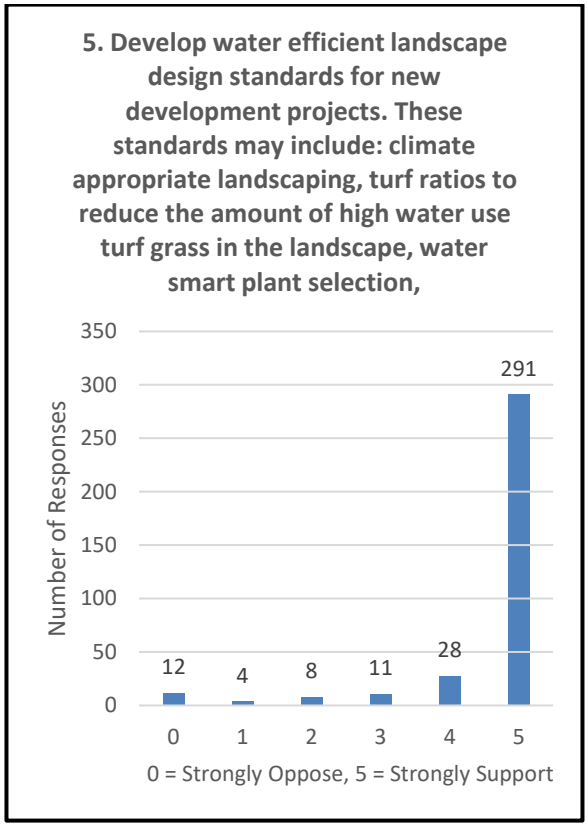


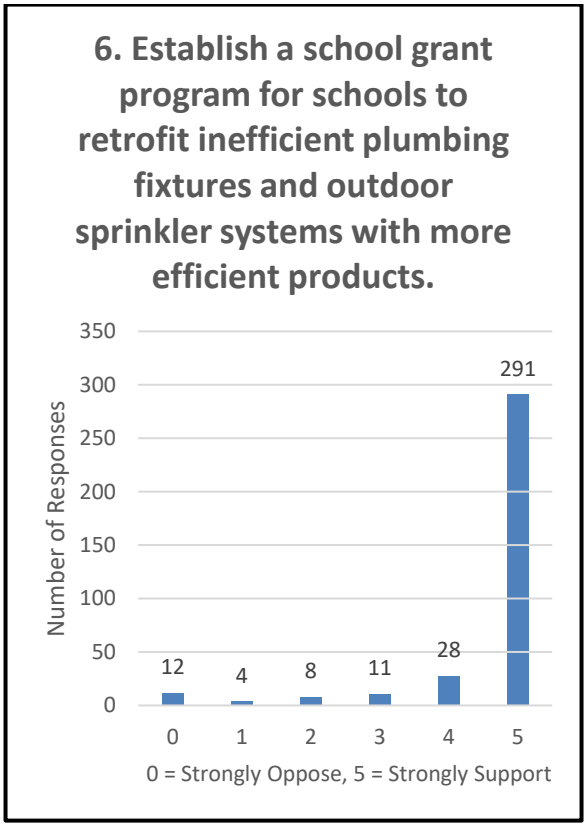
3. Require realtors to submit proof to the City that verifies a plumber has inspected the property and efficient fixtures were either already installed or were installed before the close of escrow.



4. Require that the sprinkler systems in new commercial developments and residential properties with 5 or more units have weather-based controllers and high efficiency sprinkler nozzles.



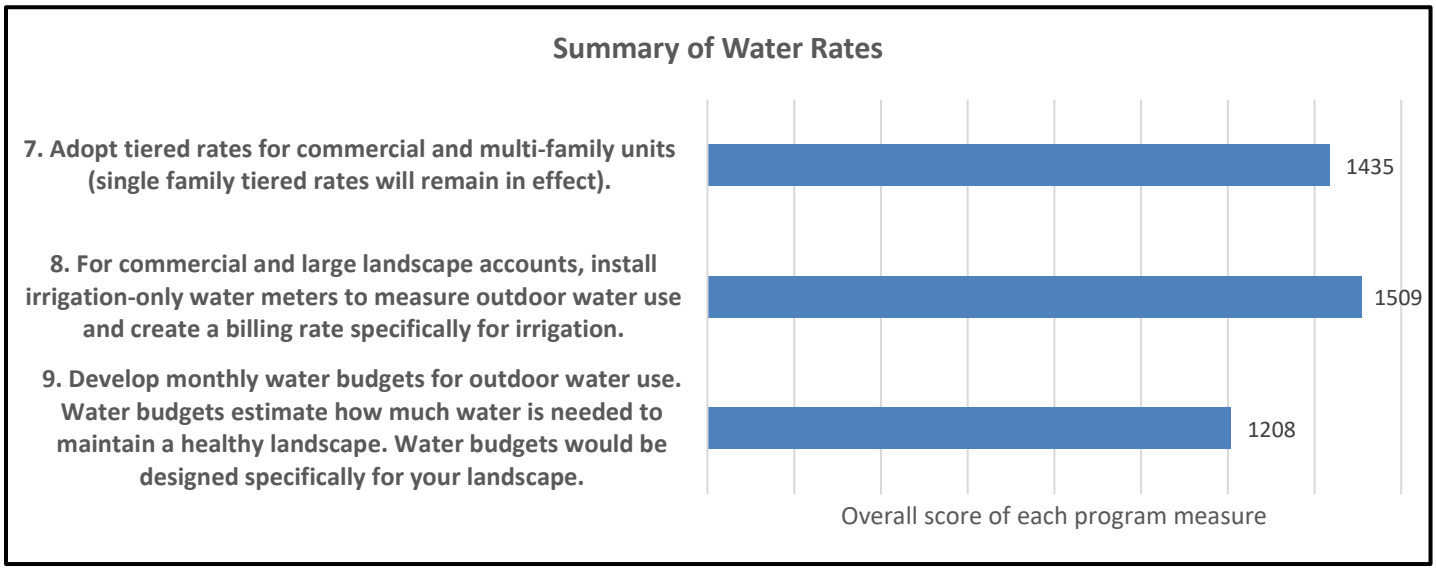




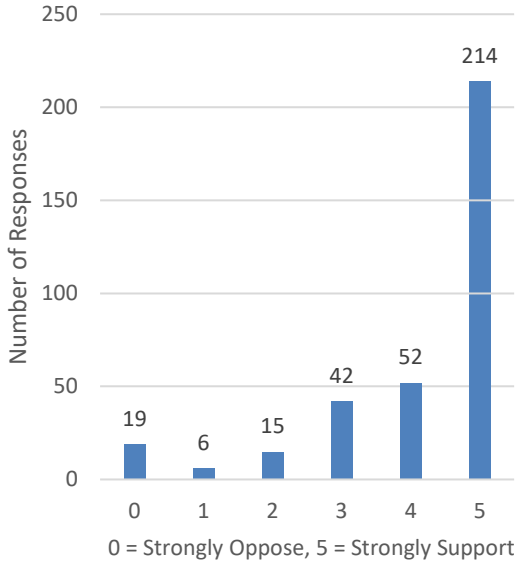
Part 2: Water Rates

The water conservation plan will include recommendations for changes to Bozeman's current water rate structure. All of the water rate options being evaluated are designed to curb excessive outdoor water use by sending price signals to customers.

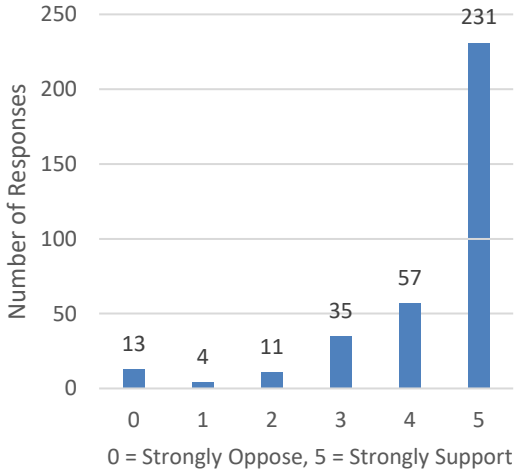
Bozeman currently uses a tiered rate structure for single family customers that includes four tiers. This ensures customers pay for the true cost of their usage and keeps the cost of water for essential uses to a minimum. As water usage increases and moves into higher tiers, the per unit price of water increases.



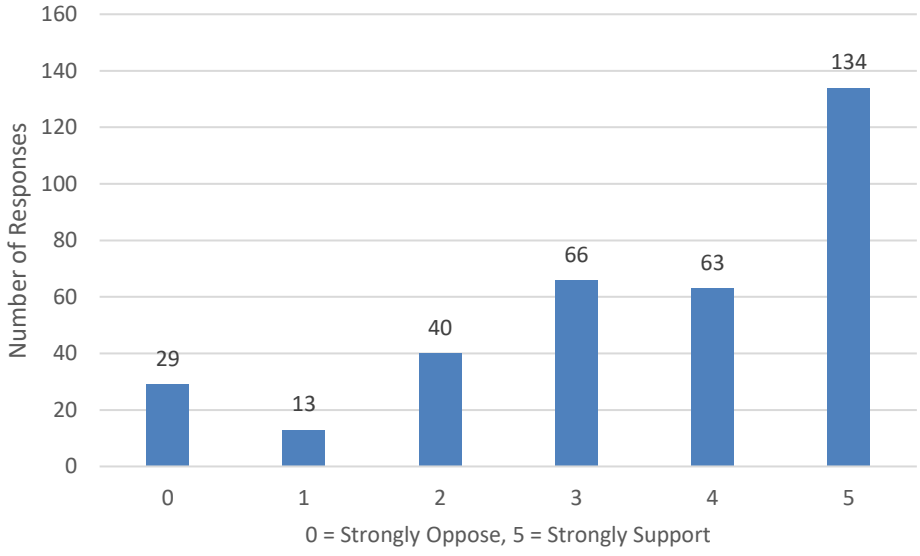
7. Adopt tiered rates for commercial and multi-family units (single family tiered rates will remain in effect).

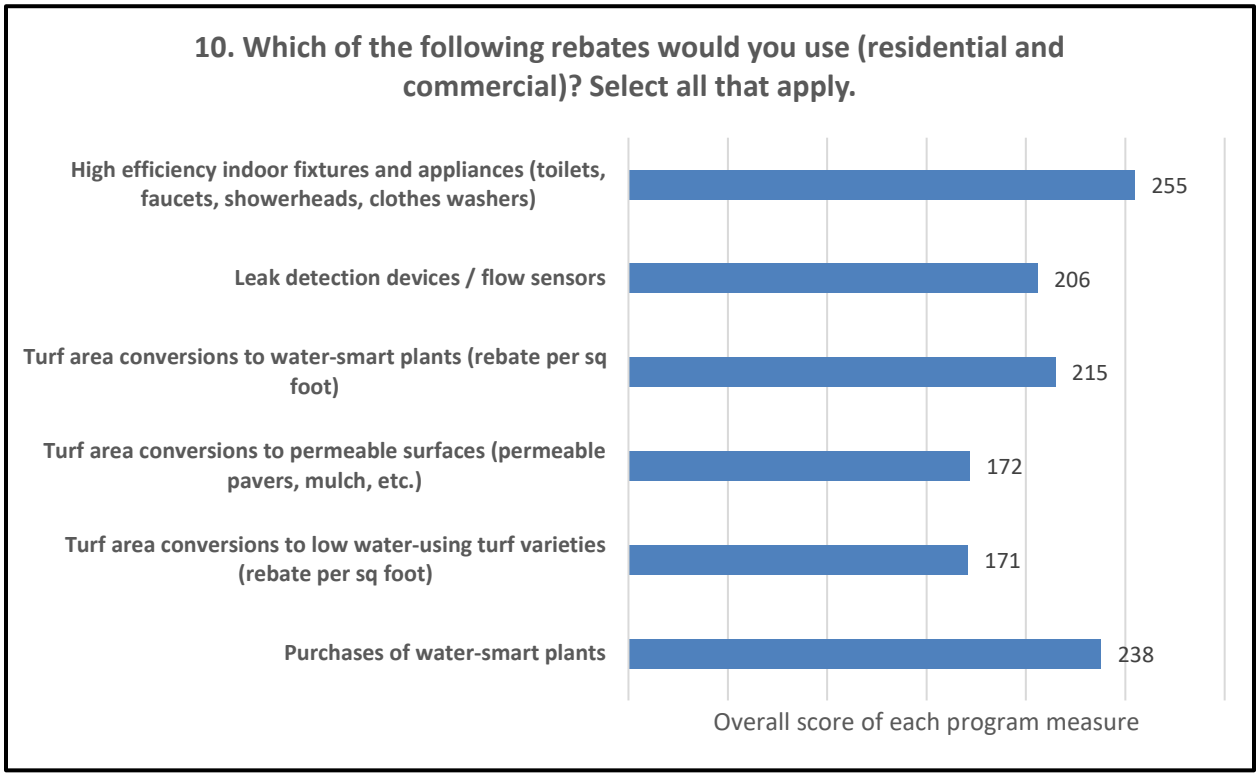


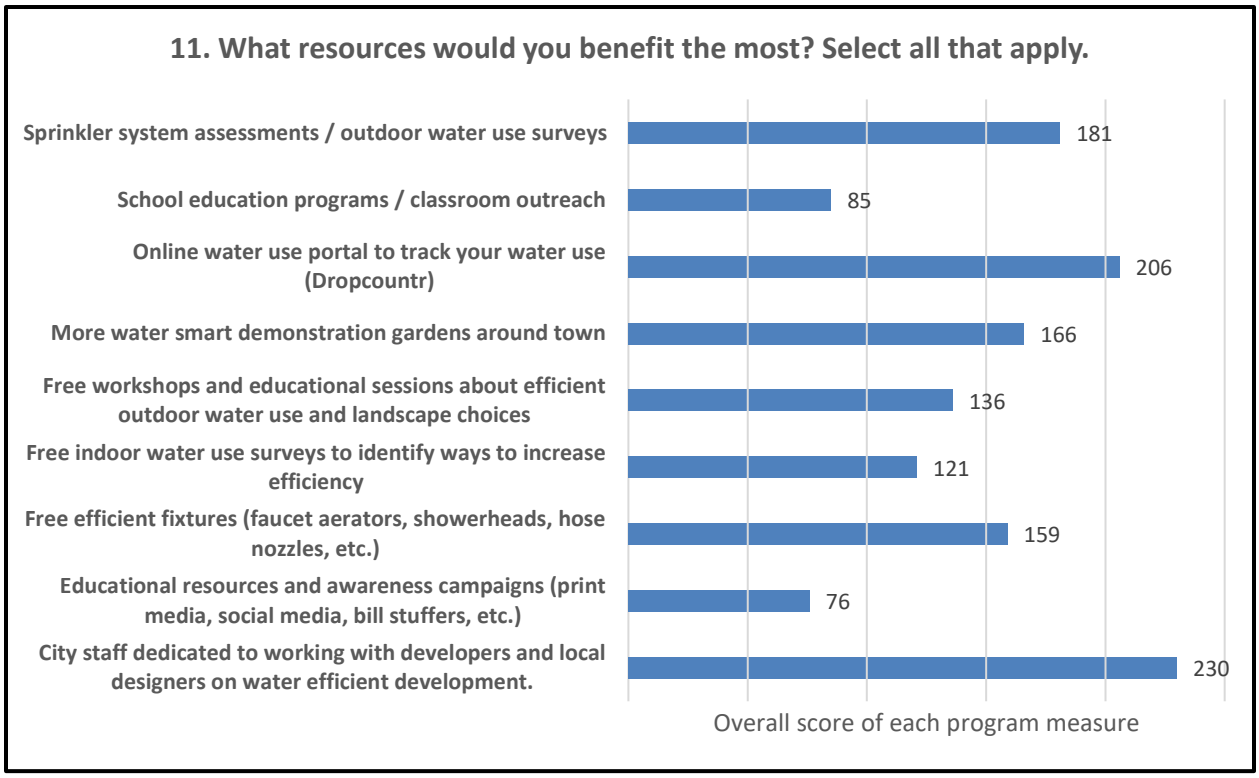
8. For commercial and large landscape accounts, install irrigation-only water meters to measure outdoor water use and create a billing rate specifically for irrigation.



9. Develop monthly water budgets for outdoor water use. Water budgets estimate how much water is needed to maintain a healthy landscape. Water budgets would be designed specifically for your landscape and would be based on factors such as size of irrigate




10. Which of the following rebates would you use (residential and commercial)? Select all that apply.
High efficiency indoor fixtures and appliances (toilets, faucets, showerheads, clothes washers)
255
Leak detection devices / flow sensors
206
Turf area conversions to water-smart plants (rebate per sq foot)
215
Turf area conversions to permeable surfaces (permeable pavers, mulch, etc.)
172
Turf area conversions to low water-using turf varieties (rebate per sq foot)
171
Purchases of water-smart plants
238
Overall score of each program measure


11. What resources would you benefit the most? Select all that apply.
Sprinkler system assessments / outdoor water use surveys
181
School education programs / classroom outreach
85
Online water use portal to track your water use (Dropcountr)
206
More water smart demonstration gardens around town
166
Free workshops and educational sessions about efficient outdoor water use and landscape choices
136
Free indoor water use surveys to identify ways to increase efficiency
121
Free efficient fixtures (faucet aerators, showerheads, hose nozzles, etc.)
159
Educational resources and awareness campaigns (print media, social media, bill stuffers, etc.)
76
City staff dedicated to working with developers and local designers on water efficient development.
230
Overall score of each program measure

City of Bozeman Water Conservation Plan Survey Results

The City of Bozeman is currently developing a water conservation plan that will guide the water conservation program for the next 20 years. Input and feedback from local stakeholders is important to ensure that the plan aligns with the goals and needs of the community. To obtain this input the City developed surveys for various stakeholder groups. **We appreciate you taking the time to take the business survey and provide us with your input.**

The next step of the water conservation plan development process is evaluating program measures to determine which measures will be included in the plan. The survey results will be utilized during this process by providing valuable insight on which program measures the local community supports and opposes. However, the survey results will not solely determine which measures are included in the plan. Other criteria such as achievable water savings, available technology/market maturity, service area match, customer equity, etc. will all be considered in determining which measures are included in the plan. A summary of the business' survey results is included below.

