

WATER EFFICIENCY PLAN

— GREELEY, CO —



2022

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City of Greeley's Water Efficiency Plan

Executive Summary

Securing safe and sufficient water supplies for Greeley's future generations in face of significant water uncertainties like drought, wildfires, climate change, etc. is challenge. Successful stewardship of precious water resources is a benchmark by which future generations will judge the current citizens and water utility staff. The City of Greeley's (City) Water Efficiency Plan (WEP) is a roadmap to establish strategic objectives and goals to outline programs and measures to ensure sufficient water supply for the future.

The City of Greeley is the business Center for Weld County, the county seat and the second largest community in Northern Colorado. The leading industries in Weld County have remained consistent and the top five are agriculture, manufacturing, energy production, health and Wellness, and business services. With the adoption of the 1958 City Charter, Greeley citizens created a Council-appointed Water Board with the duty to "acquire, develop, convey, lease, and protect water and sewer assets, supplies, and facilities." The citizens also gave the Board the power to set the minimum water and sewer rates necessary for operation, maintenance, debt service, and depreciation. This separate rate setting authority allows City Council to focus on economic development, knowing there will be a healthy water system to support their efforts.

The Water and Sewer Board has an important role in Greeley leadership, with seven voting members appointed by the City Council, as well as the Mayor, City Manager and Director of Finance as ex-officio members. The Director of Water and Sewer is the primary staff representative to this Board. As such, the Director has the responsibility to provide reports and recommendations to the Board related to their autonomous rate-making and water resource authority, and to adhere to the City Council policies and priorities as directed by the City Manager. The Water and Sewer Board has been continuously engaged in strenuous and independent oversight of the department's strategic direction, budget, and operations since its creation. This overseeing is supplemented by the annual examination of the Water and Sewer's budget by City Council.

Through the Water and Sewer Department, drinking water and irrigation water is provided to approximately 108,000 Greeley citizens. Kodak, along with three nearby municipalities (Evans, Windsor, and Milliken), annually transfer yield associated with their water rights to Greeley for water treatment and delivery. The Water and Sewer Department serves Greeley by treating and distributing nearly 9 billion gallons of water every year with more than 500 miles of pipelines, two drinking water plants, a wastewater treatment plant, three treated water reservoirs, six raw water reservoirs and a variety of pumping stations.

Greeley provides drinking water to over 108,000 residents, hundreds of businesses, other municipalities through approximately 28,000 individual accounts. Most accounts (82%) represent single family residents, however, use only one-third of the total water. Commercial, industrial, and institutional (CII) meters made up 7% of the total number of accounts but many CII water users represent a large amount of water consumption.

Greeley's water demands are similar what is seen within the Colorado Front Range communities with highest water demands during the summer due to outdoor irrigation and lowest during the winter. Under average weather conditions, about one-half of the total annual water use by all Greeley's customers is for outdoor irrigation (including non-potable deliveries for irrigating parks, schools and other large outdoor areas). Absent intentional measures to reduce demand, outdoor water use increases to about 55% of annual use under hot and dry conditions. During the peak irrigation season from June through September, outdoor water use typically makes up about 70% of total use. That percentage increases under hot and dry conditions.

Although Greeley's population has grown by approximately 17%, per capita, demand has decreased by 11% as noted. This overall declining trend in system wide per capita demand is from single family residential sector and gradual decreases in indoor use in particular.

Reducing water demand not only improves drought resilience but can reduce or defer and potentially avoid high costs of new infrastructure. Conservation has been included in Greeley's overall supply planning for over 30 years. Greeley developed its first water conservation plan in 1992—outside of State of Colorado's requirements. The City will update the WEP every five to seven years and as such, this is the third update to the original 2008 Greeley WEP to the Colorado Water Conservation Board (CWCB).

As of 2021, the City's Water Conservation program has a full time Water Conservation Manager, Water Conservation Administrator (Project Manager), and two Water Conservation Specialists. In addition, the City hires seasonal labor and outside contractors on a as needed bases.

The WEP builds on the City's current priorities and is designed to integrate and synthesize existing codes, criteria, roadmaps and strategic plans with the lens of water conservation. It is meant to be the guiding document that provides direction to advance water conservation efforts and build organizational capacity to:

- Create efficiencies, synergies, and consistencies among policies, plans, projects and programs
- Maximize cost savings opportunities
- Create goals to measure success and progress

With a use of triple bottom line approach, the Water Conservation team will transform Greeley's water conservation efforts to a sustainable future. This approach offers water efficiency goals to be optimized, innovated, and improve water efficiencies across multiple divisions within Greeley. This WEP encompasses current plans and reports from the Greeley's Water and Sewer Department—since water efficiency is connected to multiple divisions. These include:

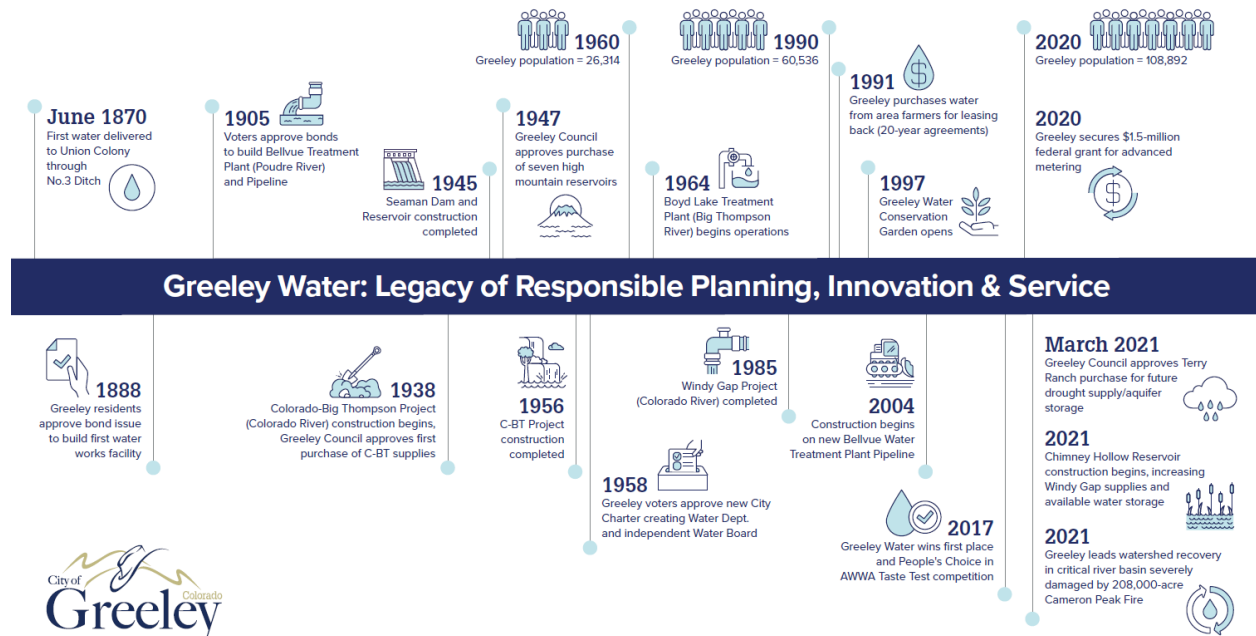
- *Greeley Non-Potable Water Master Plan, June 2021*
- *Greeley Water Transmission and Distribution Master Plan, June 2021*
- *Greeley Integrated Water Resources Plan, draft 2022*
- *Greeley Drought Emergency Plan, January 2021*
- *Enhancing Greeley's Water Efficiency Portfolio through Performance Analysis, May 2022*

The water efficiency is centered around a sustainable water future that revolves around Greeley’s community, prosperity, and water conservation management. This Plan is designed to support the five core values for Water Conservation:

- Drive water conservation through innovation and technology
- Provide excellent customer service
- Continue and build on Greeley’s water conservation history
- Commit to sustainability and environmental stewardship
- Fulfill future customer needs and changing values

Greeley’s 2022 WEP is designed to reduce systemwide water use and have identified programs that could reduce water demand by 2,034 acre-feet of water savings by 2030. Section 3.2- Water Efficiency Goals describes a 5-year scorecard to track progress and provide accountability and transparency within Water Conservation. While Section 4- Water Efficiency Activates describes existing and new program to be implemented over the coming year to meet cumulative water savings.

This plan was developed through an iterative process of public input starting with an initial citizen survey in 2021 and refined through a formal public comment process, Water and Sewer Board and City Council’s adoption. Securing safe and sufficient water supplies for future generations of Greeley residents in the face of significant uncertainties such as drought and climate change is a major challenge. This 2022 Water Efficiency Plan (WEP) for the City of Greeley establishes clear goals and outlines programs and measures to help ensure a sufficient water supply for the future. The WEP continues the Greeley water legacy of responsible planning, innovation and service.



1.0 Profile of Existing Water Supply System

1.1 OVERVIEW

The City of Greeley (City) is located at 40.4233°N, 104.709°W in a region known as northern Colorado and lies approximately 49 miles north/northeast of Denver (see Figure 1). Greeley is the Weld County seat and the largest City in the county, with a population now exceeding 108,000 people. Total population served is the City of Greeley itself in addition to wholesale water-purchasing municipalities near Greeley—Windsor, Evans, and Milliken. The City’s elevation is 4,658 feet above sea level covering a total area of 30,730 acres. Greeley’s long-range growth area adds an additional 27,599 acres to the City’s size.

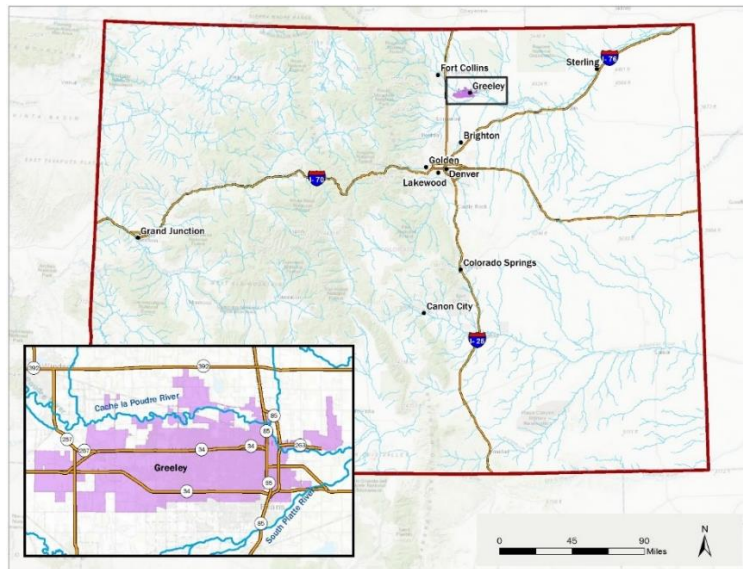


Figure 1: City of Greeley’s Location

Greeley, originally known as Union Colony, was organized in 1870 by Nathan Meeker, the agriculture editor for Horace Greeley’s New York Tribune. Meeker dreamed of founding a “utopian community based on temperance, religion, education, agriculture, irrigation, cooperation, and family values.”¹

Located on Colorado’s high plains, Greeley’s average annual precipitation is 12-14 inches per year. Because Greeley is not located near a consent water flows, most of our water supply is brought through infrastructure through other parts of the state. Greeley owns surface water rights in four major river basins—the Cache la Poudre River, Big Thompson River, Laramie River and Colorado River—and operates six water storage reservoirs year-round as part of its public drinking water system. The high mountain reservoirs are Barnes Meadow, Comanche, Hourglass, Milton Seaman, Peterson, and Twin Lakes. The reservoirs capture spring snowmelt that is released as needed to meet Greeley’s water demands.

Greeley’s aquifer storage and recovery (ASR) project, Terry Ranch, was added to the water portfolio in March 2021. This ASR project will be developed in stages over long period of time and is currently off-line.

¹Confluence- The Story of Greeley Water by Gregory J. Hobbs, Jr. and Michael Welsh, 2020

1.2 WATER SUPPLY RELIABILITY

1.2.1 Water System Profile

Greeley's water sources include direct river diversions, ownership in the Colorado-Big Thompson (C-BT) and Windy Gap projects, high mountain reservoirs, and rights in several irrigation companies. In addition, the Terry Ranch Aquifer Storage Recovery (ASR) project will provide 1.2 million acre-feet of water and aquifer storage in the future. Greeley treats water at two treatment plants, the Bellvue plant located on the Poudre River and the Boyd Lake Plant located adjacent to Boyd Lake in the Big Thompson River drainage. The City also owns and operates a non-potable system with associated ditch shares, storage, and wells. Kodak, along with three nearby municipalities (Evans, Windsor, and Milliken), annually transfer yield associated with their water rights to Greeley for treatment and delivery.

The City's water supply system stretches more than 60 miles from the westernmost raw water collection and storage facilities to the easternmost reaches of its finished water distribution system. Future water supplies from Terry Ranch extends 40 miles to the northeast of Greeley.

Water Rights

Greeley draws raw water from four main river basins on both sides of the Continental Divide: the Cache la Poudre (Poudre), Big Thompson, Upper Colorado, and Laramie. This diversity of supply sources increases the reliability and security of Greeley's system. A map of the Greeley water supply system is shown in Figure 2.

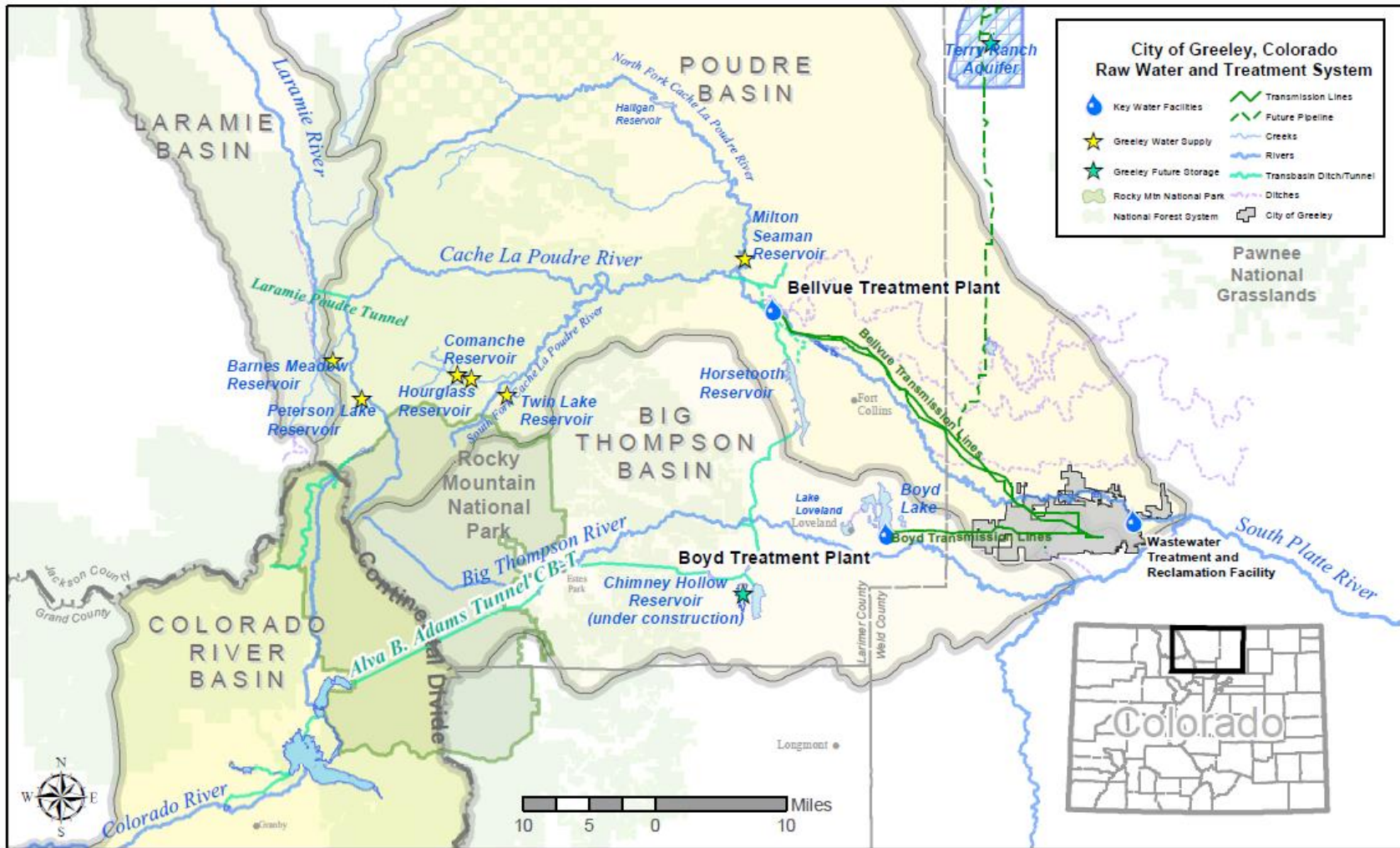


Figure 2: City of Greeley's water collection and treatment systems.