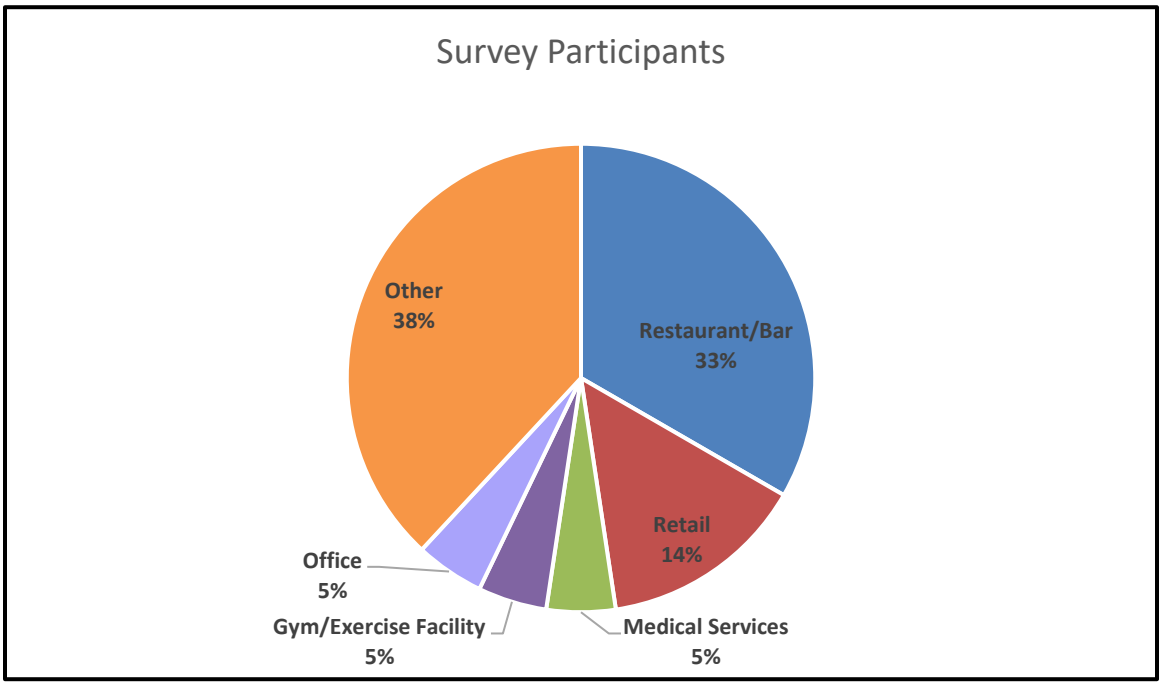
Business Survey Details

Number of Survey Participants: 16

Outreach Methods: Direct email

Survey Dates: 6/29/2021 – 7/16/2021

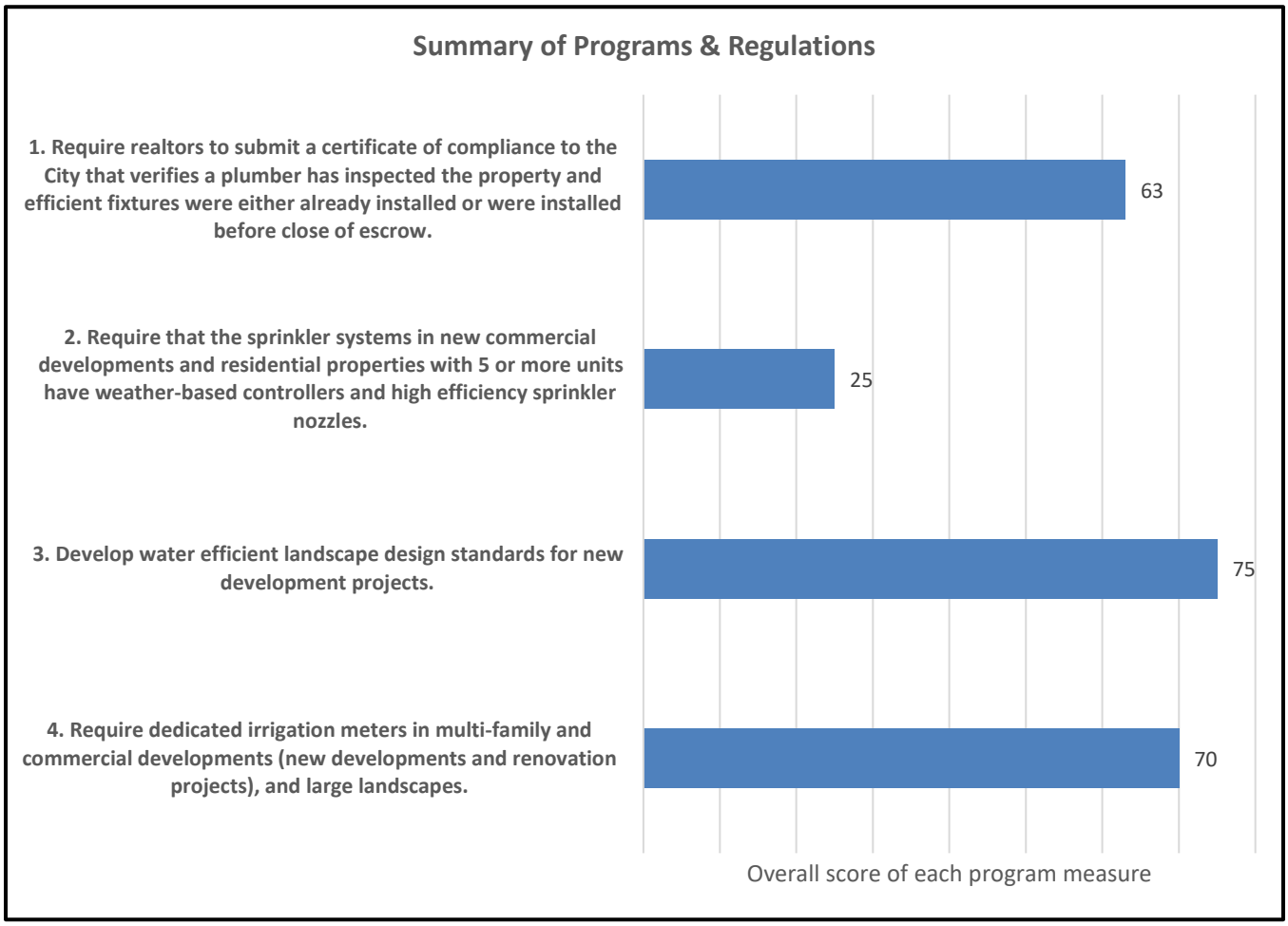
Survey Participants



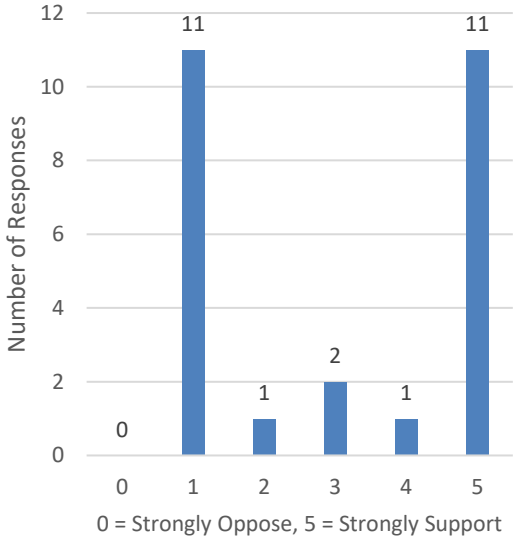
Part 1: Programs and Regulations

The water conservation plan will include recommendations for regulatory change, new programs and initiatives, water rate changes, etc. Your input will help prioritize which of these initiatives are included in the plan. Of the following, please indicate the level you would support or oppose the following programs and regulations.

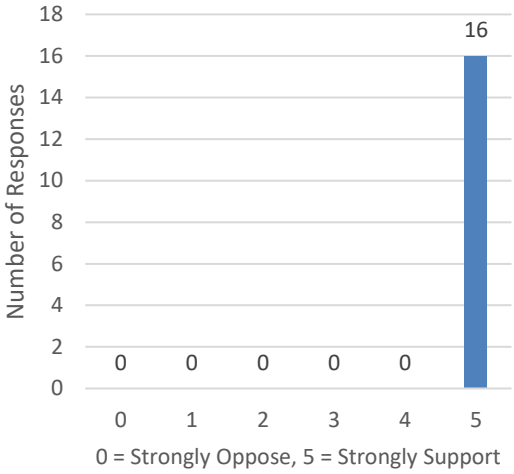
(0 = Strongly Oppose, 5 = Strongly Support)



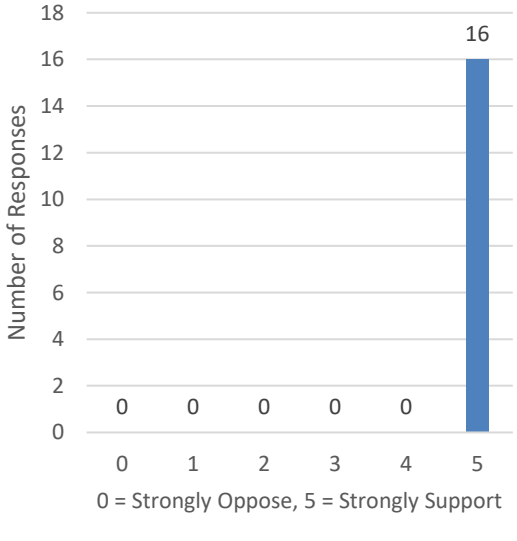
1. Require realtors to submit a certificate of compliance to the City that verifies a plumber has inspected the property and efficient fixtures were either already installed or were installed before close of escrow.



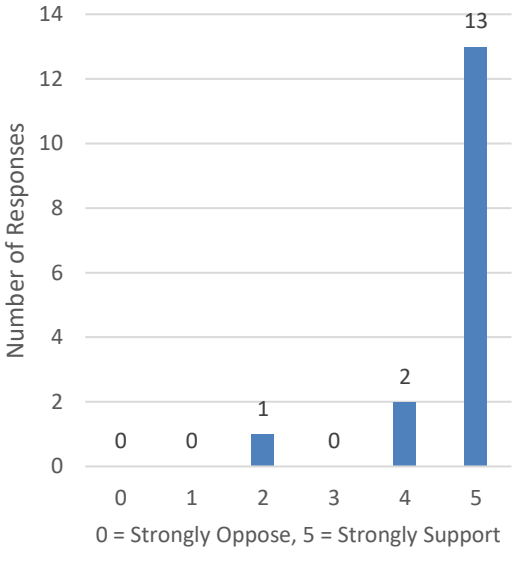
2. Require that the sprinkler systems in new commercial developments and residential properties with 5 or more units have weather-based controllers and high efficiency sprinkler nozzles.



3. Develop water efficient landscape design standards for new development projects. These standards may include: climate appropriate landscaping, turf ratios to reduce the amount of high water use turf grass in the landscape, water smart plant selection,



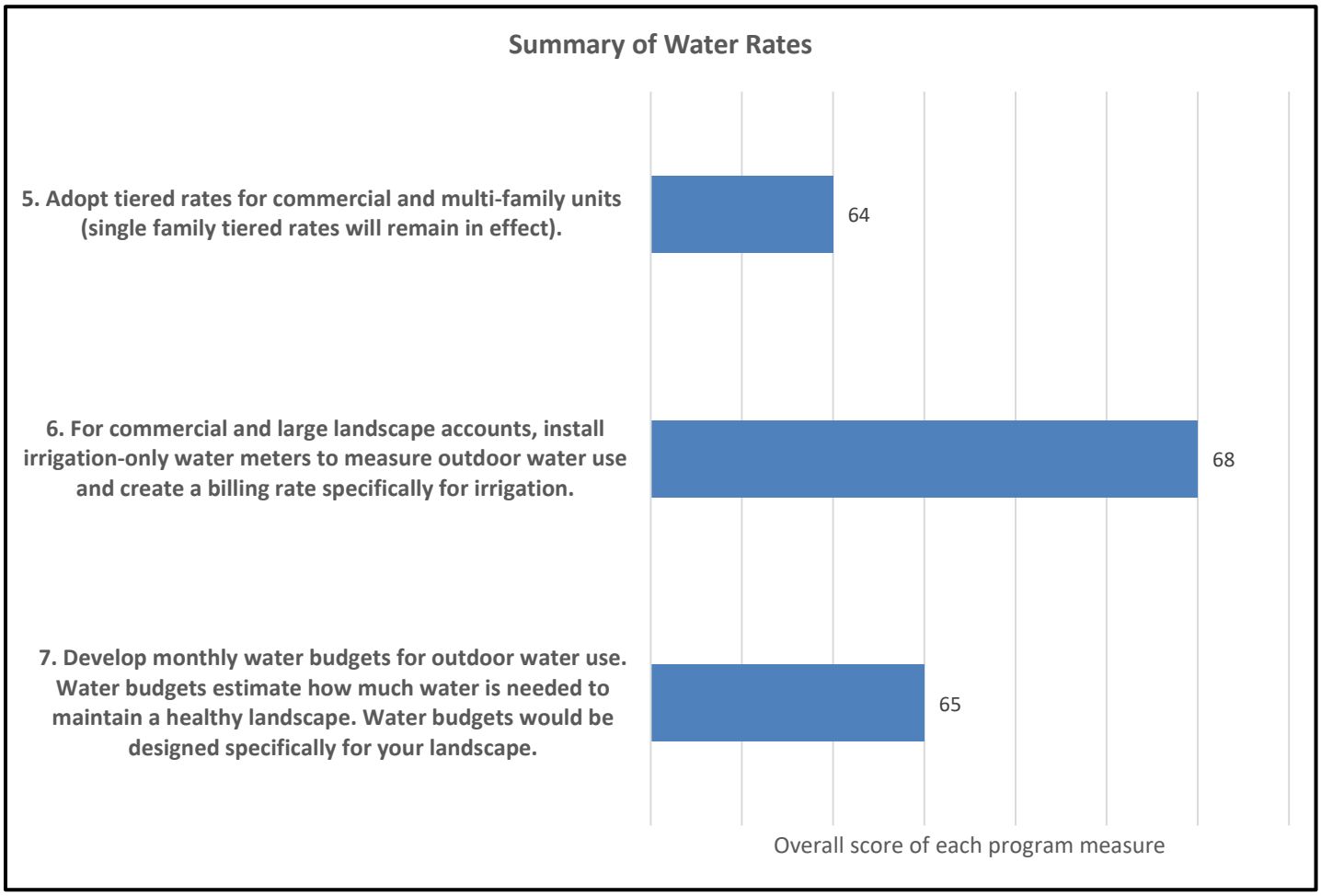
4. Require dedicated irrigation meters in multi-family and commercial developments (new developments and renovation projects), and large landscapes.

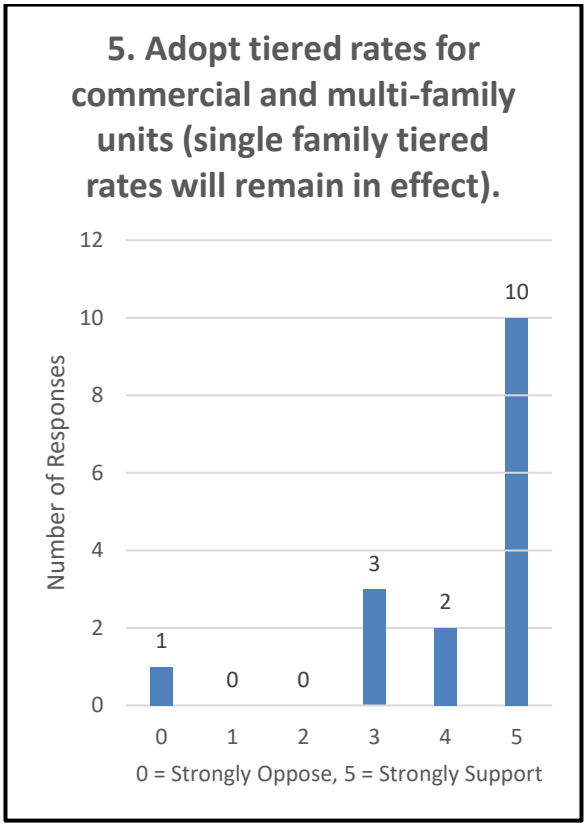


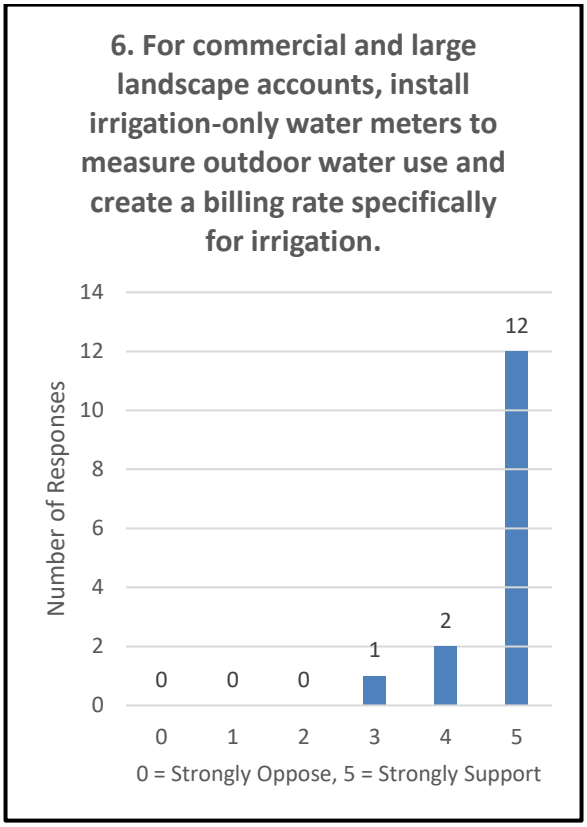
Part 2: Water Rates

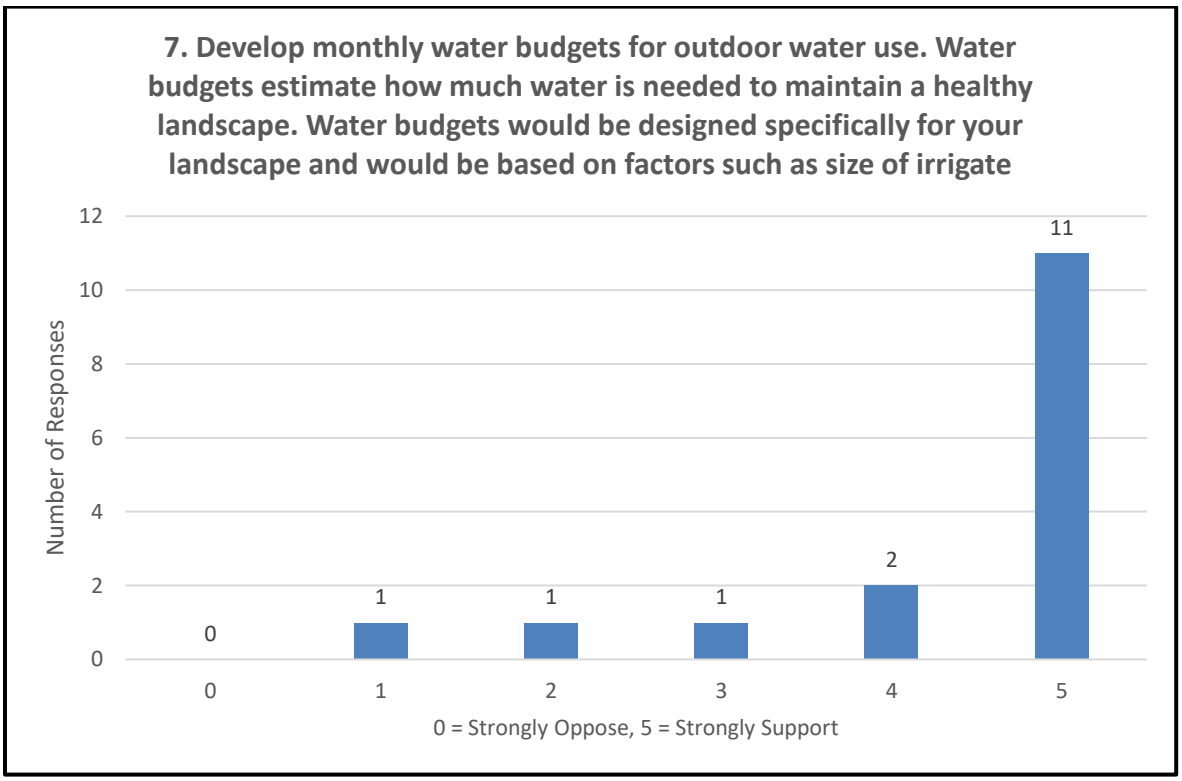
The water conservation plan will include recommendations for changes to Bozeman's current water rate structure. All of the water rate options being evaluated are designed to curb excessive outdoor water use by sending price signals to customers.

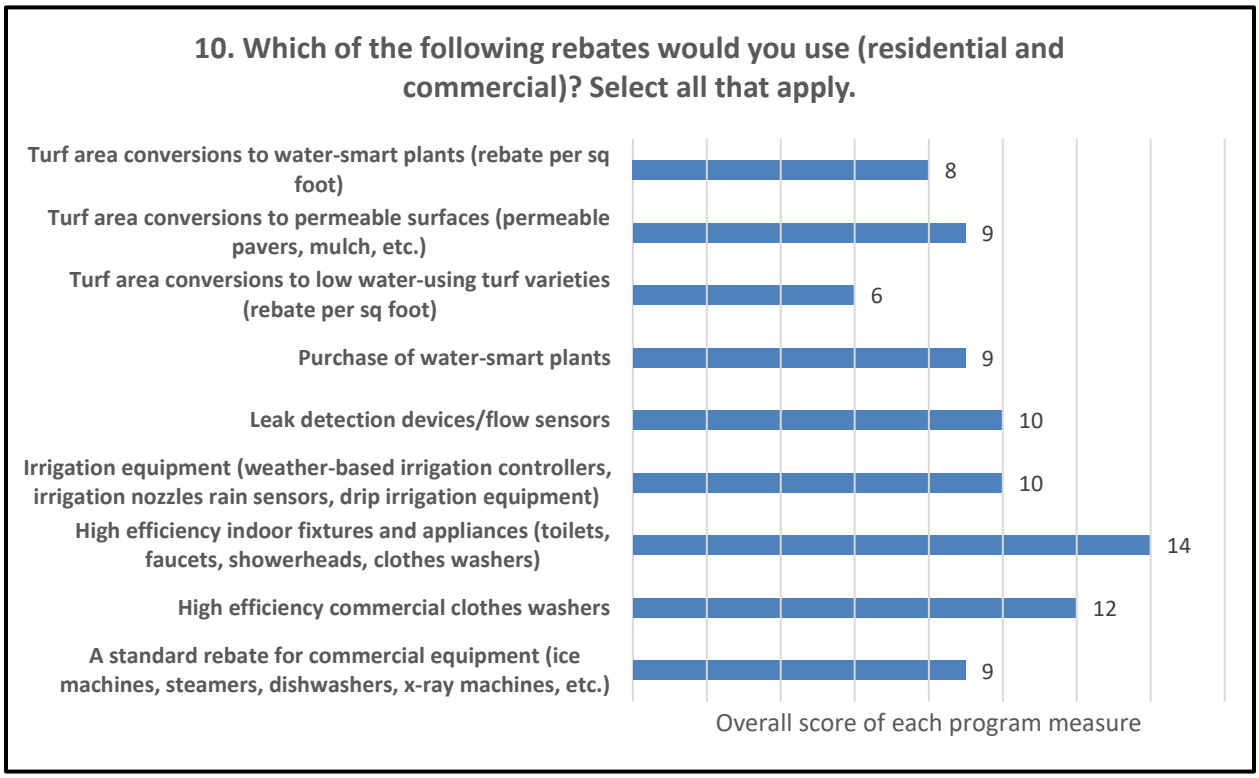
Bozeman currently uses a tiered rate structure for single family customers that includes four tiers. This ensures customers pay for the true cost of their usage and keeps the cost of water for essential uses to a minimum. As water usage increases and moves into higher tiers, the per unit price of water increases.

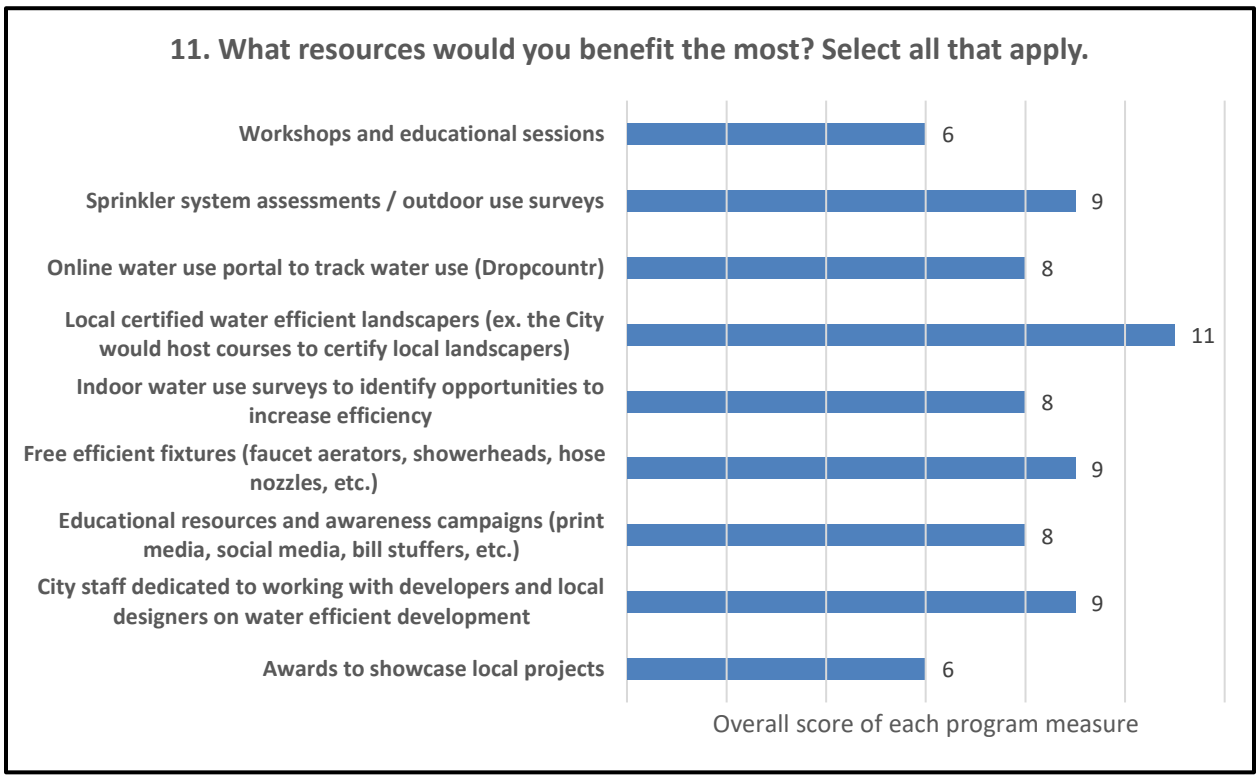



5. Adopt tiered rates for commercial and multi-family units (single family tiered rates will remain in effect).
Number of Responses
12
10
8
6
4
2
0
1
0
0
3
2
10
0
1
2
3
4
5
0 = Strongly Oppose, 5 = Strongly Support


6. For commercial and large landscape accounts, install irrigation-only water meters to measure outdoor water use and create a billing rate specifically for irrigation.
Number of Responses
14
12
10
8
6
4
2
0
0
0
0
1
2
12
0
1
2
3
4
5
0 = Strongly Oppose, 5 = Strongly Support


7. Develop monthly water budgets for outdoor water use. Water budgets estimate how much water is needed to maintain a healthy landscape. Water budgets would be designed specifically for your landscape and would be based on factors such as size of irrigate
Number of Responses
12
10
8
6
4
2
0
0
1
1
1
2
11
0
1
2
3
4
5
0 = Strongly Oppose, 5 = Strongly Support


10. Which of the following rebates would you use (residential and commercial)? Select all that apply.
Turf area conversions to water-smart plants (rebate per sq foot)
8
Turf area conversions to permeable surfaces (permeable pavers, mulch, etc.)
9
Turf area conversions to low water-using turf varieties (rebate per sq foot)
6
Purchase of water-smart plants
9
Leak detection devices/flow sensors
10
Irrigation equipment (weather-based irrigation controllers, irrigation nozzles rain sensors, drip irrigation equipment)
10
High efficiency indoor fixtures and appliances (toilets, faucets, showerheads, clothes washers)
14
High efficiency commercial clothes washers
12
A standard rebate for commercial equipment (ice machines, steamers, dishwashers, x-ray machines, etc.)
9
Overall score of each program measure


11. What resources would you benefit the most? Select all that apply.
Workshops and educational sessions
6
Sprinkler system assessments / outdoor use surveys
9
Online water use portal to track water use (Dropcountr)
8
Local certified water efficient landscapers (ex. the City would host courses to certify local landscapers)
11
Indoor water use surveys to identify opportunities to increase efficiency
8
Free efficient fixtures (faucet aerators, showerheads, hose nozzles, etc.)
9
Educational resources and awareness campaigns (print media, social media, bill stuffers, etc.)
8
City staff dedicated to working with developers and local designers on water efficient development
9
Awards to showcase local projects
6
Overall score of each program measure

City of Bozeman Water Conservation Plan Results

The City of Bozeman is currently developing a water conservation plan that will guide the water conservation program for the next 20 years. Input and feedback from local stakeholders is important to ensure that the plan aligns with the goals and needs of the community. To obtain this input the City developed surveys for various stakeholder groups. **We appreciate you taking the time to take the development survey and provide us with your input.**

The next step of the water conservation plan development process is evaluating program measures to determine which measures will be included in the plan. The survey results will be utilized during this process by providing valuable insight on which program measures the local community supports and opposes. However, the survey results will not solely determine which measures are included in the plan. Other criteria such as achievable water savings, available technology/market maturity, service area match, customer equity, etc. will all be considered in determining which measures are included in the plan. A summary of the development survey results is included below.

Development Survey Details

Number of Survey Participants: 47

Outreach Methods: Direct email

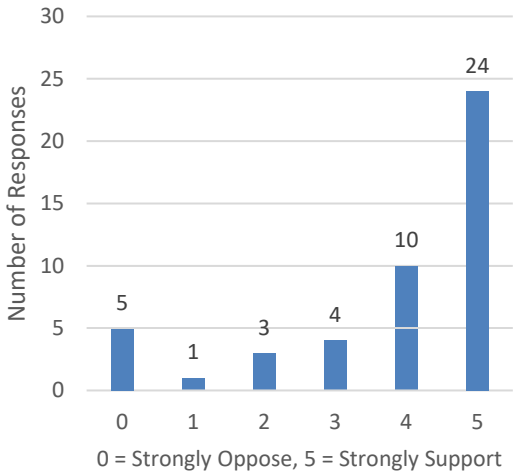
Survey Dates: 6/29/2021 – 7/16/2021

Part 1: Programs and Regulations

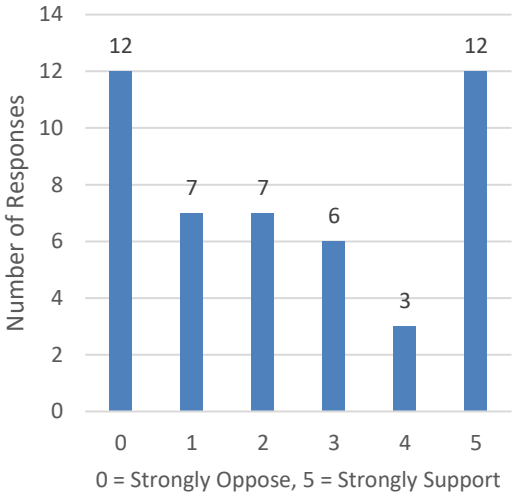
The water conservation plan will include recommendations for regulatory change, new programs and initiatives, water rate changes, etc. Your input will help prioritize which of these initiatives are included in the plan. Of the following, please indicate the level you would support or oppose the following programs and regulations.

(0 = Strongly Oppose, 5 = Strongly Support)

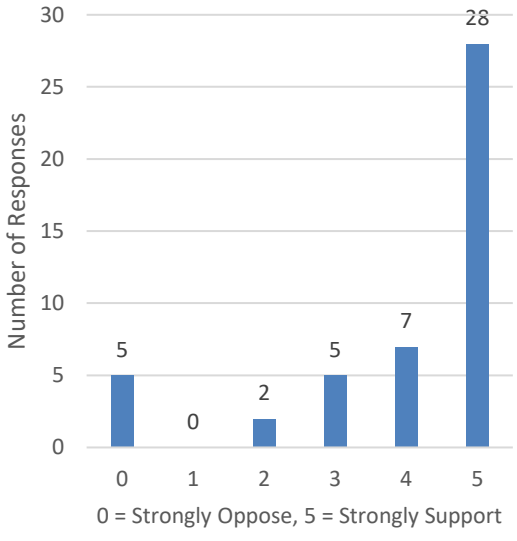
1. Require that the sprinkler systems in new commercial developments and residential properties with 5 or more units have weather-based controllers and high efficiency sprinkler nozzles.



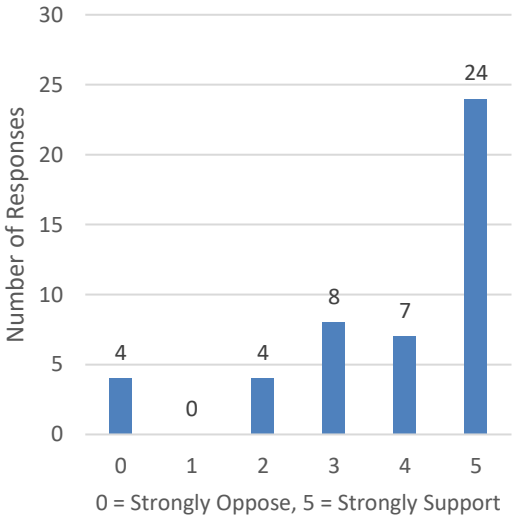
2. Require realtors to submit a certificate of compliance to the City that verifies a plumber has inspected the property and efficient fixtures were either already installed or were installed before close of escrow.



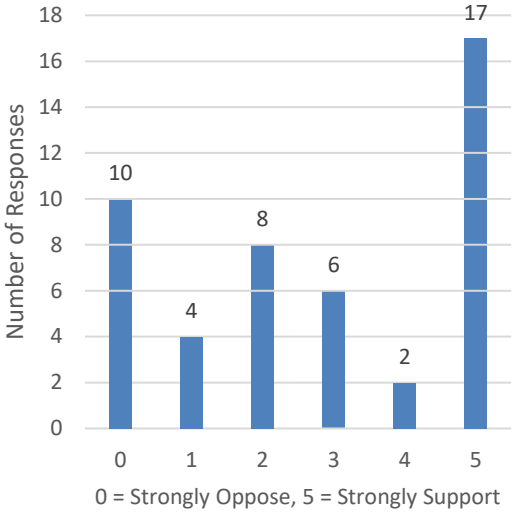
3. Require that the sprinkler systems in new commercial developments and residential properties with 5 or more units have weather-based controllers and high efficiency sprinkler nozzles.



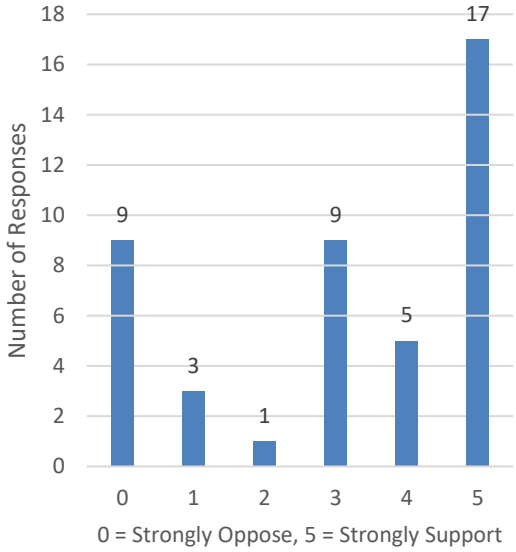
4. Develop water efficient landscape design standards for new development projects. These standards may include: climate appropriate landscaping, turf ratios to reduce the amount of high water use turf grass in the landscape, water smart plant selection,



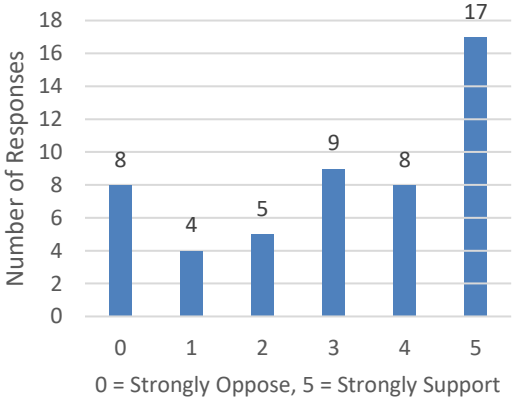
5. Require the design and installation of sprinkler systems be completed by water efficient certified contractors. The City would host training to certify the contractors.