Cache la Poudre River

Greeley owns senior direct flow rights on the Poudre River. The direct flow rights consistently yield 9,000 acre-feet for treatment at the Bellvue Plant.

Milton Seaman Reservoir, on the Poudre River's North Fork, is the City's largest multi-year storage vessel within the Poudre basin (Figure 3). Milton Seaman Reservoir is primarily used as a drought storage vessel and in most years remains relatively full with about 5,000 acre-feet of available water supplies.

Other Poudre basin rights include storage rights in five high mountain reservoirs: Barnes Meadow, Peterson, Comanche, Hourglass, and Twin Lakes. The reservoirs capture water at high elevations from some of the Poudre River tributaries. Hourglass reservoir has the most senior rights. However, Greeley's high mountain reservoir storage rights are currently only for irrigation and have low yields in drought years.



A majority of Greeley's Poudre River water rights are treatable at the Bellvue water treatment plant (Bellvue). However, some of Greeley's Poudre River water rights cannot be physically delivered to Bellvue. For example, Greeley's ownership in the Greeley Irrigation Company (GIC or the No. 3 Ditch) represents a supply located in the lower portion of the Poudre basin. These supplies are located too far downstream for treatment and thus are used for non-potable irrigation of Greeley's parks, golf courses and larger landscapes. This reduces the amount of treated water used by the City.

Greeley also owns, and is in the process of acquiring, additional storage in the lower Poudre Basin. These storage facilities will reduce treated water demands and provide operational flexibility. For example, Poudre Ponds at Greeley are lined gravel pits located near the City that reuse, not physically but via river exchange, waste water effluent (effluent). Greeley uses the exchanged effluent to meet augmentation, non-potable, and return flow obligations.

Colorado River

Greeley also obtains water from two interrelated transmountain diversion projects – the Colorado-Big Thompson (C-BT) and Windy Gap projects (Figure 3). Raw water from these projects can be delivered to either of Greeley's two treatment plants.

The C-BT Project provides supplemental water to its service area in northeastern Colorado. The project boasts 800,000 acre-feet of active storage and a relatively senior water right on the Colorado River. Owned by the U.S. Bureau of Reclamation, it is operated by the Northern Colorado Water Conservancy District (NCWCD). With 22,565 units, Greeley is the largest municipal holder of C-BT rights.

The Windy Gap Project was planned and built between 1969 and 1985. Six C-BT stakeholders (Greeley, Loveland, Fort Collins, Longmont, Boulder, and Estes Park) cooperated to form a municipal subdistrict which oversees the Project and establishes the assessments for the existing Windy Gap shareholders.

Windy Gap consists of a diversion dam on the Colorado River, pump station, and a pipeline to deliver water to Lake Granby. The C-BT system conveys the water from Lake Granby to Windy Gap customers

on the Front Range (Figure 3). The Windy Gap Subdistrict has a contract with the U.S. Bureau of Reclamation to allow the C-BT system to transport the water when there is unused capacity. In either a wet or dry year, Windy Gap does not yield. In a dry year, senior rights limit diversions and there may be little water to deliver. In a wet year, the C-BT system is at capacity and has no spare room to store or move Windy Gap water to the East Slope.

The Windy Gap Firming Project, which began construction in 2021, will create a 90,000 acre-foot East Slope reservoir known as Chimney Hollow. Greeley has committed to 9,189 units in the project. Construction is estimated to be complete by 2025.

Big Thompson River

In the 1960s, Greeley began to acquire shares in three related agricultural water companies: the Seven Lakes Company, the Lake Loveland Company, and the Greeley-Loveland Irrigation Company (collectively the Greeley-Loveland Irrigation Companies (GLIC)). As the City grew westward over ground historically irrigated by GLIC water rights, Greeley accepted shares of GLIC for raw water dedication. Greeley currently leases many GLIC shares back to agriculture. GLIC water rights are relatively junior and do not yield well during droughts. Greeley can only treat its GLIC water supplies at the city's Boyd Lake Plant. Greeley also uses GLIC water to meet non-potable irrigation demands in an effort to conserve and minimize plant treatment and transmission costs.

Laramie River

Greeley owns 1/3 of the Laramie Poudre Tunnel Company, which yields about 1,100 acre-feet of water per year. The Tunnel water rights have been changed for municipal use and can be treated at Bellvue. Because they are transbasin rights, Greeley can reuse the water until extinction, usually through the reuse of effluent for augmentation demands. In addition, Greeley also owns a small interceptor ditch right in the Laramie River Basin that yields up to 300 acre-feet per year.

Terry Ranch

In 2021, the City added 1.2 million acre-feet of water to the City's vast water portfolio. Terry Ranch is an aquifer storage and recovery project that is currently not online. The City anticipates bringing Terry Ranch online in two phases. First, aquifer recovery of native water from Terry Ranch will be utilized to supplement City's supplies during times of drought or emergencies. Second, aquifer storage will pump legally available excess water supplies to Terry Ranch and store the water for aquifer recovery during low water years.



1.2.2 Drought Planning

In January 2021, the Water and Sewer Department updated its 15-year-old Drought Emergency Plan. Water conservation techniques and programs—like the Water Budget for single-family residential customers—have made Greeley citizens more efficient. To create equity among Greeley's customers, minimize impacts to landscapes, and minimize financial impacts to citizens and the water utility, the Drought Emergency Plan allows flexibility to modify the measures it puts in place based on evolving drought conditions and the degree of success achieved in reducing water by its citizens.

Under average weather conditions, about one-half of the total annual water use by Greeley’s customers is for outdoor irrigation (including non-potable deliveries for irrigating parks, schools and other large outdoor areas). Absent intentional measures to reduce demand, outdoor water use increases to about 55% of annual use under hot and dry conditions. During the peak irrigation season from June through September, outdoor water use typically makes up about 70% of total use. That percentage increases under hot and dry conditions.

Greeley has successfully navigated previous droughts, including the most severe drought during the past few decades which was experienced in 2001-2003. To maintain sufficient water supplies in storage to guard against the potential for sever and prolong droughts, current target storage is at 21,300 AF and will be re-evaluated regularly. With C-BT as the single largest component of Greeley’s water supply, yields are determined annually by the quota set by the Northern Colorado Water Conservancy District which manages the C-BT project.

Each April, shortly after the C-BT quota for the year has been established, Greeley’s Water Resources staff will project the storage volume that will be available on April 1st of the following year under “conservative” assumptions of high outdoor irrigation demands from Greeley’s customers (as has been typical under hot and dry conditions during years such as 2002 and 2012) and low yields from Greeley’s water supplies. Based on that projection, Greeley will declare an adequate water year, or a drought under one of four potential levels. This process is summarized in Figure 3. Water savings goals for each potential drought level are:

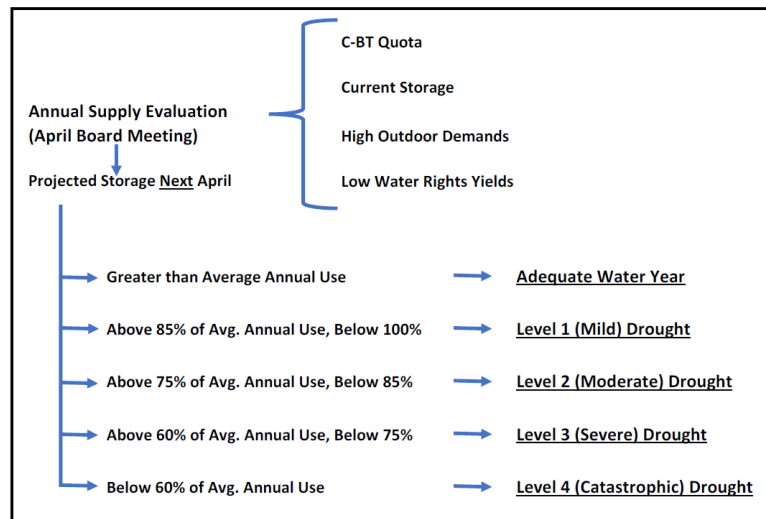


Figure 3: Annual Greeley Water Supply Evaluation and Drought Declaration Process

Greeley may also decide to declare a mild drought and invoke the drought response measures discussed later in this plan if other adverse events that affect Greeley’s water supplies (for example if wildfires affect the watersheds that Greeley relies on), or in times when a regional drought response in Northern Colorado is deemed appropriate by the Greeley’s Water and Sewer Board.

Drought response and restrictions are for outdoor irrigation use only. The following Table identifies Greeley’s recommended response measures for water budgets and landscape restriction for each of the potential drought levels.

Table 1: Greeley Drought Response Measures

GREELEY DROUGHT RESPONSE PROGRAM 2020					
With a two year recovery period	Adequate Yr	Mild	Moderate	Severe	Catastrophic
LEVEL OF RESPONSE	no drought	1	2	3	4
Target Storage	100%	85% to 99%	75% to 84%	60% to 74%	Less than 60%
Target Reduction (outdoor)	0%	15%	25%	50%	70%
Target Storage (in AF)	21,300	18,100	16,000	12,800	10,700
Annual Outdoor Reduction Goal	normal conservation	1,530	2,560	5,130	7,170
MEASURES					
Water Budget and Restrictions					
Single Family Residential on Water Budget		15%	25%	50%	70%
Proposed Water Budget Reduction	0%	15%	25%	50%	70%
Recommended Schedule Suggested Days		max 3 days/week	2 days/week	1 day/week	
Multi Family & HOA Not on Water Budget	mand. 3/wk	max 3 days/week	2 days/week	1 day/week	no watering
Reductions in Use	0%	15%	25%	50%	70%
Commercial Industrial Institutional (ICI)	mand. 3/wk	3 days/week	2 days/week	1 day/week	no watering
Reduction on Landscape Water Same as SFR	Normal conservation	15%	25%	50%	70%
Restrictions Landscape (Non Water Budget)					
Lawns/Turf	set day /week 3 days/week	no irrigation until May1 or after Sept. 30	irrigation May-Oct; 1"/week	no watering in July; let go dormant	no watering June 15-Aug 15
Non-watering Hours	10am-6pm	10am-6pm	10am-6pm	8am-8pm	8am-8pm
Installing New Lawns & Watering Permits	yes w/soil prep	yes w/soil prep	not June-Aug	not June-Aug	none
Multi Family	3 days/week	3 days/week	2 days/week	1 day/week	no watering
Large Properties with > 4 acres of Turf Need to Submit a Water Budget to Get a Watering Variance	3 days/week	1.5"/week WB	1.0"/week WB	only enough to keep it alive	not allowed
Trees and Shrubs			on days or drip or by hand		
Vegetable Gardens			on days or drip or by hand		
Flower Gardens			on days or drip or by hand		
Non Potable Ditch Water (city system)			follow restrictions or restrictions due to delivery		
Non Potable Ditch Water (private)			cannot regulate		
Well Water			cannot regulate		

GREELEY DROUGHT RESPONSE PROGRAM 2020					
With a Two Year Recovery Period	Adequate Yr	Mild	Moderate	Severe	Catastrophic
LEVEL OF RESPONSE	No drought	1	2	3	4
Other outdoor Uses (hosing and washing)					
Home Car Washing	with BMPs and no runoff	bucket & shut off	bucket & shut off	commercial car wash	commercial car wash
Frequency		1x/week	1x/month	not allowed	not allowed
Washing Sidewalks, Driveways, Garages or Other Pavement		prohibited except for health or safety			not allowed
Siding on Houses, Patios, Decks		only in prep. for painting/staining 1 x per year with power washer			not allowed
Fleet Washing at Auto Dealerships/Mobile		1x/week	1x/month	not allowed	not allowed
Car Washes -Fundraising		prohibited except at commercial carwashes			
Commercial/restaurant/fast food					
Drive Thru/Sidewalk		prohibited except for health or safety			only with a bucket & broom
Parking Lot		prohibited			
Fountains/Ponds/Spas					
Water Fountains (w/o fish)		unrestricted	no topping off	no water	no water
Public		unrestricted	no topping off	no water	no water
Private		unrestricted	unrestricted	no topping off	no topping off
Ponds with Fish or Plants		unrestricted	unrestricted	unrestricted	topping only to preserve fish
Swimming Pools and Spa's Private		unrestricted	Unrestricted	not allowed	not allowed
Semi-Private Neighborhoods		unrestricted	Unrestricted	not allowed	not allowed
City Pools		unrestricted	Unrestricted	no topping off	no topping off
City Uses					
City Parks /Athletic Fields		water budget	water budget cut	prioritize athletic fields only	
Golf Courses		10-20% cut back	10-20% cut back no watering roughs	max 1"/wk for tees and greens only	max 1"/wk for tees and greens only
City Facilities & Around Buildings		3 days/wk	2 days/week	1 day/week	no watering
Street Cleaning/Parking Lots with Trucks		unrestricted	unrestricted	restricted to essential situations	
Hydrant Flushing & Testing		unrestricted	limited to critical situations		
Washing Fleet Vehicles & Mobile Washers		1 x /week	every other week	1 x /month	none

One of the most important elements of any drought response plan is timely and effective communication with citizens to explain the situation and motivate the necessary changes in water use behavior. Improved technology, social media, and the customer WaterSmart portal portrays additional avenues for reaching and educating citizens. Figure 4 summarizes key messages for each of Greeley’s customer groups from the 2021 *Greeley Drought Emergency Plan*.

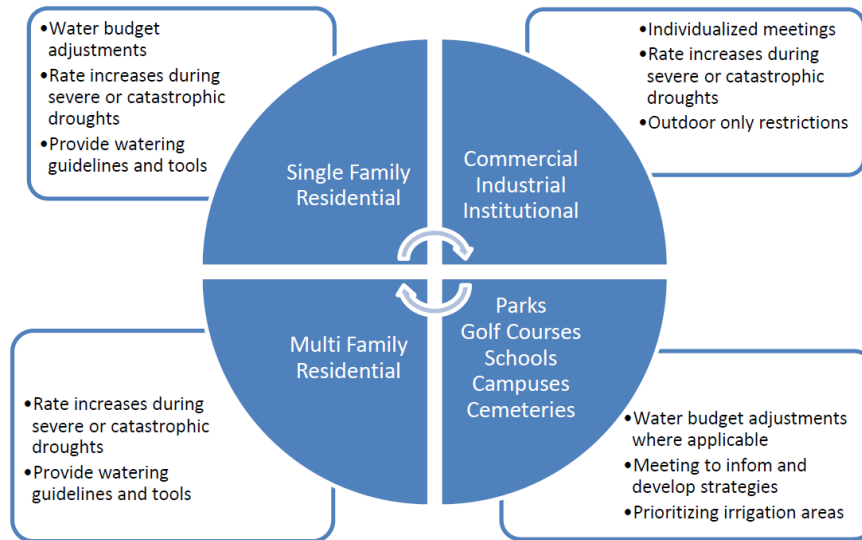


Figure 4: Summary of drought messaging strategies for Greeley’s different customer groups.

1.3 SUPPLY-SIDE LIMITATION AND FUTURE NEEDS

As part of Greeley’s long-term water efficiency planning process, future water demands come from both potable water (treated drinking water) and non-potable water (raw water). Using the *2021 Non-Potable Master Plan*, the City planned a 5-year and 20-year capital improvement projects planning horizons which align with the years 2025 and 2040. Buildout timeframe will vary depending on multiple factors and therefore, a year is not provided.

It is worth noting that water conservation methods, such as improved landscaping practices and the encouragement and adoption of non-potable water for irrigation, may help reduce the City’s annual water demands. Conditions will change with time, and uncertainties will impact the accuracy of total water demands. With the best current information from the *BBC Research & Consulting 2018 report*, water demands at buildout are presented in Table 2.

Table 2: Annual Demand Projections at Buildout

Demand	Total Water Demand (AFY) ¹
Existing	30,500
Future Demands	43,800
TOTAL	74,300

¹ AFY= acre-feet per year

This WEP encompasses current plans and reports from the Greeley’s Water and Sewer Department—since water efficiency is connected to multiple divisions. These include:

- *Greeley Non-Potable Water Master Plan, June 2021*
- *Greeley Water Transmission and Distribution Master Plan, June 2021*
- *Greeley Integrated Water Resources Plan, draft 2022*
- *Greeley Drought Emergency Plan, January 2021*
- *Enhancing Greeley’s Water Efficiency Portfolio through Performance Analysis, May 2022*

The City is currently updating its *Water Supply Master Plan* through a process termed *Integrated Water Resource Plan (IWRP)* and is scheduled to be completed the end of 2022. The IWRP process will evaluate Greeley’s long-term water supply sustainability, develop a road map to buildout and identify near-term capital improvement projects while incorporating future risk and uncertainty. The vision of the IWRP is to produce “an actionable and adaptive master plan for Greeley’s water resources that uses modern defensible methods to develop a roadmap ensuring a reliable water support for our community through an uncertain future”. Accordingly, the City will identify level of service goals that will act as guard rails to assist in planning to meet community standards.

As part the process, the IWRP will evaluate a suite of future conditions to plan for called “planning scenarios”. These scenarios define key components of future conditions such as the state of Greeley’s water supply system as mentioned above, demands, climates and other system risks. Once the planning scenarios are selected, near-term horizon projects will be identified to fill identified future supply gaps and meet level of service goals. Additionally, the IWRP will refine Greeley’s understanding of the operations and sustainability of the Terry Ranch project, Greeley’s identified long-term water supply project.

A summary of water supply limitations and future needs is shown in Table 3. This table is based on Worksheet A from the CWCB reporting criteria.

Table 3. Water supply challenges and future needs.

Future Needs/Challenges	Yes	No
System is in a designated critical water supply shortage area		X
System experiences frequent water supply shortages and/or emergencies		X
System has substantial non-revenue water		X
Experiencing high rates of population and demand growth	X	
Planning substantial improvements or additions	X	
Increases to wastewater system capacity anticipated	X	
Need additional drought reserves		X
Drinking water quality issues	X	
Aging infrastructure in need of repair	X	
Issues with water pressure in portions of distribution system	X	

2.0 Water Demands and Historical Demand Management

It is critical to monitor and understand potable and non-potable water demands and which factors will impact the. This section of the WEP focuses on demographics, service area characteristics, water demand trends, and past, current and future demand management activities and forecasts.

2.1 DEMOGRAPHICS AND SERVICE AREA CHARACTERISTICS

Greeley was founded in 1870 as Union Colony, a utopian temperance colony at the confluence of the Cache la Poudre and South Platte Rivers. The first settlers were hand selected by Nathan Meeker after a passionate article in the New York Tribune requesting like-minded folks to settle the area.

Greeley is part of what Stephen Long called “The Great American Desert” because of the native vegetation of grasses and low shrubs. Earlier settlers focused on irrigation and agriculture, education, and religion. As in the past, agriculture remains a focus for Greeley with a large immigrant population. In the 1920’s Greeley was making 25% of the nation’s sugar from sugar beets, and leftovers were used to feed cattle. The cattle industry remains an important aspect of Greeley’s culture and businesses.

Greeley is the business Center for Weld County, the county seat and the second largest community in Northern Colorado. The leading industries in Weld County have remained consistent and the top five are agriculture, manufacturing, energy production, health and Wellness, and business services. Greeley is the home to JBS USA, Leprino Foods Company, Noble Energy Inc., TTEC, Banner Health, UC Health and a complete spectrum of business associated with agribusiness, food production, business services, construction, energy, and water resources. The City of Greeley is committed to actively promoting the development of a progressive economy by creating opportunities to attract and grow target business and industry activities. Weld County is currently forecasted to grow faster than any other part of Colorado.

Demographics of Greeley are provided using the *2019 U.S. Census Bureau’s American Community Survey* data (<https://data.census.gov/cedsci>). Greeley is a relatively young community with a median age of 32 years old. As a diverse community, languages spoken at home vary in Greeley with English (75%), Spanish (21%), Asian and Pacific Islander (1.1%), other Indo-European languages (0.8%), and other languages (1.2%). Median household income is \$57,537 which is lower than the state average of \$75,231. Poverty rates are around 15.8% for all ages in Greeley with 59.9% of the population is employed. Around 60% of all residents own their home and median rents costs \$1,063 monthly. The average family size is 3.49 people per household.

2.2 HISTORICAL WATER DEMANDS

2021 Analysis of Meter Type and Billed Consumption

Greeley was one of the first Front Range communities to be fully metered and serves a wide variety of water customers. Most metered accounts are single family residences. Residential meters represent 82% of the total number of customer accounts. Many of these accounts use small amounts of water each month. For this reasons, residential accounts used only 32% of the total billed water in 2021. Commercial, industrial, and institutional (CII) meters made up 7% of the total number of accounts but

many CII water users represent a large amount of water consumption. The direct use of non-potable water—raw water from the local irrigation ditches—has contributed to reduced per capita consumption. Non-potable water is use for landscape irrigation only for CII users, golf courses and internal City Parks.

Table 4: 2021 Water Demands by customer class and billed water use.

2021 Water Demands		
Customer Type	Average Number of Accounts	Billed Water Use (gallons)
Residential	23,202	2,870,282,000
Multi-family	2,221	1,013,071,000
CII *	2,040	2,569,134,000
Other	640	1,376,765,000
Irrigation-only non-potable	69	1,045,209,000
Total	28,172	8,874,461,000

*Commercial, Industrial, and Institutional accounts

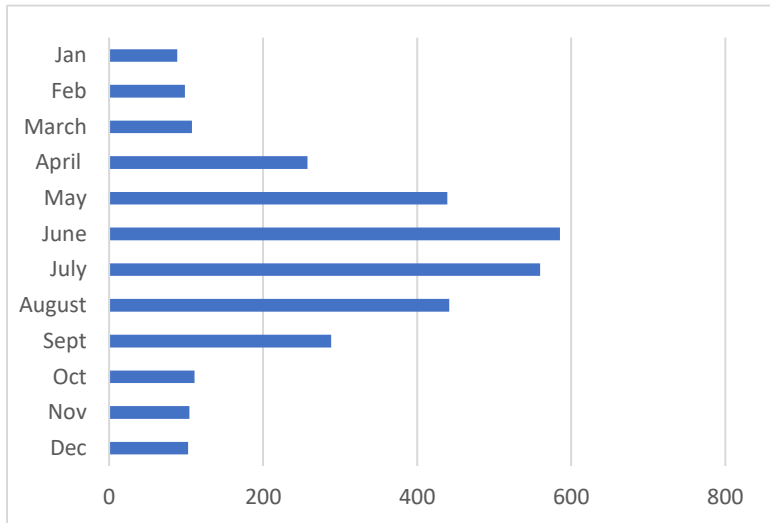
Water Use Patterns

Water use patterns vary greatly with each water customer Greeley serves. From personal homes, businesses and large landscapes, water use widely changes. This water use diversity is driven by a wide range of factors, some of which can be mitigated through education, behavioral or technical changes.

Residential household water patterns are relatively easy to compare due to the water budget that promotes and rewards water efficiency (more information on the water budget is presented in Section 4.3). However, comparing CII properties has proven to be more difficult. For example, trying to compare water use for a small coffee shop to a large office building or large industrial user is erroneous data.

Most notable is the water consumption use and altered behavioral patterns that occurred during the COVID-19 pandemic. On March 11, 2020, the world health organization declared COVID-19 a pandemic. Within a month of former President Trump declaring a nationwide emergency, Greeley began shutting down to prevent the spread of COVID-19. The shutdown included school systems, businesses, and local governments.

Looking at the water consumption data in 2020, residential family household increased their daily water consumption by 37.4% from the previous year compared in April.



With the pandemic, hygiene is a critical pathway for protections such as washing hands, showering, and washing clothes. In addition, stay at home orders or recommendations increased the frequency of toilet flushes per person. This pattern appeared to continue throughout the summer of 2020 with more residents finding sanctuary within their gardens and landscapes—defiant gardening.

Figure 5: 2020 monthly water consumption (million gallons) single family residents.

Water consumption for CII customers varied greatly due to temporarily closed businesses, universities, schools, and changes in business practices because of the COVID-19 pandemic. March 2020’s water consumption for CII customers decreased by 35.3% as compared to March in 2019 and was the lowest water consumption since 2010 for the City.

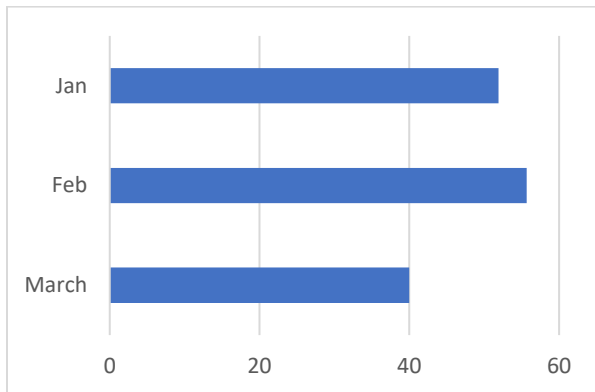


Figure 6: 2020 monthly water consumption in million gallons for CII customers

It is recommended any water use data in 2020 should be used with caution given the dramatic changes in a short period to time.

For residential users, in 2021 between 75 to 95% of households were careful with their monthly water use and stayed within their water budgets. Throughout time in Greeley, automatic irrigation systems have been installed making it easier to use water. For that reason, households using automatic irrigation systems often have higher consumption patterns. Irrigation systems can be confusing to use or typically the irrigation controller is set once and forgotten. Greeley has several strategies to address irrigation

inefficiencies through better management of irrigation schedules and reducing the peak water demands during the irrigation season.

Using a 12-year period, residential water demands are 37% outdoor use versus 63% indoor use (Figure 7). Outdoor use is dependent on weather patterns and pandemics. Over the years, a consistent development pattern is noted that single-family residential parcels continue to decrease in size over the years.

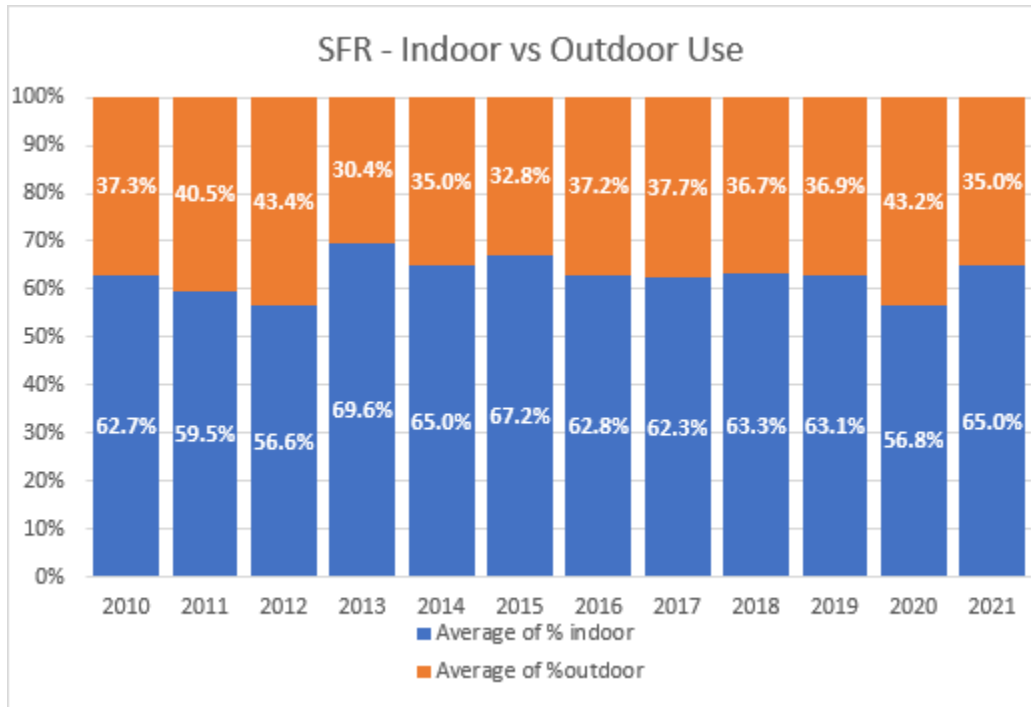
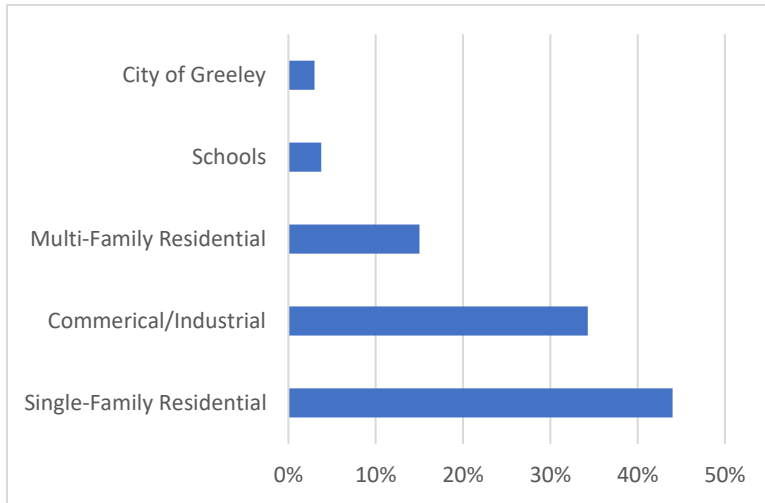


Figure 7: Single family residential indoor versus outdoor water use for Greeley

Baseline Water Use

Based on the five-year rolling average, total water demand is approximately 82% within Greeley and the remainder is associated with customers located outside of Greeley. A majority of accounts are composed of residents (82%) with the remainder comprised of commercial, industrial, parks, golf course, and schools. Thirty-seven percent of residential water use goes to landscaping; therefore, residential use shows a strong seasonal variation with nearly 75% of the of the total City annual use occurring between May and October.