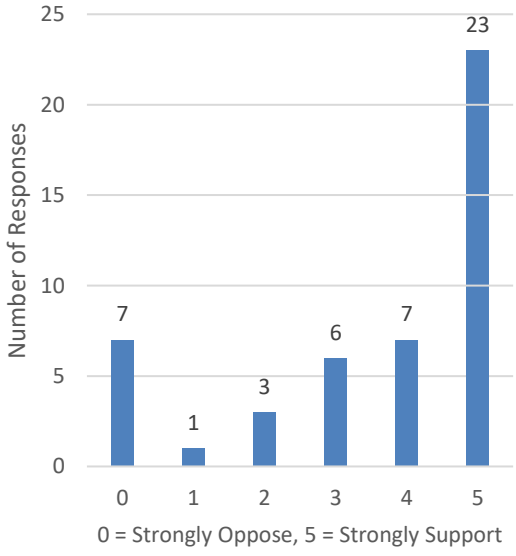
6. Require dedicated irrigation meters in multi-family and commercial developments (new developments and renovation projects), and large landscapes.

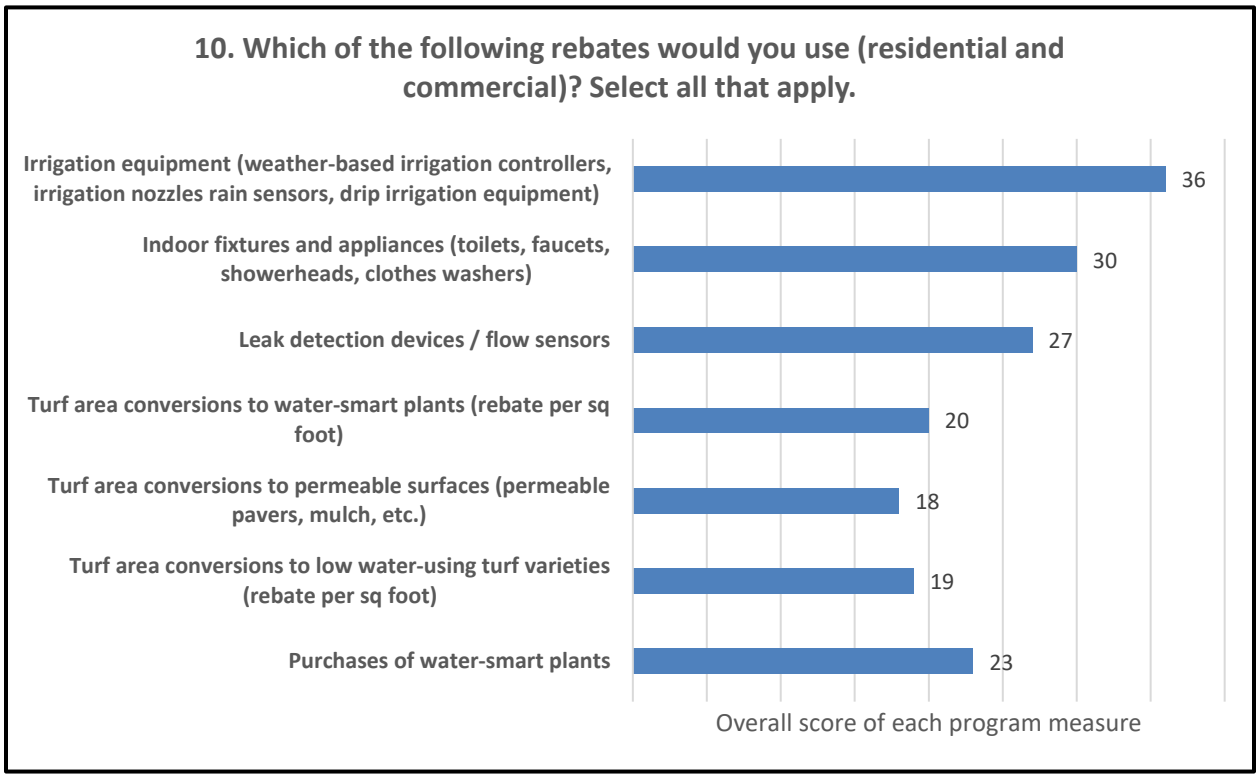


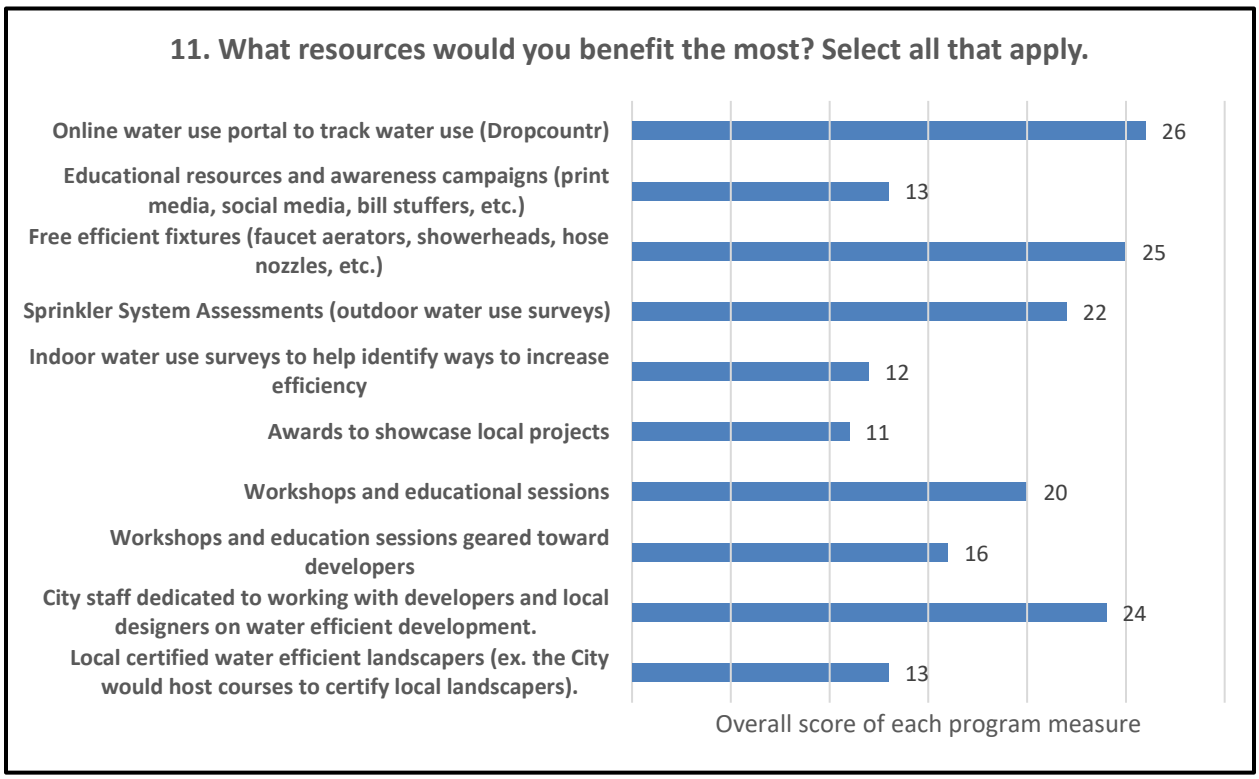
7. Local landscape ordinance for new development that would aim to reduce outdoor water through the implementation of landscape and irrigation performance and design standards, including requiring a maximum applied water allowance for all landscapes.



8. Develop an impact fee credit for developers that will offset some of the costs associated with more expensive water smart landscaping.




10. Which of the following rebates would you use (residential and commercial)? Select all that apply.
Irrigation equipment (weather-based irrigation controllers, irrigation nozzles rain sensors, drip irrigation equipment)
36
Indoor fixtures and appliances (toilets, faucets, showerheads, clothes washers)
30
Leak detection devices / flow sensors
27
Turf area conversions to water-smart plants (rebate per sq foot)
20
Turf area conversions to permeable surfaces (permeable pavers, mulch, etc.)
18
Turf area conversions to low water-using turf varieties (rebate per sq foot)
19
Purchases of water-smart plants
23
Overall score of each program measure


11. What resources would you benefit the most? Select all that apply.
Online water use portal to track water use (Dropcountr)
26
Educational resources and awareness campaigns (print media, social media, bill stuffers, etc.)
13
Free efficient fixtures (faucet aerators, showerheads, hose nozzles, etc.)
25
Sprinkler System Assessments (outdoor water use surveys)
22
Indoor water use surveys to help identify ways to increase efficiency
12
Awards to showcase local projects
11
Workshops and educational sessions
20
Workshops and education sessions geared toward developers
16
City staff dedicated to working with developers and local designers on water efficient development.
24
Local certified water efficient landscapers (ex. the City would host courses to certify local landscapers).
13
Overall score of each program measure

City of Bozeman Water Conservation Plan Survey Results

The City of Bozeman is currently developing a water conservation plan that will guide the water conservation program for the next 20 years. Input and feedback from local stakeholders is important to ensure that the plan aligns with the goals and needs of the community. To obtain this input the City developed surveys for various stakeholder groups. **We appreciate you taking the time to take the landscaping community survey and provide us with your input.**

The next step of the water conservation plan development process is evaluating program measures to determine which measures will be included in the plan. The survey results will be utilized during this process by providing valuable insight on which program measures the local community supports and opposes. However, the survey results will not solely determine which measures are included in the plan. Other criteria such as achievable water savings, available technology/market maturity, service area match, customer equity, etc. will all be considered in determining which measures are included in the plan. A summary of the landscape community survey results is included below.

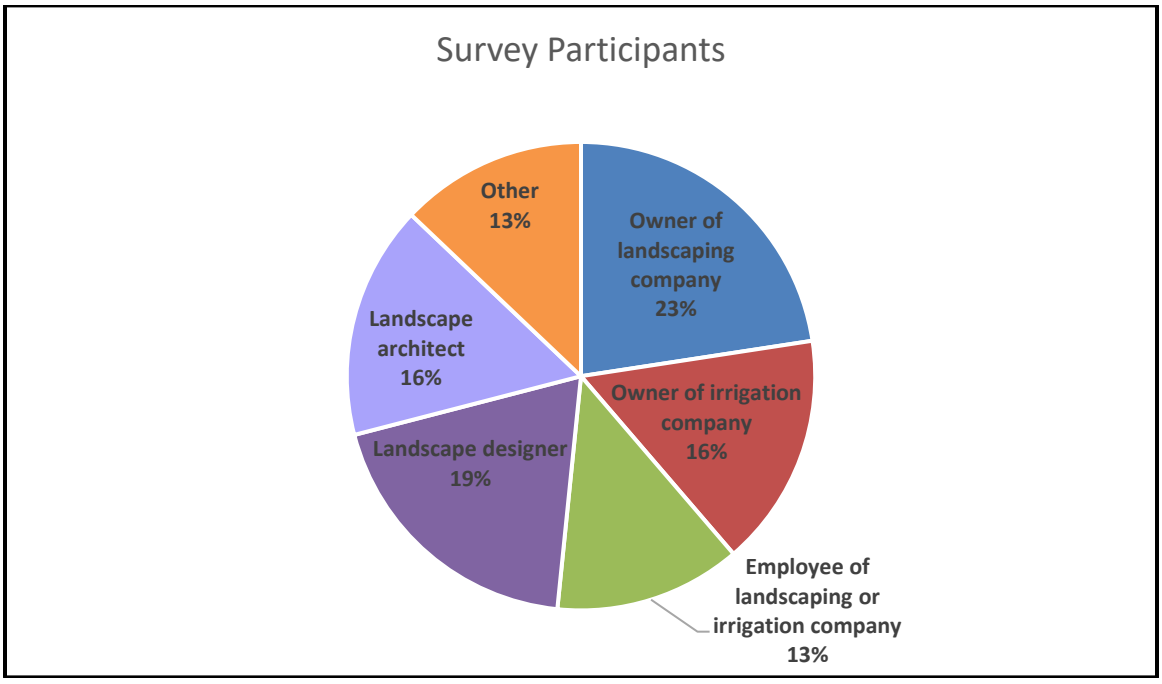
Landscape Survey Details

Number of Survey Participants: 22

Outreach Methods: Direct email

Survey Dates: 6/29/2021 – 7/16/2021

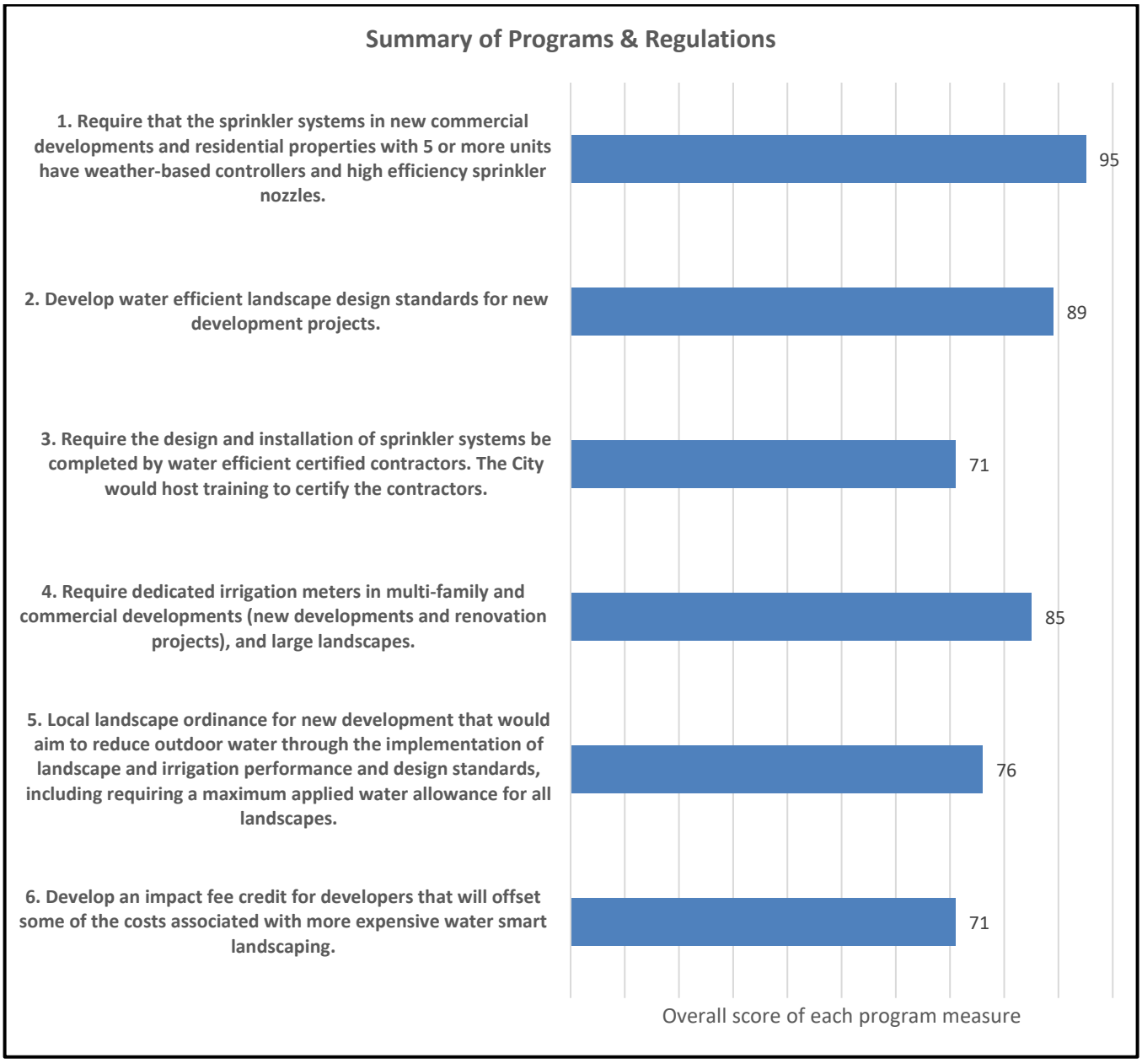
Survey Participants



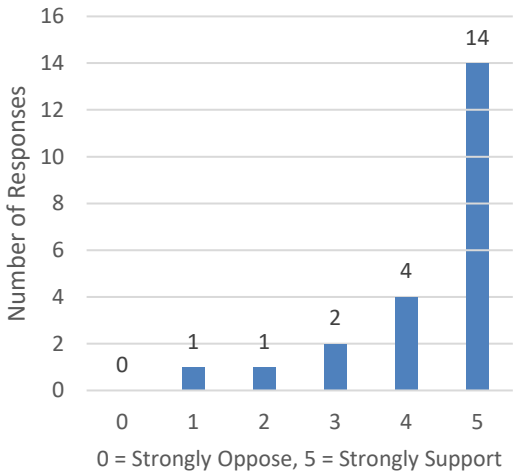
Part 1: Programs and Regulations

The water conservation plan will include recommendations for regulatory change, new programs and initiatives, water rate changes, etc. Your input will help prioritize which of these initiatives are included in the plan. Of the following, please indicate the level you would support or oppose the following programs and regulations.

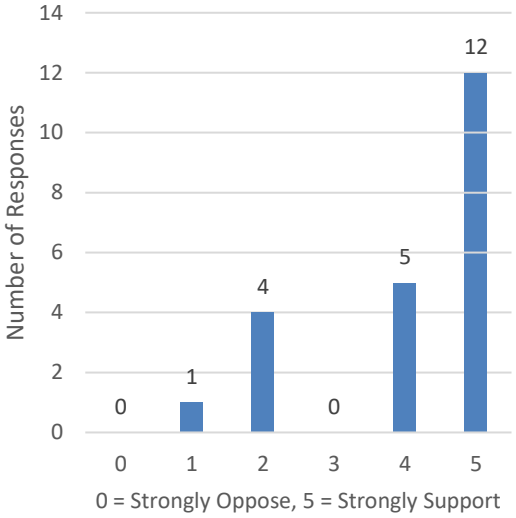
(0 = Strongly Oppose, 5 = Strongly Support)



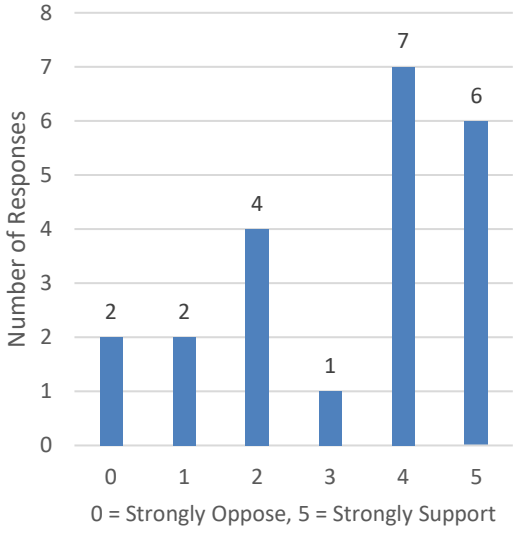
1. Require that the sprinkler systems in new commercial developments and residential properties with 5 or more units have weather-based controllers and high efficiency sprinkler nozzles.