In-City treated water use customer type is shown in Figure 8. Using a 10-year rolling average, residential demand is the highest (44%) followed by Commercial/Industrial users (33%). This distribution of customer types is common in the Front Range.

Figure 8: Percentage of In-City Potable Demand by Land Use Types 10-year rolling average.

Looking at 2021 treated water consumption, the top key accounts for annual potable water use within Greeley are:

- Food Manufacturing
- Beef processing
- Manufacturing
- Universities
- Public Schools

Figure 9 shows a 10% reduction in per capita residential demand, dropping from 119 gallons per capita per day (GPCD) in 2012 to 107 GPCD in 2021. Due to variations in precipitation, populations densities and landscaping, Greeley does not compare GPCD to other communities to assess water use and the effectiveness of its conservation programs. Greeley uses GPCD as an internal comparison to demonstrate use reductions.

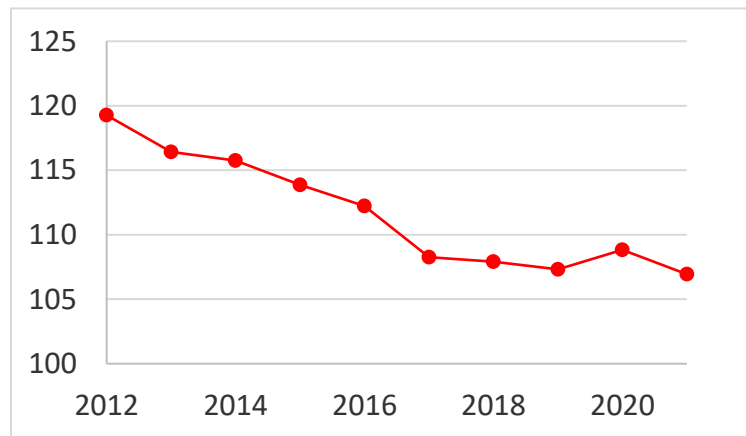


Figure 9: Residential water use from 2012-2021 in GPCD

Although Greeley’s population has grown by approximately 17%, per capita, demand has decreased by 11% as noted in Figure 10. This overall declining trend in system wide per capita demand is from single family residents. Replacement and retrofits of new high efficiency toilets, showerheads, washing machines, and dishwashers has led to less water use than previous older models. (Figure 9). Existing residential homes have more than offset the increase in demand from newer builds and business for almost 20-years.

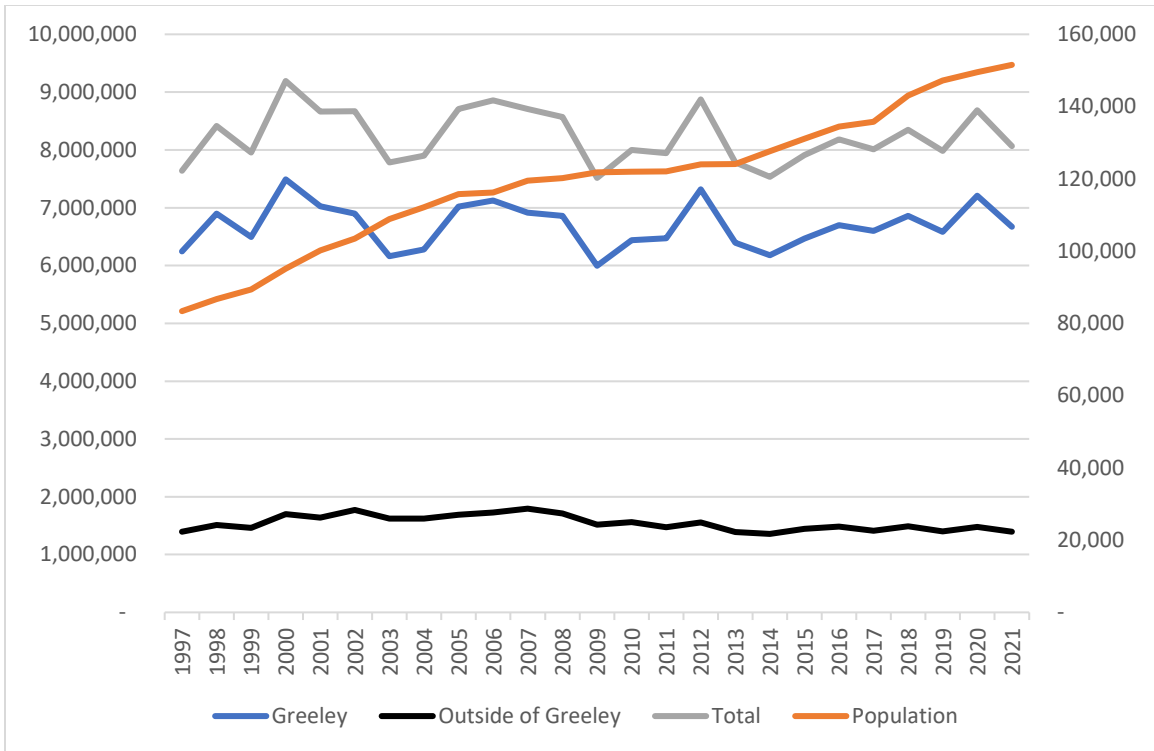


Figure 10: System wide water use from 1997-2021 in gallons per capita per day (left-axis) and population growth (right-axis)

System wide water uses will change throughout time and are dependent on factors like economic conditions, new construction, outside and CII end users, and land development patterns. The City will continue to monitor changes to optimize water conservation planning and implementation.

SYSTEM WATER LOSSES

An annual water audit and loss control report was completed in 2021 using the methodology prescribed by the *American Water Works Association M36 manual*. The results have shown that there are two primary categories for losses in Greeley: real and apparent. The real losses include physical losses of water either through leakage or theft, while apparent losses were found in systematic data handling errors and unauthorized consumption. Real losses have been estimated at 5% and apparent losses at 0.5%. Greeley is committed to its water loss control, detection and maintenance system and will continue to strive to maintain exceptional system efficiency.

Currently, Greeley’s annual water demand on a rolling, five-year average is 7,997,513,000 gallons or 24,543.43 acre-feet. Sources of water loss include:

- Water seeping into soils surrounding distribution and customer piping
- Runoff from overwatering, which seeps into surrounding soils and eventually enters the South Platte River alluvial aquifer.
- Building sources, such as leaking toilets, which ends up in the City’s wastewater collection/treatment system.

System wide water main leak detection is done on an on-going basis. The goal of the Leak Detection Program is to survey around 30 miles or 6% of existing older water mains per year. Water crews utilizes the latest wireless technology with a SEBA KMT GT-3 series of leak detection equipment. This system transmits data collected by noise and pressure loggers through the main water lines in real-time. Once leaks are identified and authenticated, crews begin repairs. In addition, Water crews respond to reported leaks and make necessary repairs in a timely manner.

Starting on July 2020, the City of Greeley has been replacing older water meters with Advanced Metering Infrastructure (AMI) as part of its water conservation program. The AMI Project demonstrates the City’s ongoing commitment to honor the call to water stewardship. As of March 2022, over 11,763 AMI meters have been installed.

Greeley has documented both quantifiable water savings and improved water demand management as more AMI smart meters replace existing outdated standard volumetric meters. With this near real-time data communication and notification system, the City now has the capability to mitigate water leaks and losses, educate customers on how to reduce water usage, and help control water consumption during water emergencies, shortages, and droughts. By having access to daily meter readings (rather than once-per-month readings), the City has and will continue to reduce non-revenue producing water by a significant amount.

ANNUAL PEAK DAY DEMANDS

The water use peak day for each year typically occurs, though not always, during July in Greeley. The overall water system, including treatment, transmission, and distribution, must be able to meet the peak day of use. Daily production and peaking factors for Greeley’s two water treatment plants (Bellvue and Boyd) are represented in Table 5 from 2015-2019.

Table 5: Daily Production Summary and Peaking Factors for Greeley’s Water Treatment Plants (2021 Water Transmission and Distribution Master Plan Appendix A)

Year	Production (MGD)			Peaking Factor (PF)		
	Average Day	Peak Month (average Day July)	Max Day	Peak Month/Average Day	Max Day/Average Day	Max Day/Peak Month
2015	21.75	38.28	44.00	1.76	2.02	1.15
2016	23.32	42.49	49.90	1.82	2.14	1.17
2017	23.19	40.86	46.12	1.76	1.99	1.13
2018	19.81	32.31	41.58	1.63	2.10	1.29
2019	18.52	29.93	38.49	1.62	2.08	1.29

All production values are in million gallons per day (MGD) units and peaking factors are ratios of these values. 2016 was the year of highest average and maximum day productions and includes the highest peak month production during the 5-year period of record. However, peaking factors are relatively consistent across the 5-year period of record.

2.3 PAST AND CURRENT DEMAND MANAGEMENT ACTIVITIES

In Greeley's 2008 Water Conservation Plan (WCP), a goal was established of reducing demand by 8.2% or 3,300 acre-ft of cumulative water savings from 2010-2030 directly through its conservation programs. To achieve that original goal, a net impact of 144 years acre-feet per year, every year until 2030 would need to be achieved. In Greeley's 2017 WCP, a goal was established of reducing demand by 9.3% from 2015-2035 through its conservation programs. To achieve the 2017 goal, a new impact of 156 acre-feet per year, every year until 2035 would need to be accomplished.

As shown in Figure 11, actual water saving exceeded the yearly goal of 156 acre-feet per year. In fact, by the end of 2021, Greeley had achieved total cumulative conservation savings of more than 2,555 acre-feet since 2010. That is approximately 77% of the 3,300 acre-feet 2017 goal has been completed by 2021.

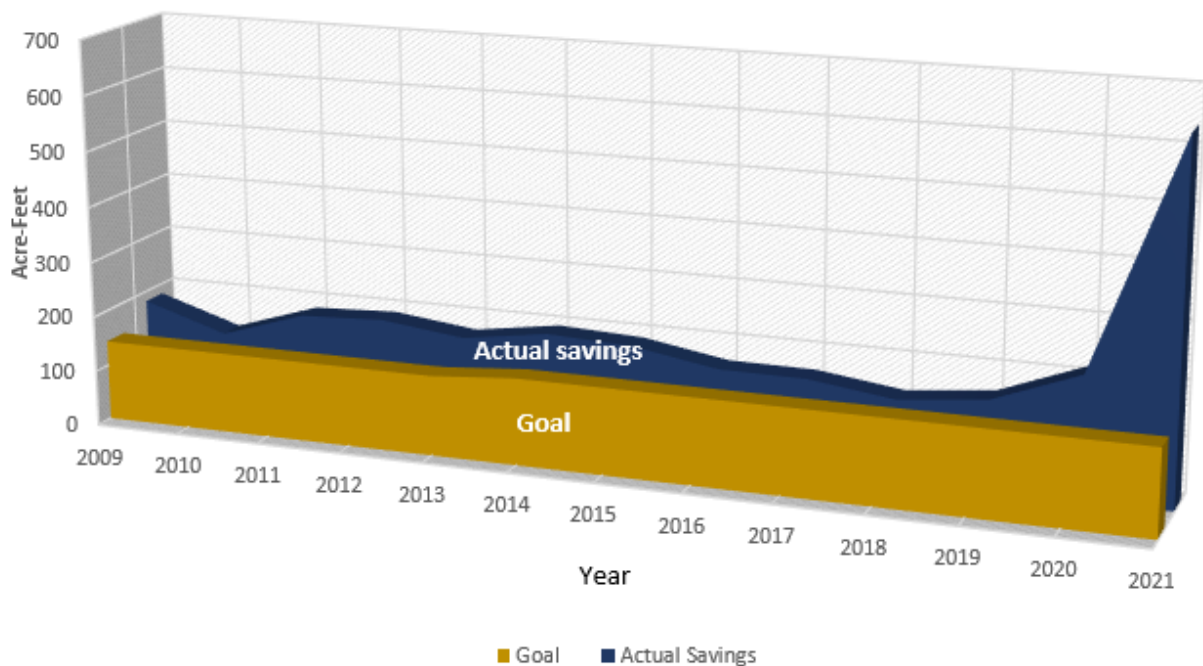


Figure 11- 2009-2021 Water Use Efficiency Plan Saving

CURRENT DEMAND MANAGEMENT ACTIVITIES

A list of current demand management activities and year of initiation is represented in Table 6. Over time programs and activities have changed from the 2017 WCP or were developed after the 2017 WCP and are a result of needs, technology, resources and opportunities. A complete description of these programs can be found in Section 4.3

Table 6: Current demand management activities

Program Area	Date Initiated
Mandatory watering restrictions (3 days per week- no watering from noon to 5 p.m.)	1907
Water Loss Control Program	Mid 1990s
Metering	Mid 1990s
Xeriscape Grants	1997
Landscape Lecture Series	1997
Speakers Bureau	1997
Water-Related Facility Tours	1997
Xeriscape Education	1997
Outdoor Irrigation Audits	1999
Weather Sensor Installation for audit customers	2002
Sod/Establishment Variances (and soil amendment requirement)	2002
Indoor Water Audits	2006
Commercial Water Audits	2006
Irrigation Rebates	2006
Commercial Rebates	2006
Irrigation Controller Programming	2006
Toilet Rebates	2006
Clothes Washer Rebate	2006
Discounted Garden in a Box kits	2012
WaterSmart Portal and Home Reports	2013
Showerhead Exchanges	2013
Teacher Training	2013
Faucet Aerator Installation for Audit Customers	2013
Online Plant Database	2015
Tiered Rates	2017
Water Budget (residential customers)	2017
Professional Landscape Certification Rebates	2017
Life After Lawn, formerly known as Cash for Grass	2018
Discounted Compost Bins	2018
Discounted Rain Barrels	2018
Leak Detection with advance metering infrastructure	2020

Spatial trends in water conservation program participation indicate that the Water Conservation team has been highly expansive and affective (Figure 12). With the use of spatial analysis, the Water Conservation Program will continue targeting outreach around specific programs and Greeley’s social-economic diversity.

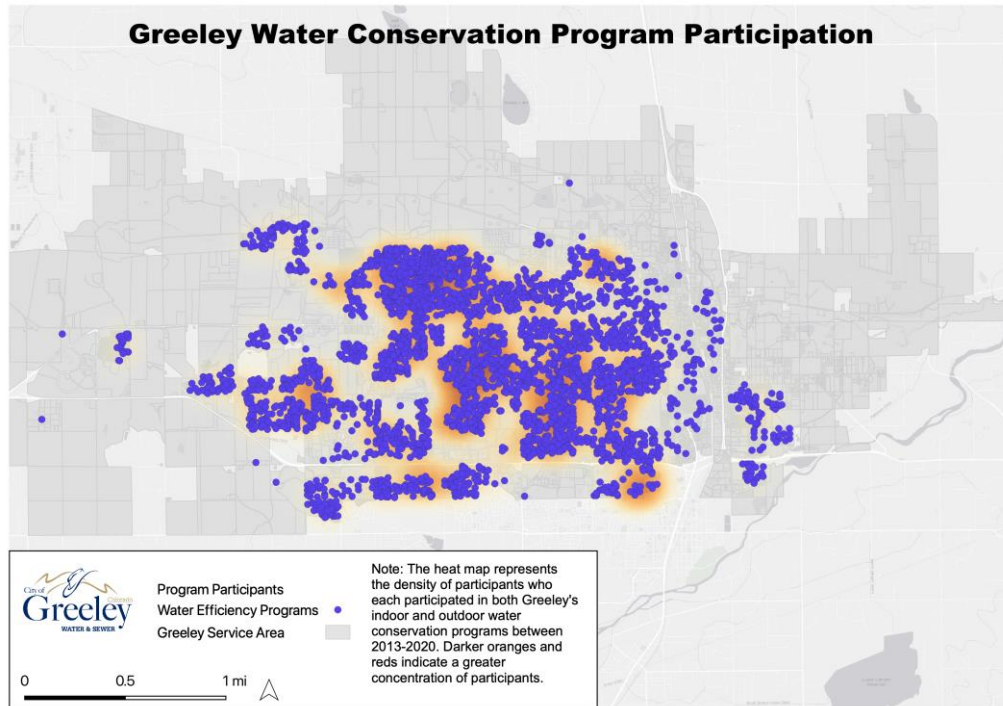


Figure 12. Greeley Water Conservation Program participation form 2013-2020.

Past and Current Land Use Activities

Greeley introduced its first lawn watering restrictions in 1907 and imposed fines for violations.² At the time, the City's population numbered no more than 8,000, and in a remarkable feat of conservation continuity, those first rules still apply today to nearly 108,000 citizens. For example, daily lawn watering and watering during the heat of the day is forbidden. Greeley's lawn watering restrictions (the minimum applicable every year) are shown in Table 9.

Table 9. Greeley Mandatory (Adequate Year) Watering Restrictions Schedule

Watering Periods	Single Family residences on a Water Budget	Single Family residences and duplex with even numbered addresses ending in: 0,2,4,6,8 and not on a water budget	Single Family residences and duplex with odd numbered addresses ending in: 1,3,5,7,9 and not on a water budget	All others: CII, home owner association common areas, multi-family residences, government, non-profit, places of worship.
Jan 1 st - April 14 th	No Lawn Watering	No Lawn Watering	No Lawn Watering	No Lawn Watering
April 15 th - August 31 st .	Stay within their water budget. No watering from 10 am to 6 pm	Sunday, Tuesday, Thursday. No watering from 10 am to 6 pm	Monday, Wednesday, Saturday. No watering from 10 am to 6 pm	No watering from 10 am to 6 pm

² A 1908 Greeley Tribune article reports "eight or nine prominent Greeley" citizens complained that their fines for sprinkling out of hours should go to the water works fund, not to the Police Magistrate.

City ordinance establishes the following water restrictions in Greeley:

- Waste of water is prohibited at any time.
- Sprinkler irrigation shall not occur between 10:00 a.m. and 6:00 p.m. from May through August even when water supplies are adequate.
- Drip irrigation, low-volume spray or bubbling sprinklers, hose-end sprinklers and weeping type soaker hoses are allowed to water trees, shrubs or flower beds at any time.
- Hand-watering of vegetables and flower gardens, trees and shrubs and individual brown spots in a lawn is allowed at any time, so long as water waste does not occur. Hand-watering means holding in the hand a hose with attached positive shutoff nozzle and does not include operating a hose with a sprinkler or manually operating an irrigation controller.
- Except during time of adequate water supply, hand-watering to clean hard surfaces such as driveways and parking lots is prohibited. Hand watering to clean property, such as roof gutters, eaves, windows or in preparation for painting, is allowed as long as water waste does not occur.
- Public organizations. The use of water for sprinkling lawns, gardens and trees on the grounds of public organizations, public parks and public golf courses served by the city water system will be permitted at any time with written variance from the director of water and sewer

When landscaping a new home or planting seed or sod in an established yard, Greeley residents must get a variance to water during restricted periods. Greeley also requires residents to prepare the soil with compost (organic matter) before receiving a variance. Under a 2002 City ordinance, new lawns require proof of adequate compost. The program has the following rules:

- Sod and compost receipts must be provided to the City to verify the installation.
- Four cubic yards of compost must be used for every 1,000 square feet of sod put down.
- The compost must be rototilled, and the property owner must provide photos or tiller rental receipts as proof.
- City employees check to verify the new lawn and compost.
- The property owner must post a variance notice when the off-hour irrigation is occurring.

Greeley is also actively working with the City of Evans and City of Windsor (two of our wholesale customers) to incorporate water planning into land use planning as these adjoining cities are linked through economies, land, agriculture, and resources.

Planned Land Use Activities

On December 15, 2015, the City of Greeley adopted the *Landscape Policy Plan for Water Efficiency* (LPPWE) was intended to be a sub-element of the Greeley 2060 Comprehensive Plan. The LPPWE is a cooperative planning project with the City's:

- Manager's Office
- Water and Sewer Department
- Culture, Parks and Recreation Department
- Community Development Department

LPPWE provides the foundation and detailed goals and policies for the City to further advance efforts in the areas of education, regulation, and incentives which maintains Greeley's existing quality landscape and urban forest. The Water Conservation team has met the specific goals

outlined that provided adequate information, training and examples of water efficient landscapes that enable the design, installation and maintenance of quality landscapes that use landscape water efficiently.

To boost land use activities around water conservation, the City of Greeley and Evans participated in 2019 *Growing Water Smart*, a joint program of the Sonoran Institute and Lincoln Institute of Land Policy's Babbitt Center to integrate land use and water planning at the community level. Greeley and the City of Evans are leveraging our relationships and providing values to our water customers by joining water conservations participation and marketing strategies. To continue collaboration, Greeley is participating with Evans' 2022 Growing Water Smart Metrics to show value of Evans' Water Efficiency Plan implementation process.

As part of the 2019 *Growing Water Smart*, synergies between City's Community Development and Water and Sewer leverages landscape codes to provide lasting water conservation values to Greeley. On October 1, 2021, City Council approved the adoption of a new development code that included planned landscape use and irrigation activities. Because of these code revisions, in the Fall of 2021, the City of Greeley was recognized by the American Planning Association, Colorado Chapter for "promoting health, equity, and community engagement through land use code language."

With the revised code in 2021, the Water and Sewer Department embarked in creating two criteria for water conservation. These Criteria include 1) *Landscape and Irrigation Criteria* and 2) *Non-potable Irrigation System Design Criteria*. These two Criteria will be adopted within the Engineering's Design Criteria update in the Fall of 2022.

The *Landscape and Irrigation Criteria* is intended to provide information for the design, review, installation and maintenance of landscape and irrigation systems within the City of Greeley to promote the efficient use of water and the reduction of water waste through best management practices.

These Criteria focuses on new development for:

- Civic and Open spaces
- Common areas for all customer classes (outlots, pocket parks, usable detention, private/on-lot required/usable areas)
- Right-of-ways
- Municipal buildings
- Multi-family residential
- Non-residential (institutional, commercial, and industrial)

Adoption of the *Landscape and Irrigation Criteria* is set for Fall of 2022 after following public participation and engagement sessions. Water Conservation and Community Development are working together to ensure processes are in place for communications regarding land-use development and water conservation practices.

The *Non-potable Irrigation System Design Criteria* is part of the Non-Potable Master Plan which is to expand the non-potable water system and reduce the use of potable water for irrigation purposes and improve irrigation practices, which is key to the City's long-term water conservation plan. The City uses non-potable water to irrigate both public and private property throughout the City. The City has a preexisting network of irrigation ditches for supplying source water for irrigation purposes.

2.4 DEMAND FORECAST

Greeley is the 12th largest city in Colorado and has developed into cultural and academic hub, hosting educational institutions such as the University of Northern Colorado (UNC) and Aims Community College. The City offers an affordable cost of living with many options for housing and economic growth. The City's population grew from 20,354 in 1950 to an estimated 108,175 in 2019. The City continues to experience strong population growth through both infill and expansion of residential, industrial and commercial development within the City's defined service area.

To plan for the water needs of the City, current and future demands on the system were analyzed to help determine what steps the City should take to ensure that sufficient supply is available. Details on methodology for projecting future water demands for the water transmission and distribution system hydraulic model (water model) can be found in the *2021 Greeley Water Transmission and Distribution Master Plan*.

The City's Long-Range Expected Growth Area (LREGA) is the area where it plans to provide water services. The future population, and resulting demands, that were distributed over the LREGA for each planning horizon used the "middle" projection from the *City of Greeley Population and Water Demand Projections* (2018 BBC Research & Consulting and 2021 Greeley Non-Potable Master Plan), referred to as the BBC report, as shown in Figure 13. Because the 2075 projection does not represent the buildout year for the City within the LREGA boundary, a buildout population was extrapolated using planning data and factors.

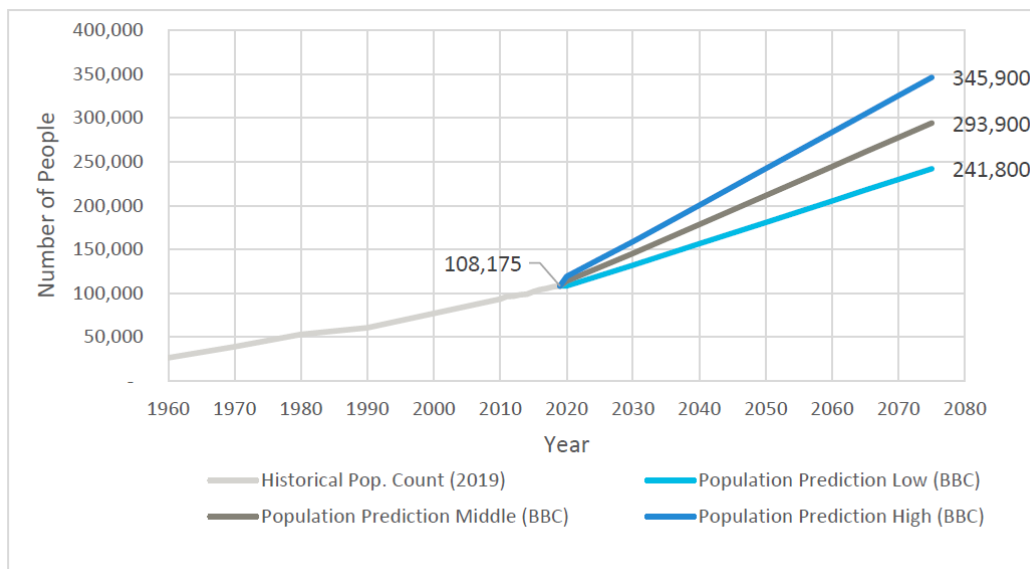


Figure 13: Historical and Projected Population Growth for Greeley

Water demands were determined using four planning horizons that were developed for existing, 2025, 2040 and buildout. Demand scenarios with all water and with non-potable irrigation are incorporated into future model to plan for sufficient system capacity at all planning horizons. The projected demands are future peak month (summer) water demands that come directly from water use and follow a diurnal pattern with a peaking factor for both residential and nonresidential demands. Table 7 focuses on infrastructure needs based on peak summer demands.

Table 7. Peak Mouth Demand Projections by Planning Horizon (2021 Water Transmission & Distribution Master Plan 2-27)

Projection Tier	Acres	Population	Residential Demand	Nonresidential Demand	Total Demand
			(MGD)	(MGD)	(MGD)
Existing	11,883	107,146	N/A	N/A	46.0
2025	15,116	128,458	2.4	2.1	50.5
2040	29,467	179,430	8.2	5.5	59.7
Buildout	44,914	425,271	35.9	20.4	102.4

Wholistically, it important for the City of plan on total annual water demands through buildout. Bear in mind, that water conservation methods listed in this Plan will help reduce the City’s annual water demands. Conditions will change with time and uncertainties will impact the accuracy of total water demands. With the best current information from the *BBC Research & Consulting 2018 report* and the *2021 Water Transmission and Distribution Master Plan*, water demands at buildout are presented below:

Table 8. Annual Demand Projections at Buildout (2021 Water Transmission & Distribution Master Plan, ES-17)

Demand	Total Water Demand (AFY)	Potable Water Demand (AFY)	Non-potable Water Demand (AFY)
Existing	30,500	28,600	1,900
Future Demands	33,500	28,300	5,200
New High Industrial Users (theoretically)	10,300	10,300	0
Total	74,300	67,200	7,100

3 Integrated Planning and Water Efficiency Benefits and Goals

3.1 WATER EFFICIENCY AND WATER SUPPLY PLANNING

As previously discussed, the City is currently updating its water supply master plan with an IWRP. In step with the vision of the IWRP, the City is integrating a suite of approaches to secure the sustainability and reliability of future water supplies. The process calls for the development of key system performance metrics and level of service goals. Performance metrics are quantitative features used to evaluate performance of the water supply system, whereas level of service goals help define acceptable system performance and are often related to policy decisions. Subsequently, the City will identify risks and uncertainties to which the Greeley water supply system may be susceptible to, prioritizing those most pertinent to the system. These decisions will precipitate the development of Planning Scenarios that describe the future conditions the City will plan for. Once scenarios are developed, the City will develop water resource alternatives that fill identified supply gaps and meet level of service goals.

Goals for the IWRP include:

- Creating a short term (5-10 year) critical infrastructure project plan
- An actionable water resources strategy including the approach to future water acquisition, conservation efforts and watershed protection activities

- Actionable operation strategy for the timing and integration of the Terry Ranch ASR project.

The Water Conservation Team acts as part of the IWRP process by assisting to define key system performance metrics and setting level of service goals; identifying system risks and uncertainties; and selecting water resource alternatives. The IWRP is scheduled to be complete in December of 2022. Water efficiency is an integral piece of planning for water supply reliability and resilience. The IWRP expects that Greeley as a community will continue to act with water smart values to lessen system vulnerabilities in drought and non-drought conditions.

3.2 WATER EFFICIENCY GOALS

The water efficiency goals are to provide Greeley’s community with tool and resources for sustainable water conservation practices utilizing customer service, education, and technology. The City used a triple bottom line (TBL) approach that will transform Greeley’s water conservation efforts to a more sustainable future. TBL offers water efficiency goals to be optimized, innovated, and improve water efficiencies across multiple divisions within Greeley. The water efficiency is centered around a sustainable water future that revolves around Greeley’s community, prosperity, and water conservation management. For the City, TBL means creating an optimal mix of water efficiency, cost effectiveness and community first in daily Water Conservation operations.



This Plan is designed to support the five core values for Water Conservation:

- Drive water conservation through innovation and technology
- Provide excellent customer service
- Continue and build on Greeley’s water conservation history
- Commit to sustainability and environmental stewardship
- Fulfill future customer needs and changing values

Through WEP implementation, the goal is to reduce total water demand by 2,034 acre-feet of water savings by 2030. To accomplish our water efficiency goals, TBL will be used to evaluate our performance and make data-informed priorities and decisions. Table below represent a 5-year scorecard to track progress and provide accountability and transparency within Water Conservation. The 5-year scorecard is used as a guidance for the Water Conservation team, to document multi-year goals and to evaluate resource allocations. To guide, measure and track progress, an Annual Scorecard is developed and will be presented to the Water Board annually. The 5-year scorecard is centered by sustainability through community, prosperity and water conservation management.