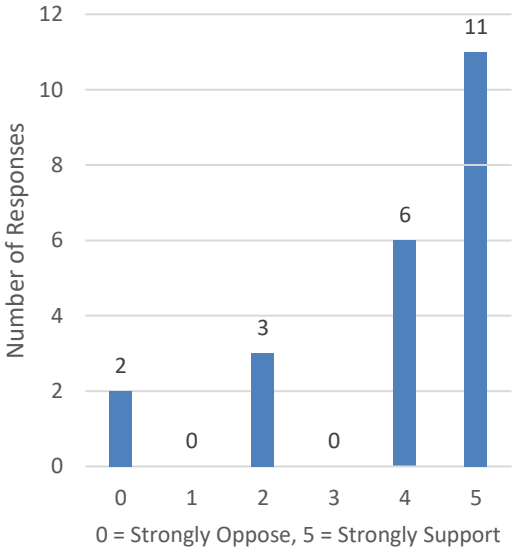
2. Develop water efficient landscape design standards for new development projects. These standards may include: climate appropriate landscaping, turf ratios to reduce the amount of high water use turf grass in the landscape, water smart plant selection,

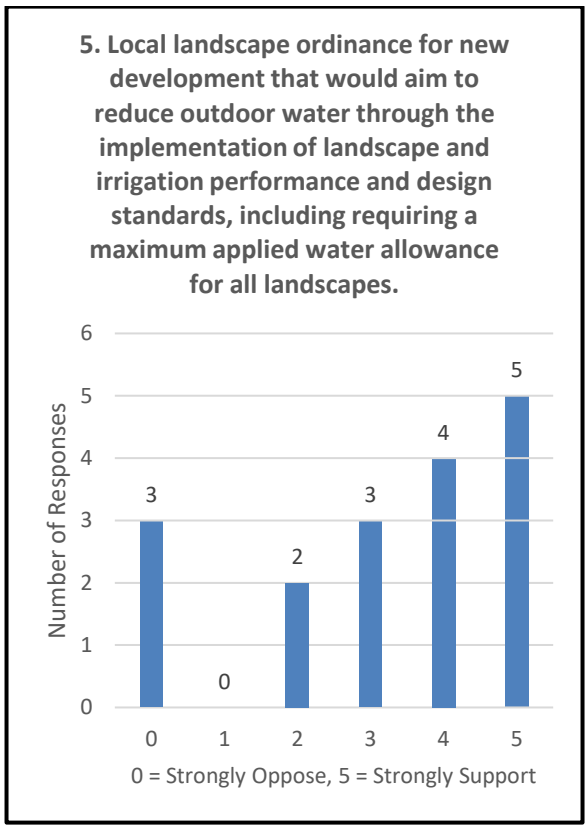


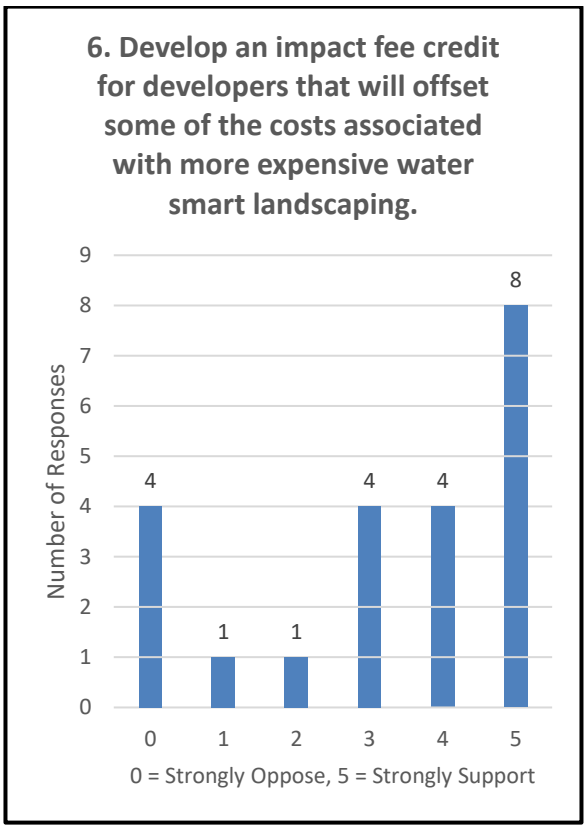
3. Require the design and installation of sprinkler systems be completed by water efficient certified contractors. The City would host training to certify the contractors.

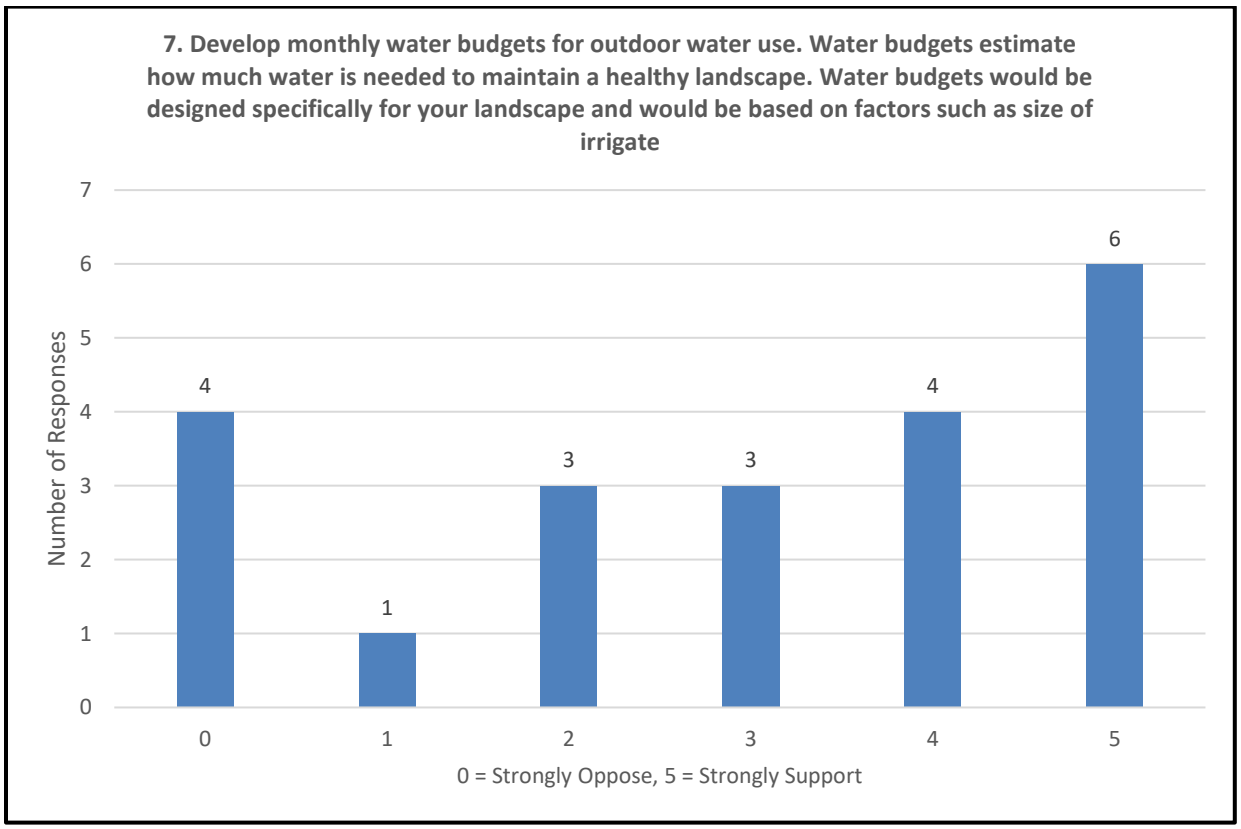


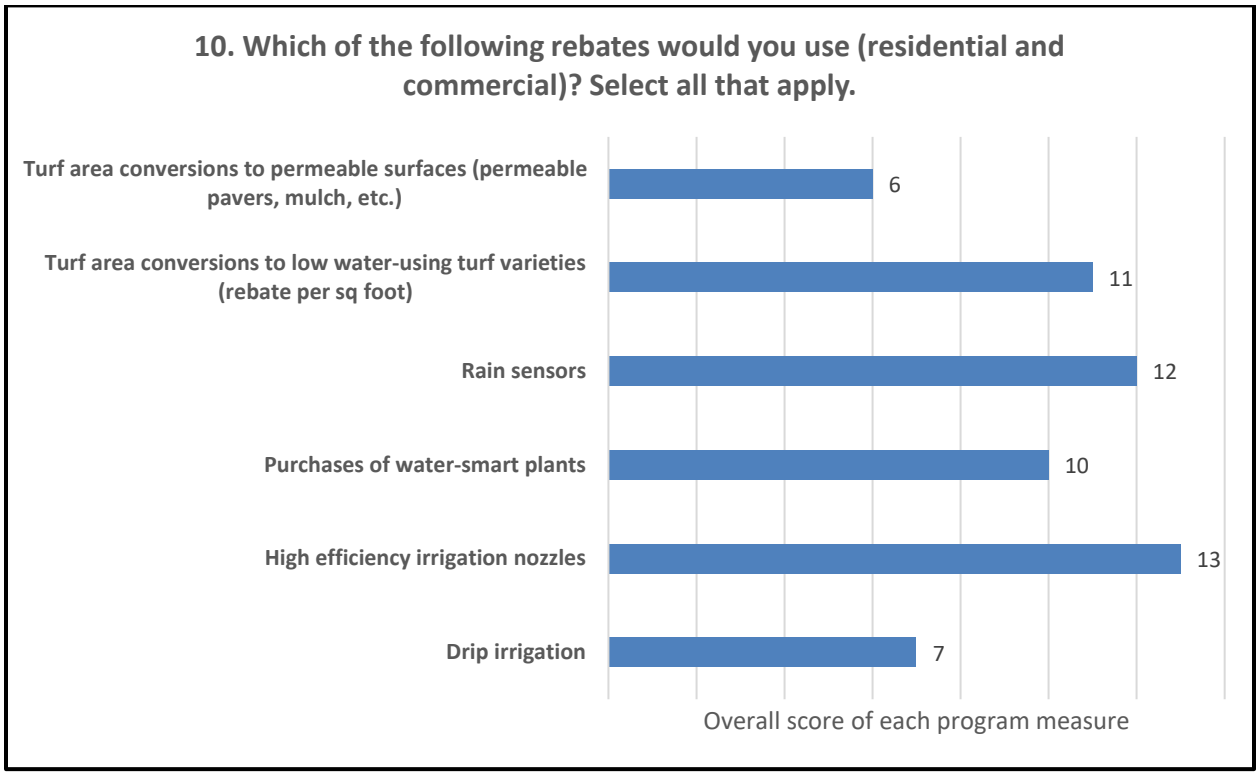
4. Require dedicated irrigation meters in multi-family and commercial developments (new developments and renovation projects), and large landscapes.

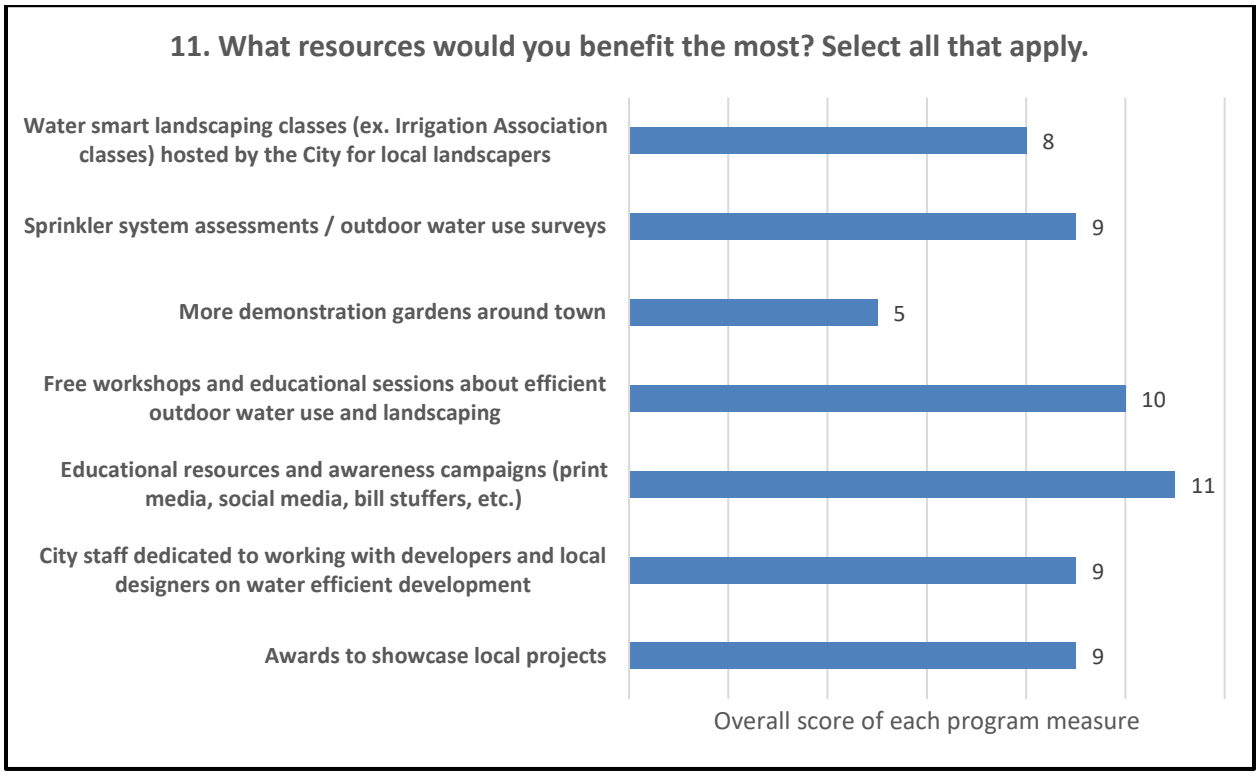



5. Local landscape ordinance for new development that would aim to reduce outdoor water through the implementation of landscape and irrigation performance and design standards, including requiring a maximum applied water allowance for all landscapes.
Number of Responses
0 = Strongly Oppose, 5 = Strongly Support


6. Develop an impact fee credit for developers that will offset some of the costs associated with more expensive water smart landscaping.
Number of Responses
0 = Strongly Oppose, 5 = Strongly Support


7. Develop monthly water budgets for outdoor water use. Water budgets estimate how much water is needed to maintain a healthy landscape. Water budgets would be designed specifically for your landscape and would be based on factors such as size of irrigate
Number of Responses
0 = Strongly Oppose, 5 = Strongly Support


10. Which of the following rebates would you use (residential and commercial)? Select all that apply.
Turf area conversions to permeable surfaces (permeable pavers, mulch, etc.)
6
Turf area conversions to low water-using turf varieties (rebate per sq foot)
11
Rain sensors
12
Purchases of water-smart plants
10
High efficiency irrigation nozzles
13
Drip irrigation
7
Overall score of each program measure


11. What resources would you benefit the most? Select all that apply.
Water smart landscaping classes (ex. Irrigation Association classes) hosted by the City for local landscapers
8
Sprinkler system assessments / outdoor water use surveys
9
More demonstration gardens around town
5
Free workshops and educational sessions about efficient outdoor water use and landscaping
10
Educational resources and awareness campaigns (print media, social media, bill stuffers, etc.)
11
City staff dedicated to working with developers and local designers on water efficient development
9
Awards to showcase local projects
9
Overall score of each program measure

City of Bozeman Water Conservation Plan Survey Results

The City of Bozeman is currently developing a water conservation plan that will guide the water conservation program for the next 20 years. Input and feedback from local stakeholders is important to ensure that the plan aligns with the goals and needs of the community. To obtain this input the City developed surveys for various stakeholder groups. **We appreciate you taking the time to take the property management survey and provide us with your input.**

The next step of the water conservation plan development process is evaluating program measures to determine which measures will be included in the plan. The survey results will be utilized during this process by providing valuable insight on which program measures the local community supports and opposes. However, the survey results will not solely determine which measures are included in the plan. Other criteria such as achievable water savings, available technology/market maturity, service area match, customer equity, etc. will all be considered in determining which measures are included in the plan. A summary of the property management survey results is included below.

Property Management Survey Details

Number of Survey Participants: 14

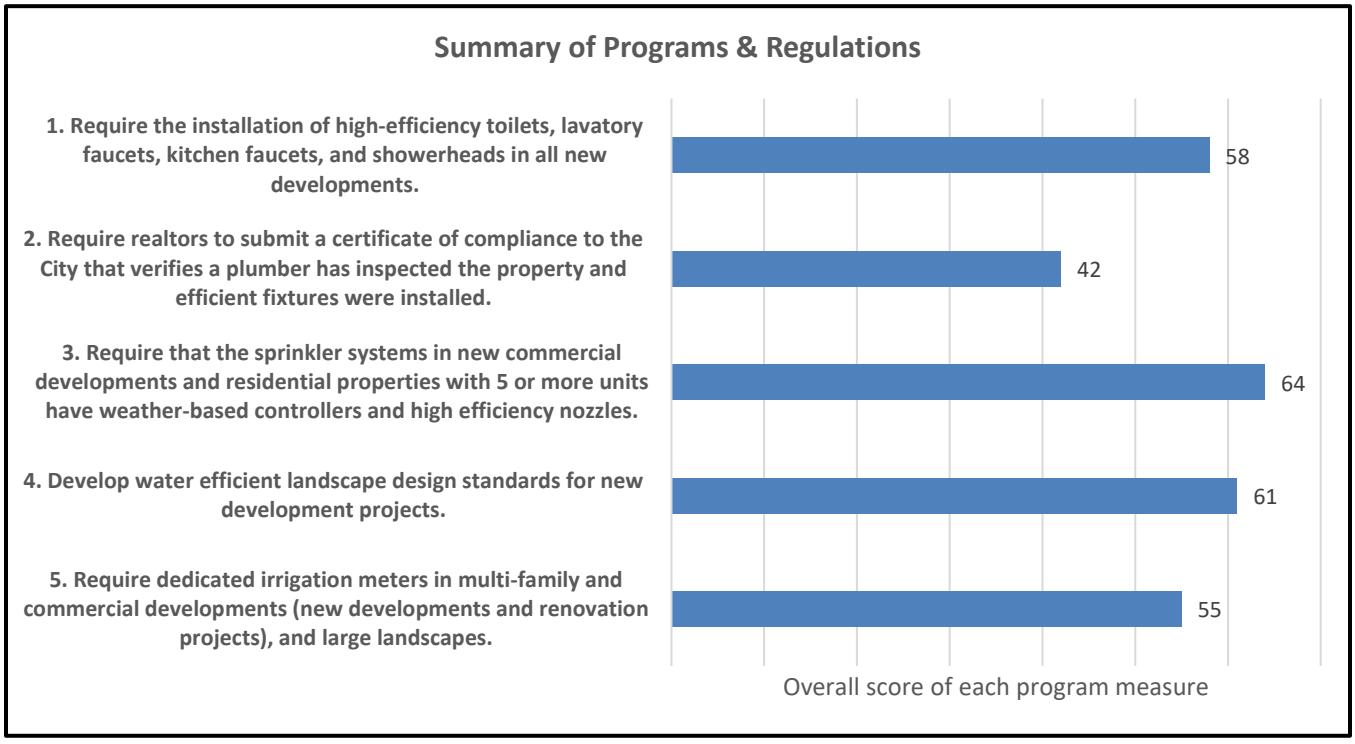
Outreach Methods: Direct email

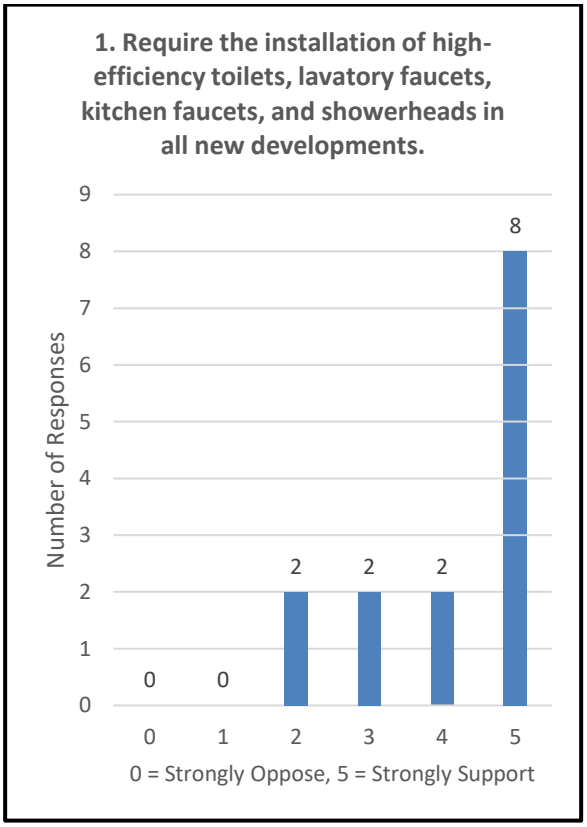
Survey Dates: 6/29/2021 – 7/16/2021

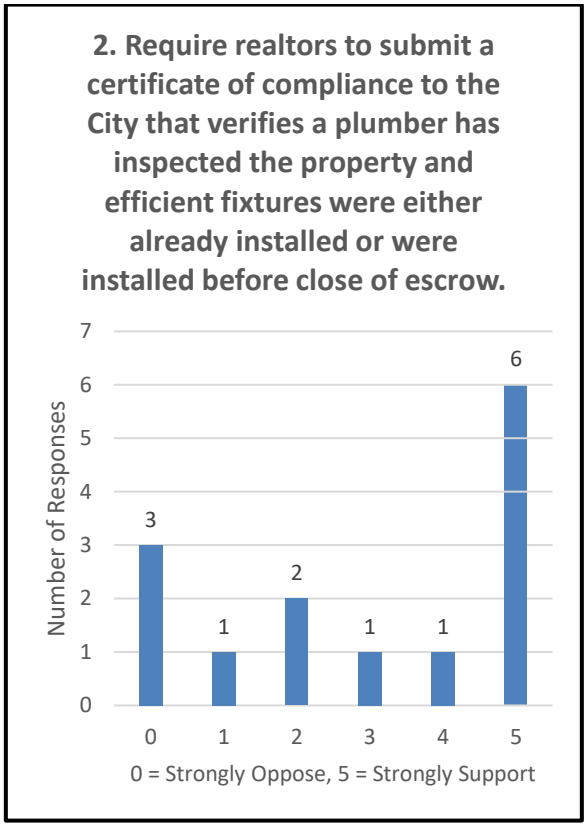
Part 1: Programs and Regulations

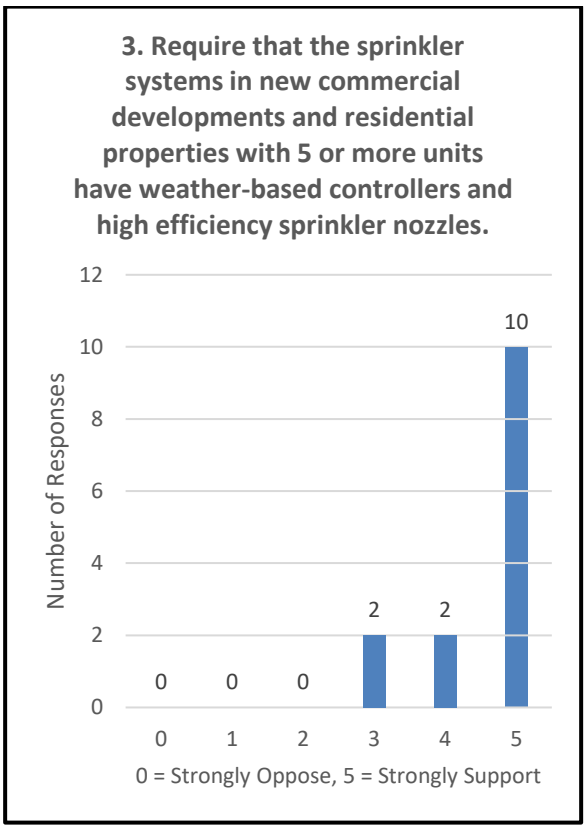
The water conservation plan will include recommendations for regulatory change, new programs and initiatives, water rate changes, etc. Your input will help prioritize which of these initiatives are included in the plan. Of the following, please indicate the level you would support or oppose the following programs and regulations.

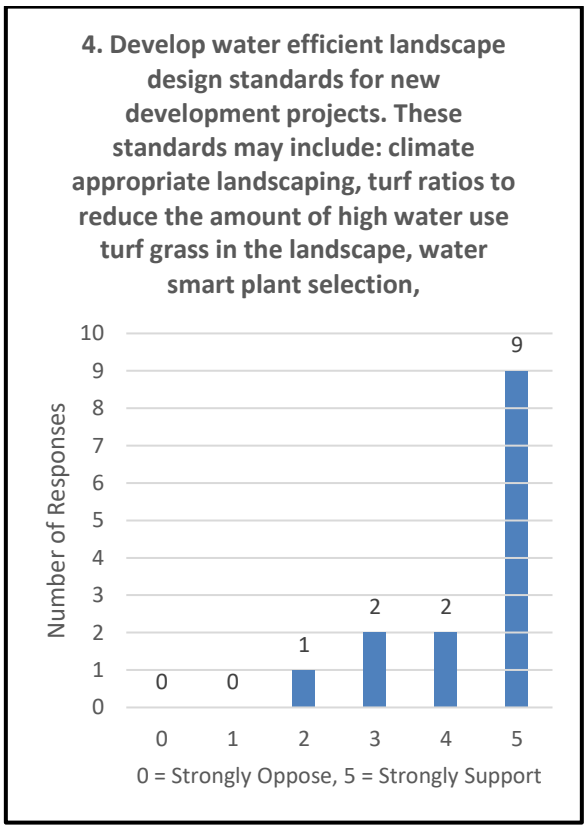
(0 = Strongly Oppose, 5 = Strongly Support)

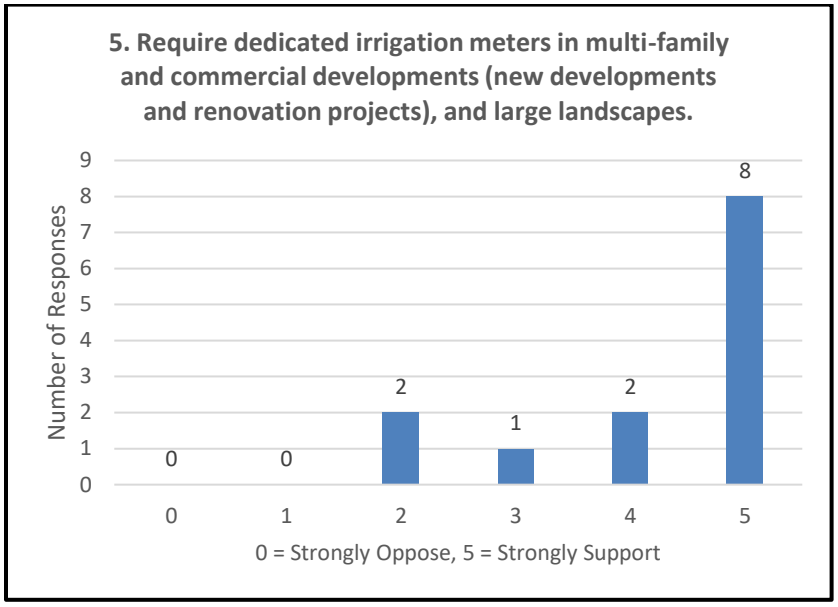



1. Require the installation of high-efficiency toilets, lavatory faucets, kitchen faucets, and showerheads in all new developments.
Number of Responses
0 1 2 3 4 5 6 7 8 9
0 0 2 2 2 8
0 1 2 3 4 5
0 = Strongly Oppose, 5 = Strongly Support


2. Require realtors to submit a certificate of compliance to the City that verifies a plumber has inspected the property and efficient fixtures were either already installed or were installed before close of escrow.
Number of Responses
0 1 2 3 4 5 6 7
3 1 2 1 1 6
0 1 2 3 4 5
0 = Strongly Oppose, 5 = Strongly Support


3. Require that the sprinkler systems in new commercial developments and residential properties with 5 or more units have weather-based controllers and high efficiency sprinkler nozzles.
Number of Responses
0 2 4 6 8 10 12
0 0 0 2 2 10
0 1 2 3 4 5
0 = Strongly Oppose, 5 = Strongly Support

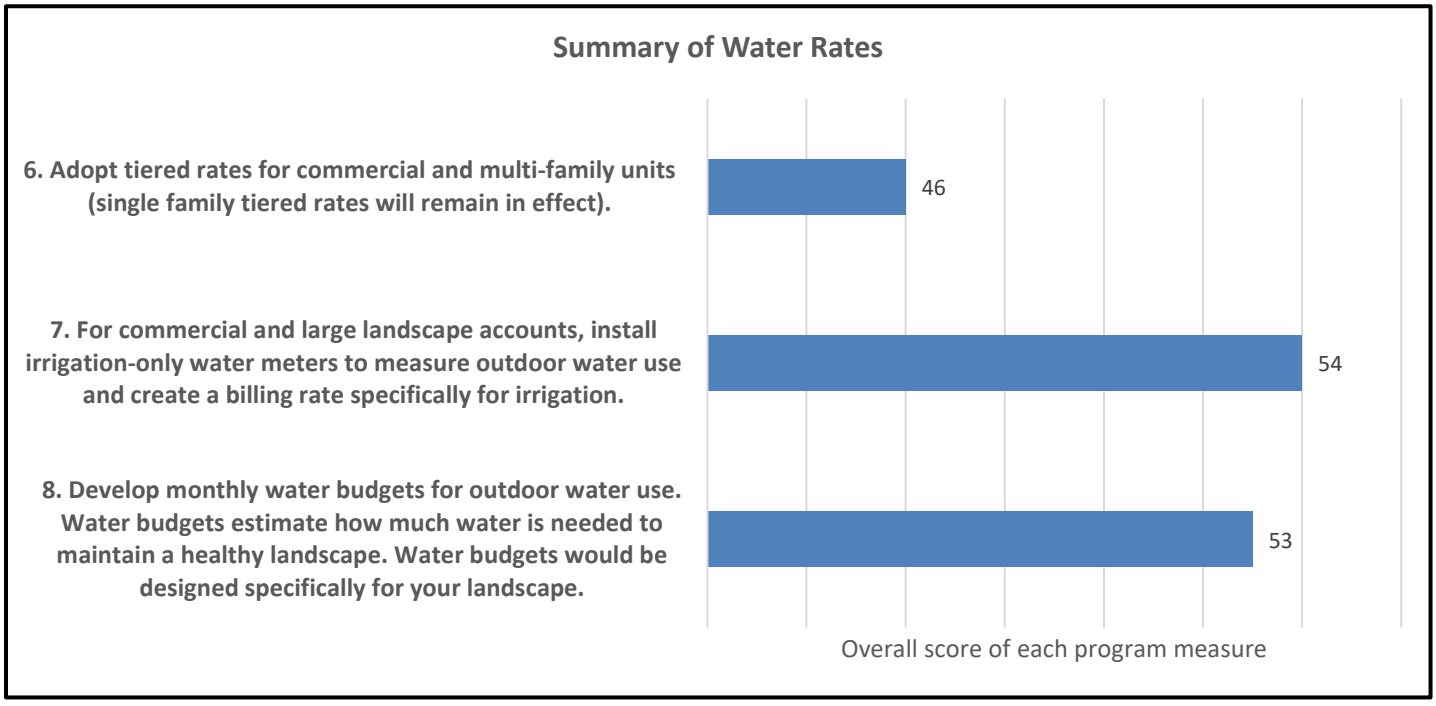

4. Develop water efficient landscape design standards for new development projects. These standards may include: climate appropriate landscaping, turf ratios to reduce the amount of high water use turf grass in the landscape, water smart plant selection,
Number of Responses
0 1 2 3 4 5 6 7 8 9 10
0 0 1 2 2 9
0 1 2 3 4 5
0 = Strongly Oppose, 5 = Strongly Support

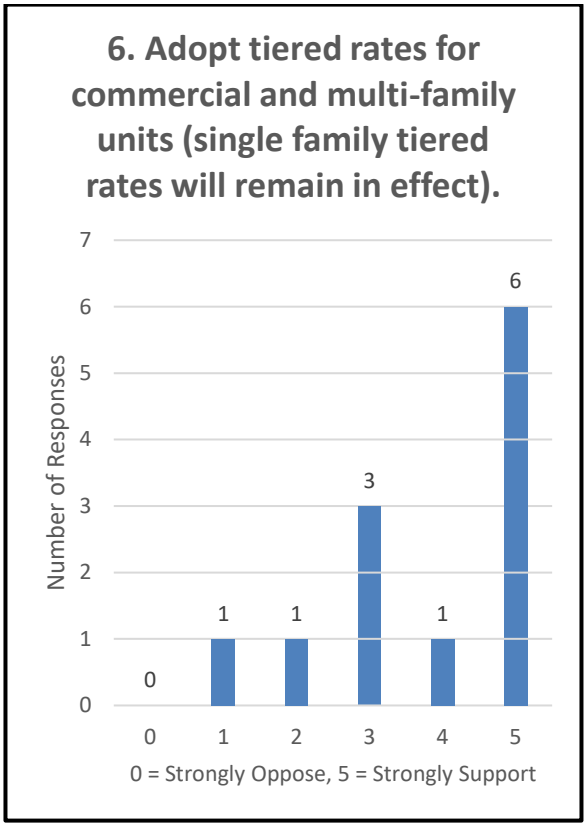


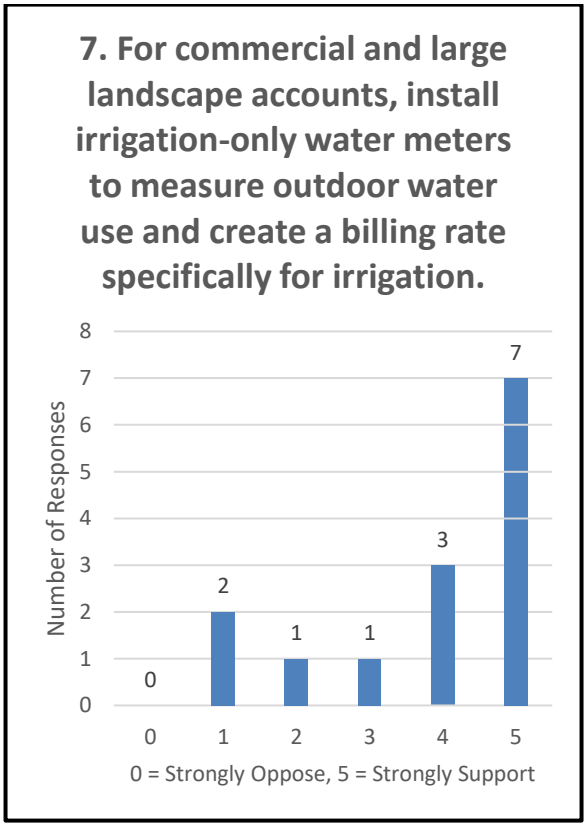
Part 2: Water Rates

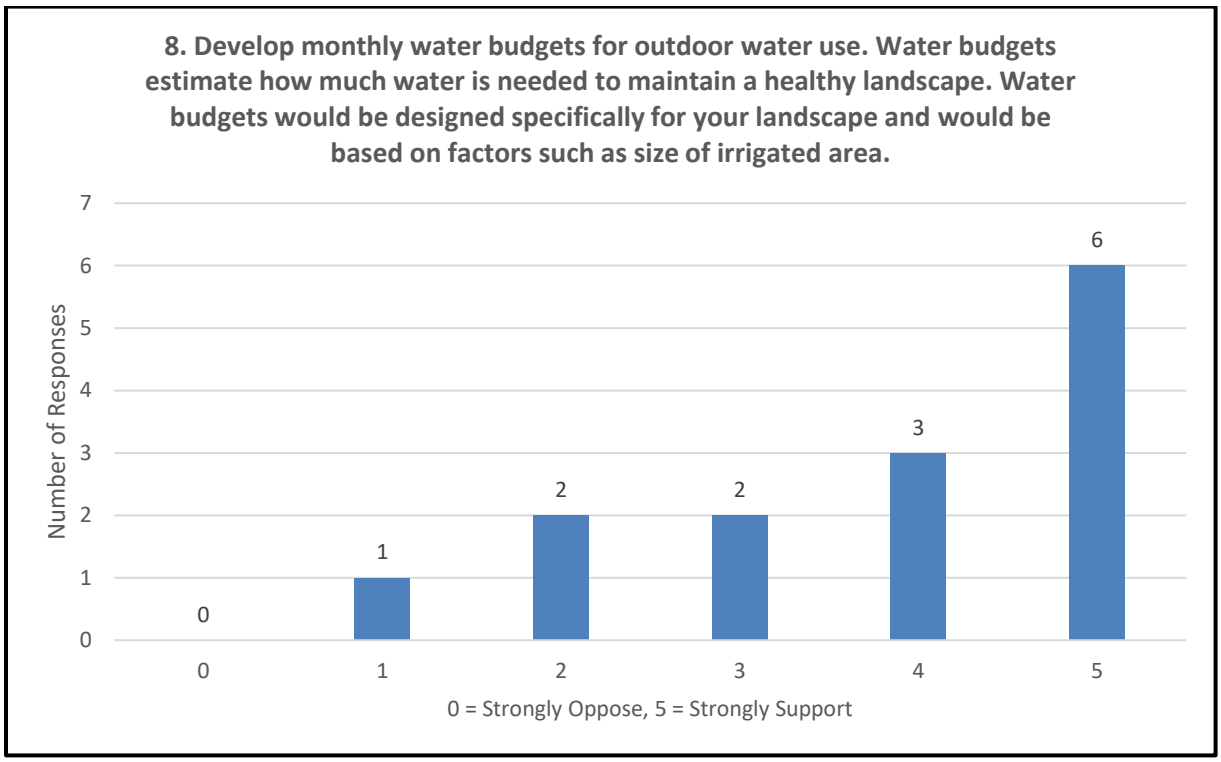
The water conservation plan will include recommendations for changes to Bozeman's current water rate structure. All of the water rate options being evaluated are designed to curb excessive outdoor water use by sending price signals to customers.