Community	Performance Indicators	Status	Resources Allocation
Education- Lecture and Presentations	<ul style="list-style-type: none"> ▪ Educational awareness of methods for water conservation. ▪ Community outreach and engagement for classrooms, civic clubs, and other groups. ▪ Work to enhance cohesiveness of presentations and water related topics. 	Ongoing	<ul style="list-style-type: none"> ▪ Staff Time- Full time person assigned to Water Conservation Administration ▪ Guest speakers ▪ Educational materials ▪ Marketing
Education-Teacher Training	<ul style="list-style-type: none"> ▪ Provide teachers credits for water and conservation issues for local teachers ▪ Correlate material within lesson plans towards water resources 	Ongoing	<ul style="list-style-type: none"> ▪ Staff Time- Full time person assigned to Water Conservation Administration and Water Conservation Specialist ▪ Educational materials (models, lesson plans, etc.) ▪ Credits and Transportation
Education- Tours	<ul style="list-style-type: none"> ▪ Provide the public with opportunities to tour Water facilities including the Water-wise gardens. 	Ongoing	<ul style="list-style-type: none"> ▪ Staff Time- Full time person assigned. ▪ Educational Materials ▪ Hand-on demonstration ▪ Transportation
Online Water Efficiency Tools	<ul style="list-style-type: none"> ▪ Maintenance and updates to current online tools. ▪ Contract agreements and associated budgets. ▪ Ensure tools are customer friendly and provide accurate information. 	Ongoing	<ul style="list-style-type: none"> ▪ Staff Time- Full time water conservation assigned. ▪ Legal for contract agreements. ▪ Internal Departments- IT and Communications and Engagement.
Technology and Innovation	<ul style="list-style-type: none"> ▪ Survey to evaluate program outreaches and more effective communication strategies. ▪ Use data-based information to construct a more effective outreach strategy. ▪ Explore methods to engage all sectors of the community and embrace diversity. 	New (2021)	<ul style="list-style-type: none"> ▪ Staff Time- Full time person assigned to Water Conservation Manager and Administration ▪ Survey materials ▪ Open Forums ▪ Marketing
Strategic Marketing Plan	<ul style="list-style-type: none"> ▪ Create quarterly plans to support objectives of the water conservation program related to marketing strategies. ▪ Quarterly report on progress on all strategic briefs including budget allocation will be created. ▪ Alignment of other city public relations strategic planning with Water Conservation 	Ongoing	<ul style="list-style-type: none"> ▪ Staff Time- Full time person assigned to Water Conservation Manager, Water Conservation Administration and Community Engagement Department ▪ Budgeting
Collaboration	<ul style="list-style-type: none"> ▪ Outreach to community businesses, non-profits, irrigation and landscape industries, etc. to create partnerships and methodology for water savings. ▪ Tap into the Water-Energy nexus. ▪ Provide guidance for partnerships. ▪ Reduce barriers and provide value 	Ongoing and New	<ul style="list-style-type: none"> ▪ Staff Time- Full time person assigned to Water Conservation Manager, Water Conservation Administration and Water Conservation Specialist. ▪ Hosting meetings and forums ▪ Agreements ▪ Associated educational credits and certifications ▪ Educational materials

Prosperity	Performance Indicators	Status	Resources Allocation
Rebates and Incentives	<ul style="list-style-type: none"> Annual review of rebate program including alignment with state and federal standards, industry changes and data-driven decisions on rebate performances. Annual review of return on investment and water savings. Alignment with the Water Department & City initiatives. 	Ongoing	<ul style="list-style-type: none"> Staff Time- Full time water conservation manager and water conservation specialist assigned. Federal, State and local standards to guide changes Alignment with other City initiatives Finance and Billing Departments
Advanced Metering Infrastructure (AMI) Optimization	<ul style="list-style-type: none"> Expansion of WaterSmart participation Utilization of spatial data paired with other dataset to detect patterns in water budgets, rebate/incentives utilization, irrigation practices, etc. to improve the Water Conservation programs. Utilize WaterSmart’s data to improve efficiency, communications strategies and customer engagement. Provide customers with notifications and/or alerts regarding water usage 	Ongoing and New	<ul style="list-style-type: none"> Staff Time- Full time water conservation assigned. Internal Departments- IT, Water Resources, Meter Shop, Engineering, GIS, Water Conservation, Billing and Finance WaterSmart software
Leak Detection	<ul style="list-style-type: none"> Reduction of water loss due to leaks. Provide customers with notifications and/or alerts regarding water usage (i.e. water leaks, burst water pipes, emergency water issues). Leak repair credit Develop a new program to quantify and reduce leaks. 	New	<ul style="list-style-type: none"> Staff Time- Full time and part-time water conservation assigned. Internal Departments- IT, Water Resources, Meter Shop, Engineering, GIS, Billing and Finance, and Communications and Engagement WaterSmart software Educational materials and marketing
Enforcement	<ul style="list-style-type: none"> Provide educational opportunities and/or fees to water wasters. Enforcement of the Landscape and Irrigation Criteria, and lawn variances. Develop policies and tracking methods for Drought Emergency Plan, Landscape and Irrigation Criteria and lawn variances. Develop policies and methods for tracking Community outreach and engagement. 	New	<ul style="list-style-type: none"> Staff Time- Full time and part-time water conservation assigned Internal Departments- IT, Water Resources, Meter Shop, GIS, Billing, Finance, Parks, and Community Engagement. Seasonal staff for enforcement Alignment with other City initiatives Educational materials and marketing
Income Qualified	<ul style="list-style-type: none"> Ensure social equality for Water Conservation programs and project. Enhance opportunities to serve all community members. Explore methods to engage all sectors of the community and embrace diversity. 	New	<ul style="list-style-type: none"> Staff Time- Full time and part-time water conservation assigned Internal Departments- IT, GIS, Billing, Finance, and Communications and Engagement. Community Engagement. Educational materials and marketing

Water Conservation Management			
	Performance Indicators	Status	Resources Allocation
Organizational Collaboration	<ul style="list-style-type: none"> Continue to leverage community and professional partnerships. Expand Water-Energy nexus, CII high water use relations, stormwater partnerships, etc. Alignment with community partnerships Pilot projects- testing new ideas based on data 	Ongoing	<ul style="list-style-type: none"> Staff Time- Full time person assigned. Federal and State standards to guide changes Align with other city initiatives Align with community partnerships Memberships, sponsorships, etc. Data monitoring
Land Use	<ul style="list-style-type: none"> Leveraging the Water budget for all customer classes targeting outdoor water use. Promoting water wise landscapes and demonstration garden areas. Maintenance of the Landscape and Irrigation Criteria Survey landscapes to have a pulse on landscape health. 	Ongoing and new	<ul style="list-style-type: none"> Staff Time- Full time person assigned. Align with other city initiatives Community Engagement. Educational materials Marketing
Water Conservation Development	<ul style="list-style-type: none"> Aligning performance goals with the annual scorecard and 5-year scorecard. Provide training and leadership opportunities for staff. Workload alignments with individual programs. Improve efficiency through cross-training, documenting operations and procedures, increase internal mobility and ensure collaboration. Targeting water efficiency programs 	Ongoing and new	<ul style="list-style-type: none"> Staff Time- Full time Water Conservation Manager Align with other city initiatives Training Memberships, sponsorships, etc.
Financial Resources and Budget	<ul style="list-style-type: none"> Submit a water conservation budget annually. Track budget and return on investment for each program. Leverage resource through grants and other funding opportunities. 	Ongoing	<ul style="list-style-type: none"> Staff Time- Full time Water Conservation Manager and input form staff.
Reporting	<ul style="list-style-type: none"> State reporting including HB1051 Annual score cards to the Board Ensuring website information, reports and forms for the public are updated. Aligning data analysis internally on water consumption. Drought Emergency Plan reserve tracking Update Water Efficiency Plan 	Ongoing and New	<ul style="list-style-type: none"> Staff Time- Full time person assigned. Internal staff- Water Resources, IT, and Communications and Engagement
Water Loss	<ul style="list-style-type: none"> AWWA M36 Water Loss Audit (M36) occurring annually. Internal collaboration on water loss Assets management with AMI meters. 	Ongoing and New	<ul style="list-style-type: none"> Staff Time- Full time person assigned. Alignment with AWWA audits

The Water Conservation team revisits the Water Efficiency Plan (WEP) approximately every five to seven years. As part of this process, Conservation’s success at accelerating gallons per capita per day (GPCD) reductions and mitigating peak demand is part of the *IWRP, Water Transmission and Distribution Master Plan and the Greeley Non-Potable Water Transmission and Distribution Master Plan*.

4.0 Water Efficiency Activities

4.1 SUMMARY OF THE SELECTION PROCESS

Historically the entire suite of current water conservation programs is regularly evaluated and judged against annual, seasonal, per customer and per capita demands. However, in 2020, the City, in conjunction with WaterNow Alliance and Western Resource Advocates, performed an analyses of the water conservation program portfolio in order to inform future budgetary decisions and program priorities. The full report is found in Appendix A. Methodologies included a customer survey, an equity-focused spatial analysis of past program participation, and a water use change analysis.

Future evaluation criteria, in conjunction with the high WRP long term planning goals. Water conservation staff will continue developing a variety of potential programs with based on best management practices, studies, reports, innovated technologies, and customer feedback. As always, the water conservation team will discuss potential programs with other Front Range and western water providers as well as CWCB staff.

Program screen criteria are based on water savings potential, cost effectiveness, community vitality and likelihood of success (Table 10).

Table 10. Evaluation criteria for success

Evaluation Criteria	Description
Water Savings Potential	Water consumption reduction per customer account.
Cost Effectiveness	Return on investment ratio to ensure the best cost effectiveness.
Community Vitality	Continue to be a community developed by design and water smart.
Likelihood of Success	Best acceptance of a program, market strategies and feasibility. Pilot programs can be used to rank success.

4.2 Demand Management Activities

These programs are defined according to CWCB’s primary water efficiency categories and are displayed as part of the TBL—Community, Prosperity, and Water Conservation Management in the below tables.

Through these demand management activities, an estimated 2,034 acre-feet of water savings by 2030 could be achieved.

Community	
Water Efficiency Activities	
Education	Lectures and Presentations
	Teacher Training
	Tours
	Water Wise Demonstration Gardens
Online water efficiency tools	Water Budget Calculations
	Registration and apply for education, program, audits and rebates
	Contact the Water Conservation Team
	Watering schedules and restrictions
	Violations Reporting
	Water wise landscape guidelines
	Plant database
	Videos and presentations
	New seed/sod variances
	WaterSmart Portal
New Technology and Innovation	Conduct surveys for baseline data
	Public engagement and impacts to water conservation programs
	Data gathering and outputs using GIS to make inform decisions on programs
Strategic Marketing Plan	Face to face marketing
	New Outreach demographics
	New releases
	Newsletters
	Paid Advertising
	Promotional items
	Direct mail
	Online communication
Collaboration	Creating partnerships on projects
	New Tap into the Water-Energy nexus
	Guidance for other partners
	Reduce barriers and provide water savings value
Cumulative Water Savings 2022- 2030 (acre-feet)	386

Prosperity	
Water Efficiency Activities	
Rebates and Incentives (Outside)	Irrigation Water Audits
	Sprinkler nozzle and heads rebates
	Smart Controllers rebates
	Pressure reducing valve
	Irrigation Flow Sensor
	Life After Lawn (turf to water-wise plants conversion)
	Rain and soil sensors
	Professional landscape Certification
Rebates and Incentives (Inside)	Indoor Water Audits
	Showerhead and aerators-free
	Toilets and Urinal Rebates
	Pre-rinse spray valve- free for commercial properties
	New Dipper wells
	New Frozen food defrost
	Washing machine rebates- multiple family only
	New Commercial ozone laundry washer
New Advance Metering Infrastructure (AMI) Optimization	New Commercial Food Steamer
	Enhance leak detection
	Minimize water loss
	Daily water monitoring capabilities
	More accurate billing
	Better customer service
Leak Detection	Reduced fuel by eliminating drive-by meter readings
	New WaterSmart software to alert customer of leaks, high usage, and unexpected use
Enforcement	No wasting water
	No watering between 10 am - 6 pm
New Income Qualified	Affordable housing rehab projects
	Assistance programs
Cumulative Water Savings 2022- 2030 (acre-feet)	1363

Water Conservation Management	
Water Efficiency Activities	
Organizational Collaboration	Water use goals
Land Use	Water Budget- conservation based rates
	Water Wise landscapes partnership
	New Landscape and Irrigation Criteria
	New Non-potable irrigation system
New Water Conservation Development	Targeting water efficiency programs
Financial Resources and Budget	Determine relevant business impact metrics for each program
	Pursue funding and resource opportunities
Reporting	House Bill 10-1051
	Water Efficiency Plan
	Drought Emergency Plan reserve tracking
	Annual score cards for accountability
Water Loss Control Programs	Distribution System Leak Detection
	Distribution system pressure management
	Water Loss Annual Audit
Cumulative Water Savings 2022- 2030 (acre-feet)	285

4.3 DEMAND MANAGEMENT ACTIVITIES

The WEP is designed to maximize water use and be a blueprint to facilitate water demand management. With a use of the TBL approach the following foundational activities will meet our savings requirements through 2030.

Community

Educational Programs: Greeley's robust educational programs include teacher training, tours, tailored customer service, landscape lectures, presentations, newsletters, and social media postings on various water conservation programs. This includes:

Lecture and Presentations: Making connections and partnerships in the community helps position Greeley's Water Conservation program as an important resource. Water conservation staff sponsors and participates in a broad array of events and educational activities to foster face-to-face interactions. Greeley participates in fairs, events sponsored by other organizations, festivals, neighborhood meetings, speaking engagements, discussions with local civic groups and classroom visits. Online lectures series have grown in popularity and provide landscape lectures to help the Greeley community save water and create natural ecosystems to become more drought resilient.

Teacher Training: Greeley co-sponsors The Confluence Institute which is a four-day training of K-12 teachers on water and conservation issues at the Poudre Learning Center. It provides teachers with resources and activities to use inside their classrooms. Teachers received District Six credit. Also Caring for Our Watershed project is sponsored by the Poudre Learning Center and Agrium. Water Resources staff support the project by judging projects and mentoring students through implementation.

Tours: Making connections within the community is done by providing city wide tours. Tours vary from watersheds, demonstration gardens to treatment plants.

Water Wise Demonstration Garden: This garden was designed to show customers what Xeriscape is and is not and to provide examples of plant material that can be utilized in their own landscapes, it also demonstrates alternative turf.

Online water efficiency tools: There are multiple online tools providing 24-hour access to customers on water efficiency options that include:

- Calculate customers' personalized water budgets and view calculated irrigable areas.
- Registration and apply for educational opportunities, programs, audits and rebates.
- Ability to contact the Water Conservation team through email or phone
- Watering schedules and restrictions
- Reporting water violations
- Water wise landscape guideline, and plant database
- Location of demonstration gardens
- Videos and presentation on past landscape lectures
- Application for new seed/sod variances. This ensures the correct soil preparations standards have been completed.

- WaterSmart portal that includes tutorials, educational material, ability to view of current and past bills, and leak and high use notifications. This process includes a Home Water Report. This report utilizes social marketing where you create social norms by giving the customer a score card on their use and compare them to similar family and property sizes.

Technology and Innovation: As part of the core values of Water Conservation, the Conservation Team will use technology to streamline and evaluate water conservation programs. Making informed decisions on water conservation programs-- which work well and sunsetting those which didn't work according to plan-- it not only standard business but guidance us to be more effective. Using technology to our advance is key for long-term conservation goals.