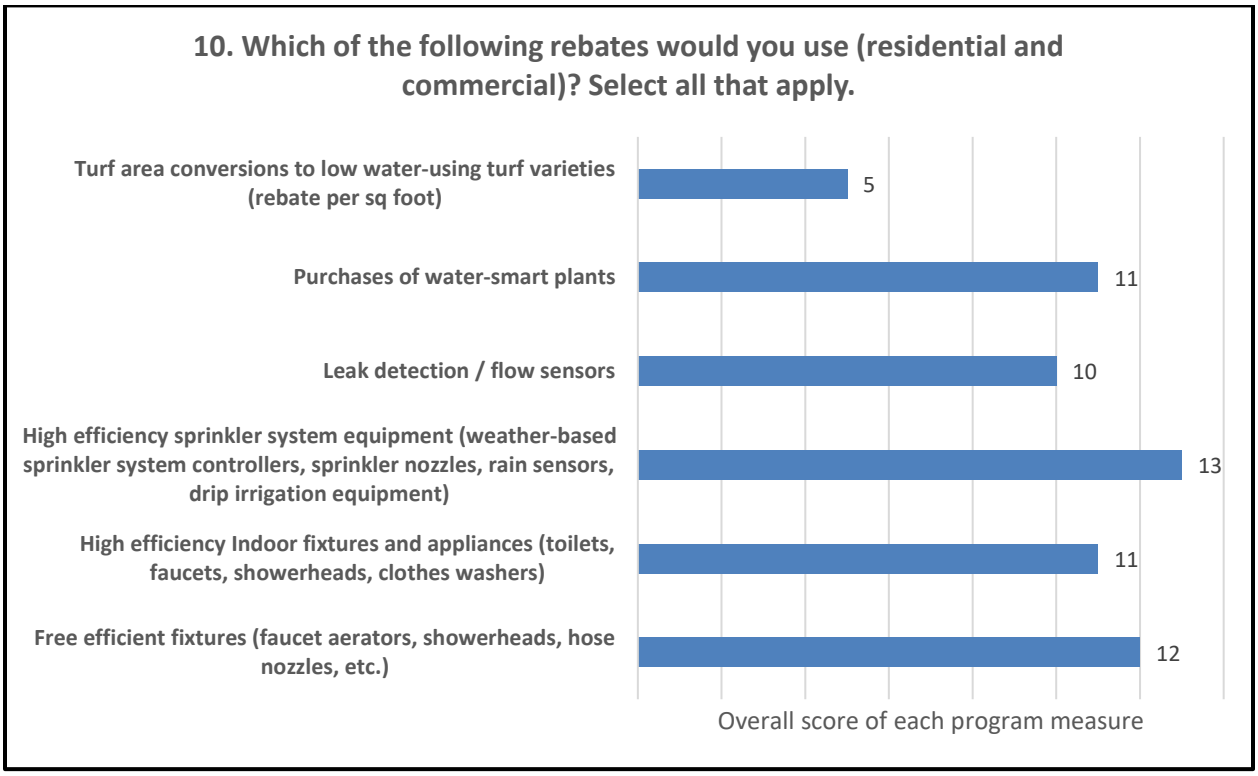
Bozeman currently uses a tiered rate structure for single family customers that includes four tiers. This ensures customers pay for the true cost of their usage and keeps the cost of water for essential uses to a minimum. As water usage increases and moves into higher tiers, the per unit price of water increases.

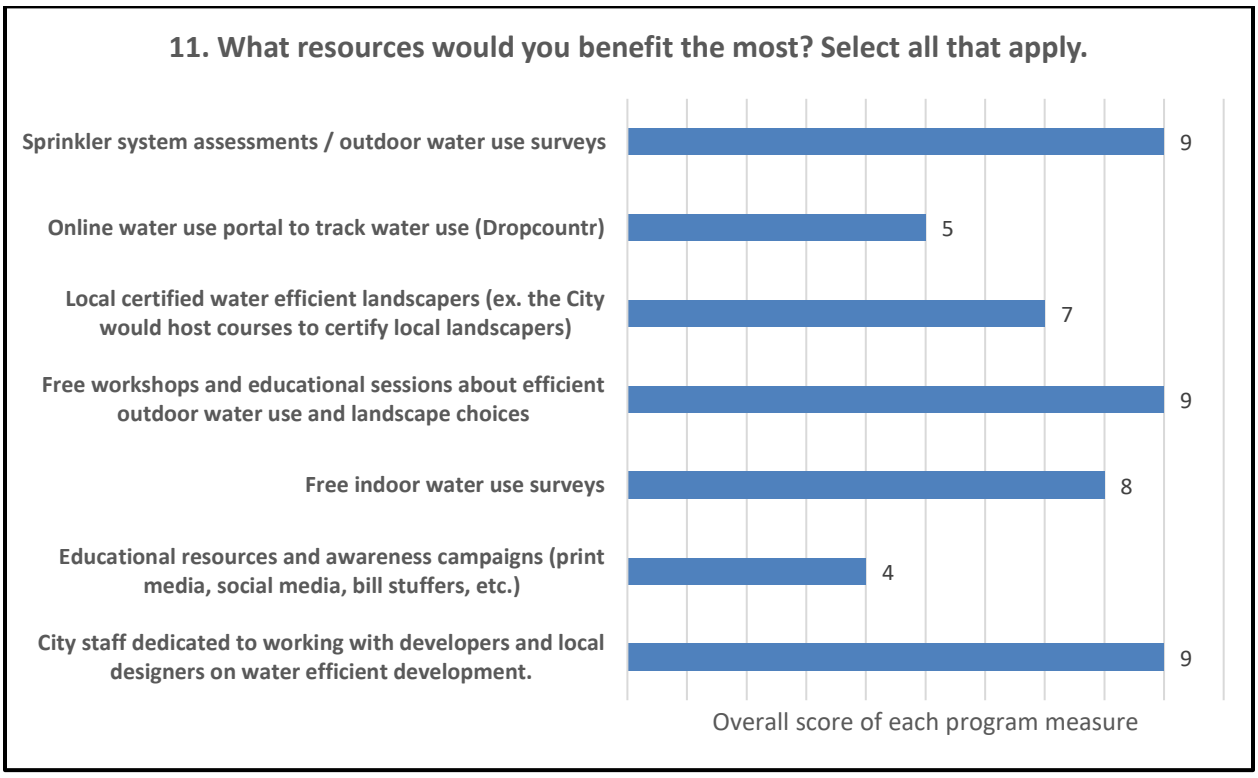



6. Adopt tiered rates for commercial and multi-family units (single family tiered rates will remain in effect).
Number of Responses
0 1 1 3 1 6
0 1 2 3 4 5
0 = Strongly Oppose, 5 = Strongly Support


7. For commercial and large landscape accounts, install irrigation-only water meters to measure outdoor water use and create a billing rate specifically for irrigation.
Number of Responses
0 2 1 1 3 7
0 1 2 3 4 5
0 = Strongly Oppose, 5 = Strongly Support


8. Develop monthly water budgets for outdoor water use. Water budgets estimate how much water is needed to maintain a healthy landscape. Water budgets would be designed specifically for your landscape and would be based on factors such as size of irrigated area.
Number of Responses
0 1 2 2 3 6
0 1 2 3 4 5
0 = Strongly Oppose, 5 = Strongly Support


10. Which of the following rebates would you use (residential and commercial)? Select all that apply.
Turf area conversions to low water-using turf varieties (rebate per sq foot)
5
Purchases of water-smart plants
11
Leak detection / flow sensors
10
High efficiency sprinkler system equipment (weather-based sprinkler system controllers, sprinkler nozzles, rain sensors, drip irrigation equipment)
13
High efficiency Indoor fixtures and appliances (toilets, faucets, showerheads, clothes washers)
11
Free efficient fixtures (faucet aerators, showerheads, hose nozzles, etc.)
12
Overall score of each program measure


11. What resources would you benefit the most? Select all that apply.
Sprinkler system assessments / outdoor water use surveys
9
Online water use portal to track water use (Dropcountr)
5
Local certified water efficient landscapers (ex. the City would host courses to certify local landscapers)
7
Free workshops and educational sessions about efficient outdoor water use and landscape choices
9
Free indoor water use surveys
8
Educational resources and awareness campaigns (print media, social media, bill stuffers, etc.)
4
City staff dedicated to working with developers and local designers on water efficient development.
9
Overall score of each program measure

APPENDIX I – WATER ADEQUACY CODE

Sec. 38.410.130. Water adequacy.

A. Subject to subsections B and C, prior to final approval by the review authority of development occurring under this chapter or chapter 10, the applicant must offset the entire estimated increase in annual municipal water demand attributable to the development pursuant to subsection D.

B. Compliance with this section is triggered if the estimated increase in annual municipal water demand attributable to the development exceeds 0.25 acre-feet after accounting for the following items as they relate to the development:

1. Current average annual municipal metered water demand;
2. Water demand offsets from a prior payment of cash-in-lieu of water rights;
3. Water demand offsets from a prior transfer of water rights into city ownership, and;
4. Water demand offsets from an existing water adequacy agreement or similarly purposed document.

C. Compliance with this section is deferred for the following developments until the occurrence of future development if the applicant records a notice of restriction on future development in a form acceptable to the review authority with the Gallatin County Clerk and Recorder:

1. An annexation that expressly defers this section under an annexation agreement;
2. Individual lots of a subdivision final plat planned for future multiple-household development;
3. Individual lots of a subdivision final plat planned for future commercial, industrial, or institutional development, or;
4. Future phases of a phased site development.

D. The city will determine the estimated increase in annual municipal water demand attributable to the development. The applicant must offset the estimated increase in annual municipal water demand attributable to the development through one or more of the following means:

1. Transfer of water rights into city ownership that are appurtenant to the land being developed, or other water rights that may be available for transfer, that the city determines to be useful.
2. Implementation of onsite and/or offsite water efficiency and conservation measures that reduce the estimated annual municipal water demand attributable to the development by one or more of the following methods:
   a. Installation of high efficiency indoor water using fixtures, appliances, and products that are more water efficient than city-adopted plumbing codes or state or federal minimum standards.
   b. Installation of unirrigated, or minimally irrigated, drought resistant or drought tolerant landscaping that exceeds the minimum requirements of division 38.550 of this chapter.
   c. Installation of high efficiency or water conserving irrigation componentry that exceeds the minimum requirements of division 38.550 of this chapter.
   d. Installation of non-potable water supply systems for landscaping irrigation purposes.
   e. Other water efficiency and conservation methods brought forward as part of the development by the applicant that the review authority may at its discretion approve.
3. Payment to the city of cash-in-lieu of water rights for that portion of the estimated annual municipal water demand attributable to the development that is not offset under subsections D.1 and D.2.

E. The unit cost for payment of cash-in-lieu of water rights will be established by city commission resolution. The cash-in-lieu of water rights payment amount provided by the applicant under subsection D.3 must be calculated using the unit cost effective on the date the payment is made to the city. The director of public works must deposit all payments received under this section, upon receipt, in the cash-in-lieu of water rights fund.

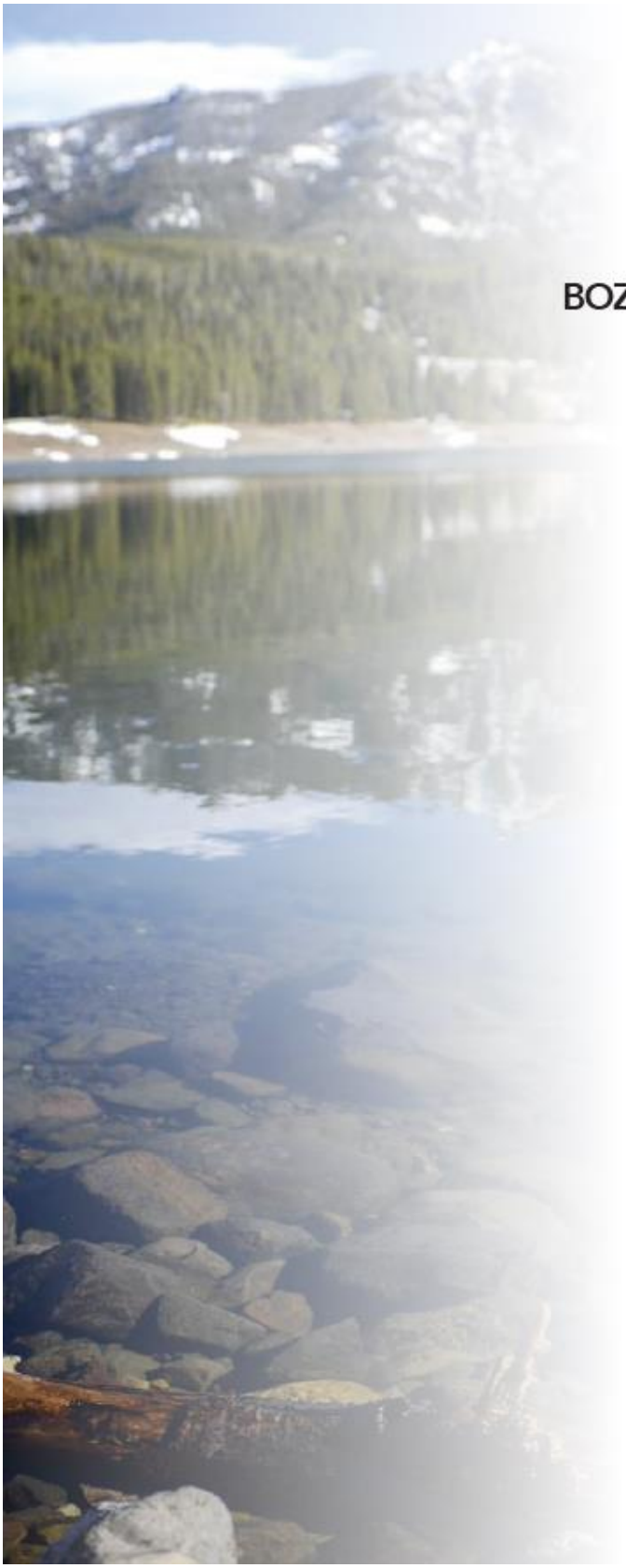
F. The city manager may adopt, and from time to time amend, administrative procedures to implement this section. The administrative procedures may at a minimum include the following items:

1. Standards established by the director of public works to determine the estimated increase in annual municipal water demand attributable to development.
2. Standards established by the director of public works to determine water demand offset amounts for implementation of water efficiency and conservation measures and water rights transferred into city ownership
3. Standards governing acceptance of water rights transferred into city ownership.
4. Standards to establish and govern the use of water demand offsets credits for that portion of demand offsets provided by an applicant that are in excess of the estimated increase in annual municipal water demand attributable to the development.
5. A process that provides for administrative appeals of determinations made by the review authority under this section.
6. Specific criteria that if met may authorize the review authority to waive this section.
7. Standards governing acceptance of water right transfers and establishing water demand offset credits may enable a deferral of payment of cash-in-lieu of water rights provided that the applicant records with the Gallatin County Clerk and Recorder an executed water adequacy agreement and related documents as approved by the city attorney securing the amount due.

(Ord. No. 2043 , § 1, 9-17-2020)

Editor's note(s)—Ord. No. 2043 , § 1, adopted Sept. 17, 2020, repealed the former § 38.410.130, and enacted a new § 38.410.130 as set out herein. The former § 38.410.130 pertained to water rights and derived from the original codification of this Unified Development Code.

APPENDIX J – NET BLUE WATER OFFSET PILOT STUDY



BOZEMAN NET BLUE PILOT PROJECT
FINAL REPORT

January 2021

PROJECT TEAM
Alliance for Water Efficiency
Environmental Law Institute
Dwight Merriam
Orion Planning + Design

EXECUTIVE SUMMARY

Development demand and the inherent impacts that accompany it has never been higher, especially in areas of the Intermountain West where water supply is already strained. In Montana, current and future growth is being concentrated in urban and suburban environments surrounding the state's seven largest cities, as new residents move in with an expectation that the public services and infrastructure they are used to will be provided. Future growth projections anticipate greater population shifts in the coming years, as more people are able to work remotely and the draw of a clean environment and wide open spaces gains strength. The West, and particularly Montana, is at a crossroads - find resilient ways to meet the coming demand or risk the loss of irreplaceable resources that sustain and support the high quality of life and economic opportunity driving growth to begin with. Communities are being forced to reevaluate more traditional approaches to planning and pursue solutions that address multiple challenges – from carbon emissions to storm water runoff. And as development continues to put pressure on water supply, expand impervious surface, and compound water quality problems, a new and holistic approach to planning and regulation will be necessary to support growing populations and sustain economies in the future.