Strategic Marketing Plan: Greeley is steadfast in the belief that personal contact is most effective element. Program staff strives to be visible in the community and to meet was as many citizens as possible. As noted in the *Enhancing Greeley's Water Efficiency Portfolio* through Performance Analysis, face to face marketing harness synergies across conservation programs. This document also provides guidance on targeting outreach based on demographics, survey data, and marketing methods. The Water Conservation Program uses new releases, newsletters, paid advertising, promotional giveaway items, direct mail, and online communications. Quarterly the water communications plan is reviewed to help focus, monitor, and evaluate the Water Conservation outreach efforts. Conservation information and initiatives are an important part of Greeley's Water and Sewer's overall public messaging.

Collaboration: Collaboration improved the way water conservation work together and problem solve. Through working with our community members, the Water Conservation team will continue to innovate, improved efficiency, increase success and help achieve the water conservation goals. The Water Conservation team will be looking at methods to tap into the Water-Energy nexus, LEED building projects, regionalized messaging, landscape certifications and work with our schools systems.

Prosperity

Rebates and Incentives:

Annually, the Water Conservation Team reviews rebate and incentive programs to algin with State and Federal standards, industry changes and data-driven decision on rebate performances. Below is a list of outdoor and indoor programs.

A. Outdoor Programs like:

1. Irrigation Audits- Throughout the summer Greeley's Water Conservation Team offers outdoor irrigation audits. Staff visit properties to perform a visual inspection and collect data to diagnose irrigation inefficiencies, educate customers on proper operation, scheduling techniques and maintenance. Customers receive a final report with recommendations along with a personalized irrigation schedule.
2. Sprinkler nozzle and head rebates- By replacing old technology with nozzles and heads with modern low volume this is save overall irrigation water application rates. In addition, by ensure head and nozzles match each zone, this will all efficiencies in application rate.
3. Smart Controllers Rebate -Smart Controllers apply the water according to the weather and reduce the need for customers to know how to adjust their run times. When coupled with an

irrigation audit and quality sprinkler heads, it can improve the efficiency of the water applied, human error and the “set it and forget it” mentality.

4. Pressure Reducing Valve- Greeley pressure ranges from 80-120 psi which is too high for most irrigation systems thus causing misting and /or displaced water due to even slight breezes. Another pressure reducing valve occurs during the drip irrigation conservation process. Rebates are to offset the cost of installing a pressure reducer on their sprinkler system allowing it to run at the correct pressure.
5. Irrigation Flow Sensor- Flow sensor can sense when other than normal flow is going through the sprinkler system or line and can shut off the clock to avoid a large amount of water leaking out a broken pipe or if a sprinkler head gets damaged.
6. Life After Lawn (Turf to water-wise plants)- This program incentivizes customers to replace water thirsty turf with low water and/or native perennials, trees and shrubs or native grasses.
7. Rain and soil sensors – Rain sensors are adjustable and can shut off the system when the threshold of precipitation is met. Soil moisture sensor detect the amount of moisture in the soil and will activate the system when that water is depleted. the system will water on demand rather than on a set schedule which could save water.
8. Professional Landscape Certification -Provides incentives for landscape contractors to pursue certifications and continuing education.
9. Pool covers: Besides offering energy savings, pool cover also conserve water by reducing the amount of make-up water needed by 30-50%.

B. Indoor Programs:

1. Indoor audits-These audits work as an educational tool to help Greeley citizens realize all the uses of water indoor, like AC units, humidifiers, and auto-fill floats. This face-to-face marketing allow to assist in leak detection and provide information about other conservation programs.
2. Showerhead and aerators exchange-This is a relatively simple way to upgrade plumbing fixtures to WaterSense standard which can help save water and energy by providing free showerheads and aerators.
3. Toilets and Urinal Rebates- By replacing older toilet and urinal this will help save water and many times you are also fixing a leak the customer didn't know they had.
4. Pre-rinse spray valve-These high-pressure valves apply water in a way that helps dishwashers remove the most stubborn food from dishes, pots and pans before they go into the dish machine.
5. Dipper wells- Low-efficiency dipper wells operate using a continuous flow of water. High-efficiency dipper wells have automatic shutoffs and other features to dramatically reduce their water use.
6. Frozen food defrost-Food - This product prevent excessive water from going down the drain while thawing frozen foods.
7. Washing machine rebates (Shared facilities only) New HE washers save water by using 4-7 gallons per cycle compared to loading washer that can use 40 or more gallons.
8. Commercial ozone laundry washer: Ozone works best in cold water, so large facilities do not have to pay for energy to heat the water. In addition, the process reduces total water usage by creating an overall more efficient wash process.

9. Commercial Food Steamer: Energy Star certified steam cookers save 90% or more water when compared to older standard steam cooker models. Updating commercial food steamers will save water and energy.

Advance Metering Infrastructure (AMI) optimization and monthly Meter Reading: Every connection to Greeley's water utility infrastructure is metered. Customer's meters are read monthly or through AMI on an hourly time scale. AMI is scheduled to be completed in 2026 for the whole City of Greeley. The AMI system provides near real-time monitoring and alert capabilities that will detect high usage and leaks when paired with the WaterSmart software. Benefits of AMI are:

- Enhanced leak detection
- Minimized water loss
- Daily water monitoring capabilities for customers rather than waiting a month for a record of water usage.
- More accurate billing
- Better customer service
- Reduced fuel usage by eliminating drive-by meter readings and additional vehicles to check meters

WaterSmart software allows customer to review, understand and make decisions about their own water use. This not only does this on-line portal improves water efficiency but provides communication strategies and customer encouragement.

Leak Detection: Currently the AMI system is paired with the WaterSmart software and can alert customers to leaks, high usage, and unexpected use. The customer is then alerted via text message or e-mail. Water Conservation staff also make efforts to notify customers that do not have contact information on file through door tags. Leak repair assistance offers a credit to customers that discover a leak in their water system on a case-by-case basis. Working with other internal staff, the Water Conservation team will be developing a new program to quantify and reduce leaks.

Enforcement: The Water Conservation team takes an educational approach to enforcement. Wasting water and watering in the middle of the day between 10:00 am and 6:00 pm are prohibited. First time offenders receive a written notice with program offerings to better help the customer understand their water use and improve efficiency. If there is no action taken by the customer, then the City has the ability to levy fines.

Income Qualified: Greeley is a culturally dynamic community with different socio-economic conditions within Greeley's customer base. Most outdoor over-use of water occurs by the higher-income customers. Though lower-income customers typically do not contribute to high summer water production levels but have challenges with indoor use. From the *Enhancing Greeley's Water Efficiency Portfolio through Performance Analysis* report, water conservation can harness synergies for outreach opportunities and provide a suite of future programs to this important population.

Water Conservation Management

Organizational Collaboration: Partnerships are key to help create community messages, obtain feedback, keep abreast to industry trends, pooling resources and ensure reasonable and effective water savings actions.

Greeley continuously networks finding the best resources for specific water conservation programs. Through this collaboration process, the Water Conservation Team will align with community partnerships that follow the core values. The Water Conservation team works one-on-one with key organizations locally, and at the State and Federal government levels.

Land Use:

Water Budget: Water budgets support the City’s goals of promoting efficient water use. A water budget is the most equitable (fair) way to reward efficiency and discourage water waste. A water budget is unique to each residential household and provides your home all the water you need. It is based on:

- Family size
- Landscape size
- Real-time weather conditions

In this custom tiered rate has four tiers as illustrated in Figure 14 – rewarding customer that stay within their water budget.

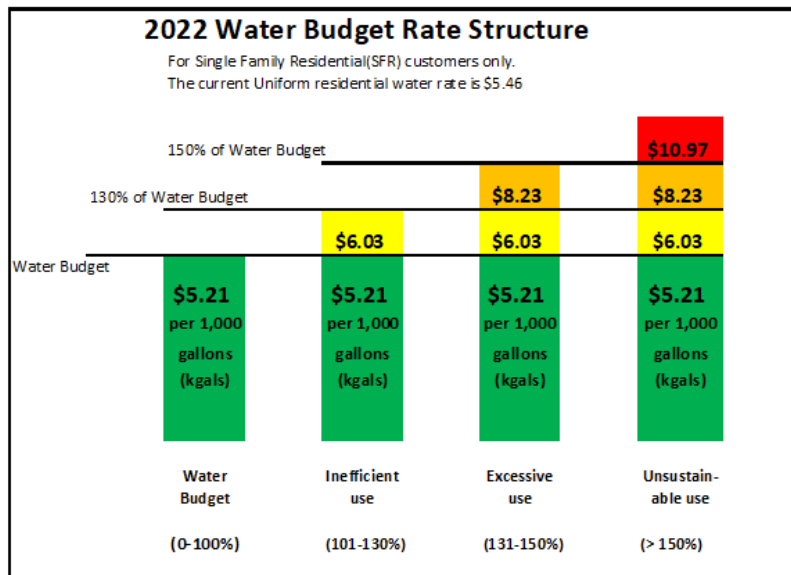


Figure 14. 2022 Water Budget Rate Structure

Since 2017, the Water Conservation Program evaluated and implemented a water-budget-based rate structure for each single-family residential customer, including information on each household’s irrigated area and forecasted demand based on weather data. This empowered customers with information that would allow them to take an active role in monitoring and lowering their consumption (and in turn their water bills) through a water-budget-based rate structure. Part of the rate model includes targeted communication pieces to customers who

regularly exceed water budgets, flagging exceptionally high-water bills, and notifying users who grossly exceed their water budget.

Water Wise Landscapes: Water conservation maintains two demonstration gardens to support customer education on water-wise landscape plants. Other projects include partnerships. One with the University of Northern Colorado on showcasing water wise landscapes by removing non-essential turf by the student center. The second is partnering with the Stormwater division and CSU Stormwater center, Greeley has installed five rain garden demonstration projects in Greeley.

Additional methods to promote water wise landscapes, such as customer recognition or grants yard makeovers will continue to be developed.

Landscape and Irrigation Criteria and Non-potable Irrigation System Design Criteria: The *Landscape and Irrigation Criteria* is intended to provide information for the design, review, installation and maintenance of landscape and irrigation systems within the City of Greeley to promote the efficient use of water and the reduction of water waste through best management practices.

The Non-potable Irrigation System Design Criteria expand the non-potable water system and reduce the use of potable water for irrigation purposes and improve irrigation practices.

Landscape and irrigation plan reviews are for new CII development, civic and open spaces, rights-of-way, and common areas. This review and inspection help contractors maintain quality work and help protect property owners against innately inefficient irrigation systems. Furthermore, the total landscape water requirements are calculated and submitted during the landscape and irrigation plans review process.

Water Conservation Development: Targeting water efficiency programs is key to success. This is based on data informed decisions, performance accountability and staffing levels. Here are some main future focuses:

- Water Users: The purpose of the measure to is target water users, analyze water use, develop efficiency benchmarks and determine ways to help all customer classes to become more water efficient.
- Governmental Properties: The Water Conservation Team is working with City departments to improve water efficiencies within its own City's property. This includes fixture updates, water budgets for open spaces like parks, and landscape innovations.
- Customer service: From leak detection to landscape changes, the Water Conservation customer care installs a lasting history for the Greeley community. The Water Conservation team will leverage billing systems and WaterSmart to provide more meaningful usage information to customers. This will support educational opportunities.
- Technology and innovation: Methodologies to use technology to innovate water conservation programs.
- Internal water conservation staff: A success water conservation program needs people to guide water conservation efforts in the community. There are currently four full-time employees, one-part time employee and a seasonal staff and volunteers dedicated to developing, implementing and promote water conservation efficiency programs in Greeley. Ensuring processes are streamlined, staff are cross trained, and are aware of the latest water conservation technologies

is the backbone of success for the WEP. Personalized performance goals will align with the annual scorecard and 5-year score card in this plan.

As new ideas emerge, pilot projects will be conducted. This will test the viability of executing the project at a full scale and help manage risk and reveal flaws in the plan before substantial resources have been committed.

Financial Resources and Budget: The Water Conservation Program measures the return on investment for water conservation programs. This provides relevant business impact metrics for each program and allows the Water Conservation Manager to make data-driven decisions on each program. Levering financial resources provides value to the Greeley community. Since 2020, the Water Conservation team has secured over \$3.5 million dollars in grants and professional services boosting long-term water conservation efforts. Water Conservation will continue to pursue funding and resource opportunities.

Reporting: State, local and internal reporting is critical analysis how water conservation is tracking within all programs. These tools are used to guide decision-making and solve any identified issues. The Water Conservation will continue to report to CWCB all requirements associated with House Bill 10-1051 and continuous tracking methods mentioned in Section 5.2 of this WEP.

Water Loss Control Programs: Greeley's robust Water Loss program includes annual water audit and loss control reports using the methodology prescribed by the American Water Works Association M36 manual, system wide water main leak detection program, an active meter maintenance program with meter replacements to AMI meters by 2026, and strong asset management assessment and planning group to replace aging infrastructure.

5.0 Implementation and Monitoring Plan

Greeley has one of the most robust and longest-standing water conservation programs in the State of Colorado. Using the roadmaps mentioned in the WEP, the Water Conservation Manager will plan, develop, and lead the Water Conservation team to cost effectively reduce water use for Greeley through dynamic programming and outreach.

5.1 IMPLEMENTATION PLAN

Demand management solutions are implemented using data driven decisions and by removing planning barriers such the lack of leadership, limited manpower to complete tasks, inadequate resources and funding, and impractical business planning. Through the Water Conservation leadership team, 5-year scorecards will guide, and track performance of the water conservation programs. Staff will create an annual scorecard on specific programs and projects to address the long-term goals from the 5-year scorecard. The annual scorecard will be showcased at public Board meetings. Using the triple bottom line approach will allow flexibility to pilot new programs and sunset others.

The Water Conservation team will be setting the level of service goals as part of its short and long-term demand management strategy of the Integrated Water Resource Planning.

5.2 MONITORING PLAN

Greeley monitors all water conservation and efficiency programs activities by those customers who have participated through costs and estimated water savings. Business impact metrics will be measured

through water savings analysis using similar methodologies found in the *Enhancing Greeley's Water Efficiency Portfolio through Performance Analysis* report.

Accurate monitoring will be performed by analyzing per capita water use, per unit water use and accounting for variations created by annual weather conditions. Data will be submitted for House Bill 10-1051 annually. In addition, Greeley will annually conduct self-water audits and loss control programs following the guideline of the American Water Works Association M36 manual and participate in the Colorado Water Loss Control Initiative.

Geospatial analysis paired with customer surveys will allow the Water Conservation team to stay informed on customers' values and interests, and to benchmark water conservation programs through time. Furthermore, surveys will allow Greeley to expand on the success of its existing program and further focus how to reach targeted audiences using community based social marketing campaigns.

Using the latest technology, the AMI data paired with WaterSmart software will allow daily weekly, and monthly data analysis and reports. Greeley's water customers have access to safe, secure, real-time data of their water usage through an online customer portal. Accurate information allows customers to proactively partner with the City in its conservation efforts by monitoring and adjusting their personal usage—a feature that will be especially beneficial to commercial and landscape customers who have higher usage rates and thus, higher water bills.

6.0 Adoption of New Policy, Public Review and Formal Approval

6.1 Adoption of New Policy

WEP adoption involved internal and external stakeholder feedback, flexibility and finalizing the WEP with the Water and Sewer's Director. In addition, in 2021 over 720 customers provided survey responses to gain a better understanding of customers' awareness of- and interest in- Greeley's water conservation programs. Results of the survey are found in Appendix A. Survey results have been integrated into this WEP.