In 2014, the Alliance for Water Efficiency (AWE), along with partners at the Environmental Law Institute and River Network, launched the ***Net Blue: Water-Neutral Growth*** program. Net Blue is an innovative, industry-vetted approach to water neutrality for new development, helping communities to grow sustainably despite water scarcity. It represents a paradigm shift in the way cities, counties, states, and regions plan for growth when resources are scarce or strained. To advance this approach into practice, the project team built a Net Blue Toolkit with a model ordinance that communities can tailor and customize to create a water demand offset approach meeting local needs. This approach keeps water use at the same or reduced levels relative to the rate at which use was growing at the time of the ordinance's adoption. The concept of "water-neutral" growth is achieved by integrating land use planning and water management to require or incentivize water use offsets that reduce overall demand on water resources resulting from new development. In addition to stretching water supplies and decreasing the need for new infrastructure, this approach can also help leave more water in watersheds for fish, wildlife, and recreation. A water-neutral growth ordinance utilizes various smart water strategies in the offset process – ranging from water efficiency to green infrastructure – to protect water for future diverse needs and users. The Toolkit includes the following components to help communities pursue a Net Blue approach and tailor it to their specific development review procedures, public processes, and unique challenges.

- A Model Ordinance Worksheet, a User's Guide, and Examples
- An Offset Methodology, User's Guide, and Sample Implementation
- Community Outreach materials for distribution, including a Net Blue Fact Sheet and FAQ's

What does it mean to be "water neutral"?

Water-neutral growth is achieved by integrating land use planning and water management to require or incentivize water use offsets that reduce overall demand on water resources resulting from new development.

What are water offsets?

Water offsets are strategies that reduce or limit projected potable water use resulting from new development or expand the use of existing connections. Offsets may include fixture and appliance replacements and retrofits, rainwater harvesting, and low-impact development controls through landscaping and site design.

Seven communities in different regions throughout the United States were consulted to help develop the model ordinance and the offset components, and to ensure the Net Blue program is adaptable to many different political climates, legal frameworks, and environmental challenges. Its introduction accelerated a growing national dialogue on the need to link water resources and land use planning nationwide; it spurred the launching of the Water and Planning Network at the American Planning Association.

PROJECT BACKGROUND

The City of Bozeman was chosen as a pilot community to demonstrate the successful integration of the Net Blue approach for a variety of reasons. Located in the heart of southwest Montana outside Yellowstone National Park, Bozeman is experiencing exponential growth amidst a challenging water climate. In 2018 Bozeman was named the fastest-growing city of its size, with projected growth adding approximately 27,000 people by 2045. Its position along the I-90 corridor, proximity to outdoor recreation, amenable climate, and natural beauty create an attractive environment for retirees and second homeowners as well as businesses seeking to attract employees and a remote workforce interested in the quality of life and lifestyle Bozeman offers. As a result, housing development has boomed over the past decade, cost of living has skyrocketed, and the community has begun to feel the effects of unfettered growth on the natural environment - and on water resources in particular.

Bozeman's naturally arid climate only contributes to the strain growth and development has placed on water resources. As climate change continues, Bozeman will see even less annual precipitation than the average 17 inches received each year (compared to the U.S. average of 38 inches annually). For a community that relies on precipitation to bolster annual snow pack and recharge the aquifer, this shift is especially concerning for future water supply. Bozeman sits at the headwaters of the Missouri River, meaning there is no upstream water source to draw from; the City relies wholly on snowmelt from Hyalite Creek, Sourdough Creek, and Lyman Spring to meet current and future demand. With less precipitation forecast annually, average snow pack levels have dropped. Warmer winters have exacerbated this problem, leading to earlier peak runoff conditions as the snow pack melts each spring. Earlier runoff contributes to drier conditions throughout the summer months, a product of increasing temperatures in an already arid climate.

The water conundrum: A limited resource, a cacophony of voices and a region that continues to grow

By Lewis Kendall Chronicle Staff Writer May 6, 2018

1 of 7

Bozeman's location within the Upper Missouri River Basin further complicates these issues. The basin is "closed" to the allocation of future water rights, meaning current and future demand resulting from population growth must be accommodated using the resources available today. As demand continues to grow due to new development and high outdoor water use, universal measures to minimize consumption through offsets and efficiencies are not only necessary for Bozeman - they are critical for the longevity of the region. Elected officials and community leaders have long recognized the importance of planning for water resilience. Water adequacy requirements have been in place since the 1980's when the first water adequacy ordinance was adopted, followed by the adoption of a Water Adequacy Administrative Procedures Manual. The City adopted an Integrated Water Resources Plan in 2013 to balance water supply and demand as the city continues to grow, followed by the development of a water conservation program in 2014. In 2017, the city's first Drought Management Plan was adopted to ensure reliable water supplies are available for essential uses during times of shortage. With a recent update to the City's community plan and the development of a climate action plan aimed at policy change necessary to protect natural resources and promote sustainable growth moving forward, the community is primed for the successful integration of offsets using the Net Blue approach to assist in implementing both City plans and policy.

PROJECT GOALS

This project brought together a diverse team to assist the City of Bozeman in drafting a water-neutral ordinance using the Net Blue Toolkit and resources. The following goals were established early on to ensure the project's overall success and reinforce project objectives through consistent messaging when communicating with City leadership, diverse stakeholders, and to members of the public less familiar with water issues in the community. By applying the Net Blue approach in Bozeman, the project team hoped to:

- **Increase community-wide understanding of water-neutral development among diverse stakeholder groups, especially those individuals active in the construction and design community.**
- **Broaden support for water-neutral development by using the Net Blue toolkit to align the City's existing Water Adequacy Ordinance and Administrative Procedures Manual with recently adopted policy including the City's strategic plan, community plan, climate plan, and ongoing planning initiatives.**
- **Increase collaboration between water resource management staff and the City planning department, reinforcing the interrelatedness of development review and decision-making to further positive outcomes related to the protection and conservation of limited water resources.**

PROCESS AND APPROACH

To provide the City of Bozeman with the highest level of technical assistance to accomplish project goals, the Alliance for Water Efficiency brought together a diverse team comprised of industry leaders from across the country well-versed in water law, policy, comprehensive planning and implementation, and public outreach. Team members included:

- Mary Ann Dickinson, President and CEO of the Alliance for Water Efficiency
- Bill Christiansen, Director of Programs for the Alliance for Water Efficiency
- Adam Schempp, Senior Attorney at the Environmental Law Institute
- Dwight Merriam, FAICP and Attorney at Law, Advisory Committee member for Net Blue
- Allison Mouch, AICP and Partner with Orion Planning + Design

Each member of the team brought a unique skill set and knowledge base to the project. The Alliance for Water Efficiency led on direction and coordination among team members, handling day-to-day project management, providing technical guidance on the Net Blue offset methodology, and working with City staff on draft revisions to the ordinance and manual. Adam Schempp and Dwight Merriam provided law and policy review throughout the drafting process, offering insight on water conservation and sustainability objectives through interpretation of existing laws and legal developments nationwide. Mr. Merriam also provided a legal lens on how specific water offsets and credits may be embraced or challenged by the development community. As a Montana resident and professional land use planner working across the state and country, Allison Mouch's role focused on the alignment of recent planning and policy decisions made by the City to better understand where adjustment within the current development code was

PROJECT TIMELINE

01/19 COMMUNITY DISCOVERY

Plan, code and policy review; develop detailed scope, project strategy, and timeline

05/19 ORDINANCE DEVELOPMENT

Draft revisions to the Water Adequacy Ordinance; internal review, discussion, and revision

10/19 INTERNAL STAKEHOLDER ENGAGEMENT

Convene City stakeholders from the Planning Department, Engineering Department, and legal counsel to present proposed revisions and next steps

08/20 POLICY PASSAGE

Approval and final adoption of ordinance revisions by the Planning Board, Zoning Commission, and City Commission

11/20 WATER ADEQUACY MANUAL UPDATE

Draft revisions to the Water Adequacy Manual; internal review, discussion, and revision

12/20 EXTERNAL STAKEHOLDER ENGAGEMENT

Workshop with external stakeholder to introduce the Net Blue approach and proposed revisions to the Manual

warranted. All team members assisted with outreach and the facilitation of proactive discussions among both internal and external stakeholder groups as the project moved forward.

In addition to members convened by AWE, City of Bozeman staff played an integral role in the project team's success, bringing a deep knowledge and understanding of the City's current efforts and future resource needs to the table. Jessica Ahlstrom, Water Conservation Specialist, and Brian Heaston, Engineer III, provided significant feedback and direction on the successful incorporation of Net Blue into the Water Adequacy Manual update, taking on much of the revisions themselves. Jessica served as the team's primary contact with the City and specifically helped to shepherd ordinance and manual updates through the public process.

The project was originally organized into three phases: community discovery, ordinance development, and stakeholder engagement and policy passage. As described below and shown by the timeline on the previous page, these phases morphed throughout the project's lifetime to accommodate the needs of the community and ensure a successful final product.

The discovery phase kicked off in January 2019 with the full team convening virtually to discuss project roles and responsibilities, anticipated timelines and schedule, and to determine next steps. During the winter and spring of 2019 team members reviewed the City's current community plan (known as a "growth policy" under state statute), Unified Development Code, the Water Adequacy Ordinance and Procedures Manual, and other related plans and policy documents for consistency with Net Blue objectives and for obvious points of integration. Following this comprehensive review, the team determined the best approach for Bozeman would be to update the Water Adequacy Ordinance and Procedures Manual first, incorporating select elements and methodology from the Net Blue toolkit. Once the ordinance and manual were updated, specific cross-references to the City's Unified Development Code could be further expanded using the Net Blue model where appropriate, such as site design standards for landscaping and stormwater management. This approach was further supported by the City's policy on considering updates to the unified development code on a bi-annual basis and in conformance with established priorities; alternately, updates to the Water Adequacy Procedures Manual can be done administratively, giving staff time to introduce and coordinate future code amendments strategically with planning staff, boards, and leadership, in conformance with the established process and timeframes.

Following team agreement on approach, the drafting of revisions to the Water Adequacy Ordinance got underway. Drafting continued through the summer of 2019 with the core objective of hosting a meeting with key internal stakeholders that fall. This internal stakeholder meeting served as a thorough introduction to the Net Blue approach among a broader group of stakeholders comprised of city planners and engineering staff along with legal counsel. On October 11, 2019, project team members and internal stakeholders gathered at the City Planning Office for an in-depth workshop aimed at:

- **Highlighting the benefits of Net Blue as applied to the City of Bozeman**
- **Reviewing options, discussing alternatives, and determining a preferred approach to both ordinance and manual updates**
- **Agreeing upon a schedule and next steps to carry the desired revisions forward**

The meeting proved successful in answering these questions and the team moved forward with revisions to the Water Adequacy Ordinance as directed and supported by staff, with the objective that draft revisions would be considered by the Planning Board, Zoning Commission, and City Commission in early 2020.

ACCOMPLISHMENTS

The year 2020 brought forth significant challenges as well as accomplishments for the City and the Net Blue team. After project delays related to the ongoing pandemic that shuttered much of the country through the spring, the proposed revisions to the Water Adequacy Ordinance were moved forward in early July and approved by the City Commission on August 3, 2020. Following approval, the team met virtually to discuss next steps and begin drafting revisions to the Water Adequacy Procedures Manual, as decided upon the previous October. City staff took the lead on draft revisions to the manual, with the Net Blue team providing review of the draft document as well as additional training and technical assistance on how specific on-site and off-site offset measures could be incorporated effectively into the City's methodology and calculations. The City's community plan was also in the final stages of an update and adoption in the fall of 2020 while revisions to the manual were underway, so a thorough analysis of how the plan directly and indirectly aligned with the Net Blue approach and ongoing water efficiency measures in both policy and action was conducted.

A draft of the Water Adequacy Procedures Manual was completed in late November and introduced to external stakeholders via webinar on December 11, 2020. Over sixty representatives from the planning, design, engineering, development, and construction community took part in the educational webinar. The webinar was intended to familiarize those key stakeholder groups who will use the offset measures in future development proposals with the Net Blue approach, understanding potential concerns and challenges from their point of view, and using the questions, discussion, and feedback gleaned from this virtual conversation to improve and finalize the draft manual prior to adoption. Feedback gained from participants of the webinar was overwhelmingly positive; while emphasis on cash-in-lieu payments was reduced in revisions to the manual, and on-site and off-site offset measures expanded, the applicability of these new requirements was not only understood by those in attendance - but welcomed.

The AWE Net Blue Offset Methodology workbook was customized to meet the unique needs of Bozeman. The project team worked with city staff to create an Excel-based calculator to estimate the demand of new development and calculate onsite and offsite offsets. The comprehensive demand calculator includes eleven different new connection types and allows for custom entries. The offset calculator provides onsite offsets for indoor efficiency options and efficient irrigation practices. There are nine conservation options that can be implemented for offsite offsets and opportunities for custom conservation measures to be proposed. This tool will be a valuable resource for the city to administer the ordinance and for developers to identify the most cost-effective opportunities to offset water demand via efficiency projects.

The success of this pilot project will ultimately be measured in the City of Bozeman's ability to reduce the annual average water consumption of its residents through the use of offset credits, water banking, and cash-in-lieu payments, all of which cannot be fully anticipated until the final revisions to the Water Adequacy Procedures Manual have been embraced and adopted by City leadership. However, the goals of this project were successfully met in that the City accomplished the following with assistance from the Net Blue project team:

- **An updated Water Adequacy Ordinance that reflects current policy on water resource protection and management and includes a customized offset tool created specifically for Bozeman that will aide the city in administration of the ordinance and help developers identify the most cost effective opportunities to offset water demand through efficiency projects.**
- **A new tool that can be used by the city and developers to estimate the water demand of new development and calculate onsite and offsite water demand offsets.**
- **An updated draft of the Water Adequacy Procedures Manual incorporating elements of the Net Blue approach that is poised for adoption in early 2021**
- **Staff ownership of revisions and amendments and general support from City departments and leadership**
- **Understanding, support, and enthusiasm from external stakeholders introduced to the draft**

CHALLENGES AND OPPORTUNITIES

All pilot projects offer opportunities for improvement through challenges experienced, and this project was no different. The following list highlights a handful of issues and opportunities experienced by the team during the course of the project - some unique to Bozeman, others not - and how these may be addressed in the future for even better project outcomes.

- **Clearly defined team roles and responsibilities.** Working with a large team comprised of members spanning states, time zones, and areas of expertise can pose a challenge, especially when those team members have not worked together before. This project highlighted the benefits of building rapport, understanding individual strengths and weaknesses, and clearly articulating expectations. In some cases, those expectations were unknown, for the very reason that this project was a first! Improvement - and continued success - will surely come as future opportunities for collaboration arise. A detailed scope of services beyond the MOA adopted and including specific tasks and timeframes could help to further articulate roles and expectations moving forward, especially between the team and the client.
- **Shorter timeline to project execution.** The original project was intended for completion within one year; due to a variety of factors - a national pandemic, staff capacity, personal schedules, and public processes, the project took a full two years to complete. This not only impacts internal momentum but also external awareness and interest; maintaining a tighter timeframe would help maintain momentum so important to project success in the future.
- **Building rapport with local leadership.** The project team never had an opportunity to meet with and interact with the Planning Board, Zoning Commission, and City Commission during the process. While all clients and communities treat the consultant and elected official relationship differently, this interaction may have helped keep the project in the forefront of the broader community discussion, especially when other overlapping planning and policy efforts were underway.
- **Earlier interaction with stakeholder groups.** Similar to the above sentiments, building closer relationships with external stakeholder groups and professionals in the field may have helped keep the project moving forward, aided the revision process and broadened the overall reach of outreach efforts toward the project's conclusion. While it was important to the team that draft revisions were only introduced to stakeholders once internally vetted and deemed ready, a significant opportunity for education about the Net Blue approach was lost at the project's beginning.
- **Integrated vs. stand-alone ordinance.** The City of Bozeman chose to integrate elements of the Net Blue Toolkit, methodology, and overall approach into their existing ordinance and manual; this proved challenging in that the toolkit, worksheets, and other resources support adoption as a stand-alone ordinance. For so many communities this will provide a fast and effective way of introducing water efficiency measures into outdated codes easily; where communities like Bozeman have existing water efficiency infrastructure, deciding where and how Net Blue's application fits best will need to be addressed on a case-by-case basis.
- **Last but not least... a global pandemic! Although beyond anyone's control,** the global pandemic that began in early 2020 threw a wrench in nearly everyone's plans, limiting the team's in-person interactions with staff and stakeholders and contributing to the extended timeframes discussed above. It also forced greater familiarity with technology and virtual participation, which will ultimately benefit future projects and budgets for years to come.

CONCLUSIONS AND RECOMMENDATIONS

As this pilot project reaches its conclusion, it is especially rewarding to see the City of Bozeman moving towards final adoption of an updated Water Adequacy Procedures Manual that effectively integrates elements of the Net Blue approach. To ensure its continued success, the project team recommends that the City continue to pursue integration of water efficiency measures in both policy and code as follows:

- Adopt the final revisions to the Water Adequacy Procedures Manual in the first quarter of 2021. As described on the previous page, drawing the timeline out further will only frustrate those stakeholders engaged in December 2020 and reduce the efficacy of the measures over time. A quick adoption and immediate application will reinforce the importance of these provisions ahead of the 2021 construction season.

- Consider an update of the City's Integrated Water Resources Plan (2013) to recognize Net Blue as an implementation strategy that can serve to unify the City's ongoing policy direction on water efficiency and resource management.

- Use the recently adopted Community Plan and the objectives and actions identified through this process as being aligned with the Net Blue approach to guide amendments to the Unified Development Code. Specifically, those implementation actions identified in Chapter 4 of the Community Plan recommending updates to the City's land use regulations in alignment with the Integrated Water Resources Plan. Such amendments should prioritize building code improvements, site design and landscaping elements, and other aspects appropriate for incorporation in the development code.

- Continued staff coordination between planning, engineering, and water conservation on development application review and recommendation should be emphasized.