6.2 PUBLIC REVIEW PROCESS

Through Greeley's Communications and Engagement staff, a communication plan and marketing strategies were developed. These included:

Executive Team and Internal Staff: Both Water and Sewer's executive team and staff were briefed at various times throughout 2021 and 2022 providing input, suggestions, and insight to optimize end results of the WEP. The plan will be part of the Integrated Water Resources Plan to evaluate Greeley's long-term water supply sustainability and incorporate near-term projects to reduce future water risks and uncertainty.

Technical Analysis: The Water Conservation team was selected to WaterNow Alliance's Project Accelerator program for support in analyzing the performance of its water conservation program portfolio to inform future budgetary decisions, program priorities, and this WEP.

60 Day Public Comment Period: As part of the communication plan, the 2022 WEP was posted the Water and Sewer long range planning website starting on August 3, 2022 to promote and solicited feedback. Those comments will be provided in Appendix B. Tactics to engage the public were through

social media, website updates, Water and Sewer’s monthly newsletter, news release, Speak Up Greeley project page, presentations to Boards, virtual public briefing/open house and key stakeholder working group meetings.

6.3 EFFICIENCY PLAN APPROVAL (Pending)

Please note this section will include approval from the Water and Sewer Board along with City Council after the public has provided comments.

Local Approval

CWCB Approval

6.4 WATER EFFICIENCY PLAN REVIEW AND UPDATE

Greeley will submit a formal water efficiency plan update by 2029. A review and revision of each section will be completed as necessary.

Appendices

APPENDIX A: ENHANCING GREELEY’S WATER EFFICIENCY PORTFOLIO THROUGH PERFORMANCE ANALYSIS

APPENDIX B: PUBLIC NOTICE ANNOUNCEMENT, PUBLIC COMMENTS, & OFFICIAL PLAN ADOPTION

Please note this section will include approval from the Water and Sewer Board along with City Council after the public has provided comments.



APPENDIX A

Subject: Draft Final Report: Enhancing Greeley’s Water Efficiency Portfolio through Performance Analysis

Date: May 3, 2022

To: Dena Egenhoff, Water Conservation Manager, and Ruth Quade, Water Conservation Administrator, City of Greeley

From: Lindsay Rogers and John Berggren, Western Resource Advocates; Amy Weinfurter, WaterNow Alliance

Final Report: Enhancing Greeley’s Water Efficiency Portfolio through Performance Analysis

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Executive Summary

The City of Greeley has one of the most robust and longest-standing water conservation programs in the State of Colorado. In 2020, the City applied and was selected to WaterNow Alliance’s Project Accelerator program for support in analyzing the performance of its water conservation program portfolio in order to inform future budgetary decisions, program priorities, and the City’s forthcoming Water Efficiency Plan update. This report synthesizes key findings and methodologies from the conservation program performance analysis which included a customer survey, an equity-focused spatial analysis of past program participation, and a water use change analysis.

This analysis found that across the board, Greeley’s Water Conservation Programs have saved both water and money, and have been highly valued by program participants. During the six years spanning 2013-2018, selected programs engaged nearly 5,000 participants, and achieved water savings ranging from 2.9 to 19.5 AF per year per program. These programs’ average cost per acre foot savings is far below the current cost of water from the Colorado Big-Thompson Project. Based on the customer survey, 94% of respondents reported that Greeley’s conservation programs were important or very important. While the data analysis suggests that these programs are effective, it also provides insight into specific programs to expand or condense and how to most effectively conduct outreach to Greeley’s target audiences.

Program Prioritization

1. *Residential Audits:* Residential Audits (both indoor and outdoor) saved an estimated 19.5 AF per year, which is encouraging because the customer survey results suggest continued interest in further participation in this program, particularly the Outdoor Irrigation Audit. The quantitative analysis also shows that participation in the Residential Audit often overlaps with participation in other indoor and outdoor water conservation programs, suggesting that this program is an effective “gateway” to utilizing other water conservation tools and resources. Survey results support this finding in that 95% of Residential Audit participants reported taking some kind of water saving action as a result of their audit.
2. *Outdoor Efficiency Incentives:* The survey showed particularly large interest in outdoor water efficiency rebates and incentives. There may be an opportunity to expand participation in programs like the Smart Controller Rebate, PRV Rebate, and Rotary Nozzles Rebate. These programs have high water savings per account but have seen lower levels of overall participation, compared to other programs. The outdoor Life After Lawn and Garden in a Box programs – though not captured by the water use change analysis – were the most popular incentive opportunities for future participation according to the survey results.
3. *Educational Programs & Online Efficiency Tools:* Greeley’s array of educational programs and online tools were, for the most part, well utilized by Greeley residents and of interest to respondents for future participation. Many past participants reported taking specific water savings actions as a result of participation in an educational program. While data on staff resources and cost for educational programs and online efficiency tools is beyond the scope of this project, one can assume that most of these programs and tools are less expensive and time intensive than residential audits and outdoor efficiency incentive programs.

Communications and Outreach

1. *Harness synergies across conservation programs.* Approximately 30% of residents were part of multiple conservation programs, suggesting there may be ways to further encourage participants to take advantage of other relevant programs. Strategies may include continuing to encourage participants to complete an audit as an entry point to other programs, as well as reaching out to past participants to suggest additional or complementary programs.
2. *Create targeted outreach on specific programs to Hispanic and Latino customers.* Survey results suggest some differences in program preferences among Hispanic and Latino respondents. For example, respondents of Hispanic, Latino or Spanish origin expressed more interest in the High Efficiency Toilet rebate. These insights could help target outreach around specific programs in neighborhoods with larger percentages of Hispanic and Latino residents, as identified in the spatial analysis, or help prioritize the translation of specific program materials.

3. *Take advantage of popular outreach methods.* Email updates and monthly e-newsletters were the most popular form of communication for most customers. These channels can be used to further promote and increase awareness of the conservation programs, specifically Greeley’s online efficiency tools with which respondents were generally less familiar.
4. *Focus community engagement messaging on customers’ key water conservation motivations.* Motivation to participate in future water conservation programs is primarily based on saving money on water bills, protecting Greeley’s limited water resources, reducing personal use, paying for a fixture or appliance, and supporting community values.

The City of Greeley should be very proud of its efforts to build a popular, impactful, and highly valued Water Conservation Program. The report is intended to act as a tool for Greeley’s Water Conservation team to make data-drive decisions, and to be a resource to Colorado’s water conservation community in evaluating the impact of conservation programs and scaling-up future investments in water conservation.

Introduction

The City of Greeley’s leadership in water conservation began in 1907, with the City’s first watering restrictions, and Greeley now has one of the most robust water conservation programs in the State of Colorado.¹ Given the City of Greeley’s (Greeley, Greeley Water, or the City) semi-arid climate, receiving less than 13 inches of rainfall per year, these water conservation programs form an important strategy to ensure a reliable and sufficient water supply for city residents, now and into the future.² Greeley’s extensive water conservation programs have been successful at reducing water demand and keeping water rates affordable. These programs included free irrigation audits, direct installation of smart irrigation controllers, a conservation lecture series, a water-budget based rate structure, and a Life After Lawn turf replacement program, among many others.

In 2020, Greeley Water applied for WaterNow Alliance’s Project Accelerator program³ for capacity and expertise in optimizing its existing conservation programs through data-driven, performance analysis and an equity-focused analysis of metrics such as socioeconomic status of participants, age and geographic distribution, and the value of each program to the City’s residents. The resulting analysis, shared in the below report, will drive the City’s next Water Efficiency Plan and inform its annual water conservation program budget and priorities.

¹ City of Greeley, Colorado. (2016). Greeley Water Conservation Report 2016.

² City of Greeley, Colorado. (2020). Conservation. <https://greeleygov.com/services/ws/conservation/>

³ See: <https://waternow.org/our-work/our-work-projects/project-accelerator/>.

Through the Project Accelerator, WaterNow Alliance (WaterNow) and Western Resource Advocates (WRA) worked with Greeley Water, to evaluate the City’s water efficiency program portfolio through several key phases:

- (1) Interviews on the program background and priorities with City staff and officials;
- (2) Background research on and review of the City’s water efficiency program portfolio and available data;
- (3) A customer survey on Greeley’s water conservation programs.
- (4) Quantitative analysis of Greeley’s water conservation programs;

The report focuses on phases three and four of the project (customer survey and quantitative performance analysis) and synthesizes key findings on the City’s water conservation program portfolio. The intent of this report is to support Greeley’s Water Conservation team as they make important future decisions on programs and budgets. It is also intended to be shared with the broader Colorado water community as a resource for those that are interested in scaling up their investment in water conservation and evaluating the impact of their programs.

Customer Survey Findings

In February and March 2021, the project team conducted a survey of Greeley Water & Sewer customers to gain a better understanding of customers’ awareness of – and interest in – Greeley’s water conservation programs. Questions included past participation rates, potential future participation, general sentiments, and personal actions taken to advance water conservation. The survey focused on four key categories of Greeley’s conservation strategies, each with their own programs. The individual programs are listed below and more information on each program is provided in Appendix A.

1. *Educational Programs*

- a. Landscape Lecture Series – free lectures and workshops on landscape topics to improve water efficiency
- b. Xeriscape Education – literature, classes, and tours of Greeley’s Xeriscape gardens
- c. Tours of Greeley water-related facilities
- d. Teacher Training on water conservation issues for local teachers
- e. Speakers Bureau – Greeley Water speakers visit classrooms, civic clubs, and other groups
- f. Annual Mayor’s Water Challenge – water use reduction contest

2. *Water Audits*

- a. Residential Indoor Water Audits
- b. Residential Outdoor Irrigation Audits
- c. Commercial Audits (Indoor and/or Outdoor)

- d. Outdoor Irrigation Rebates – available to those that have completed an audit (e.g., smart irrigation controller, rotary sprinkler nozzles)
 - e. Commercial Rebates – available to those that have completed an audit (e.g., water efficient appliances, irrigation hardware)
3. *Water Efficiency Incentive Programs*
 - a. Compost Bin or Discounted Rain Barrel Sale
 - b. Discounted Garden in a Box Kit
 - c. Free Low-Flow Showerhead Exchange
 - d. High Efficiency Toilet Rebate
 - e. Life After Lawn Turf Replacement Rebates
 4. *Online Water Efficiency Tools*
 - a. Water Budget Resource
 - b. WaterSmart Customer Portal
 - c. Online Plant Database
 - d. Greeley Water Conservation Webpage

The survey was based on 45 questions, including optional demographic questions derived from the U.S. Census demographic questions. It was conducted using the Alchemer survey tool which allowed for advanced survey logic. The survey questions were derived based on past water conservation survey research conducted by the project team including San Diego County Water Authority's 2017 Water Issues Public Opinion Poll⁴, Seattle Public Utilities 2006 Residential Water Conservation Benchmarking Survey⁵, and Soquel Creek Water District's 2015 Voter Survey on Water Issues.⁶ Questions were modified to suit Greeley's local context, priorities, and values. The full list of survey questions and survey logic is available in Appendix B.

Over the course of two months, Greeley Water staff advertised the survey through bill stuffers, emails to a listserv of approximately 600 people, social media, the WaterSmart portal, the water conservation webpage, and other outlets (see Appendix C for bill stuffer design). To promote survey participation, respondents were entered into a raffle to receive gift certificates for local restaurants. The survey, which took participants approximately 10-15 minutes to complete, garnered 720 completed responses.

Of note, based on the voluntary nature of this survey and the survey's findings on program participation, this pool of survey respondents is likely more engaged with Greeley's water conservation programming than the City of Greeley's broader public. While this may influence the survey results, importantly, the survey respondents are among Greeley's target audience, as they are those that are likely to engage and respond to outreach and opportunities presented by the utility in the future.

⁴ <https://www.sdcwa.org/sites/default/files/2017%20SDCWA%20Poll%20Complete%20Report.pdf>

⁵ <http://www.seattle.gov/Documents/Departments/SPU/Documents/2006WaterConservationSurvey.pdf>

⁶ <https://www.soquelcreekwater.org/ArchiveCenter/ViewFile/Item/74>

That being said, it is important to acknowledge that a shortcoming of this survey is that some segments of Greeley’s population are under-represented when compared to 2020 census data. Perhaps most notably, 9% of survey respondents identified as Hispanic, Latino, or of Spanish origin, whereas, per Greeley’s 2020 Census bureau data, 39% of the population identifies as Hispanic, Latino or Spanish origin. This discrepancy may be partially attributed to the fact that the survey was only offered in English. Additionally, 93% of survey respondents said they own their own homes. This suggests that renters are under-represented in this survey as – per the 2020 census data – Greeley is only 60% owner-occupied housing units. This discrepancy is unsurprising given renters are likely to be less attuned to water conservation incentives that their landlord would be more likely eligible for, and many renters (particularly in multi-family housing) do not pay their own water bill. When possible, survey results described below are analyzed based on demographic information. Additionally, demographic program participation information is represented in the quantitative Spatial Trends Section of this report. Results from the demographic survey questions are available in Appendix D. Opportunities for better targeting future outreach to reach a wider cross-section of Greeley’s community is provided in the Recommendations section.

Awareness & Importance of Greeley Water Conservation Programming

Survey respondents were asked if they were aware of each of the four primary types of Greeley Water programs: 1) education-related programs, 2) water efficiency incentive programs, 3) water audits, and 4) online water efficiency tools. Respondents were most aware of the water efficiency incentives and least aware of the online water efficiency tools. As illustrated in Figure 1, in order of awareness, 80% were aware of water efficiency incentive programs, 76% were aware of education-related programs, 70% were aware of water audits, and 55% were aware of online water efficiency tools.

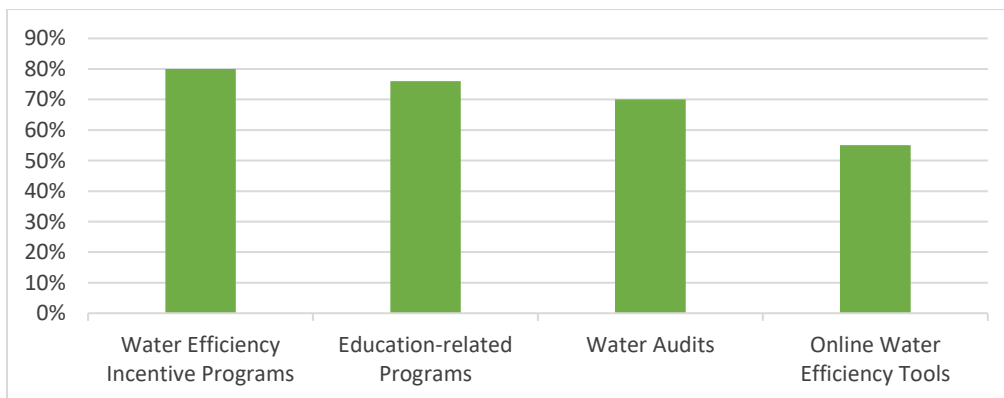


Figure 1. Percentage of respondents aware of four primary categories of conservation programming among all participants.

Figure 2 indicates that across the board, survey respondents felt that Greeley’s water conservation programs were important, with a total of 94% of respondents reporting that the

programs were important or very important. Notably, when the results were analyzed for those respondents that were completely *unaware* of Greeley’s four various conservation programs prior to completing the survey, the vast majority (approximately 90%) of these respondents still felt Greeley’s conservation programs were very important or important.

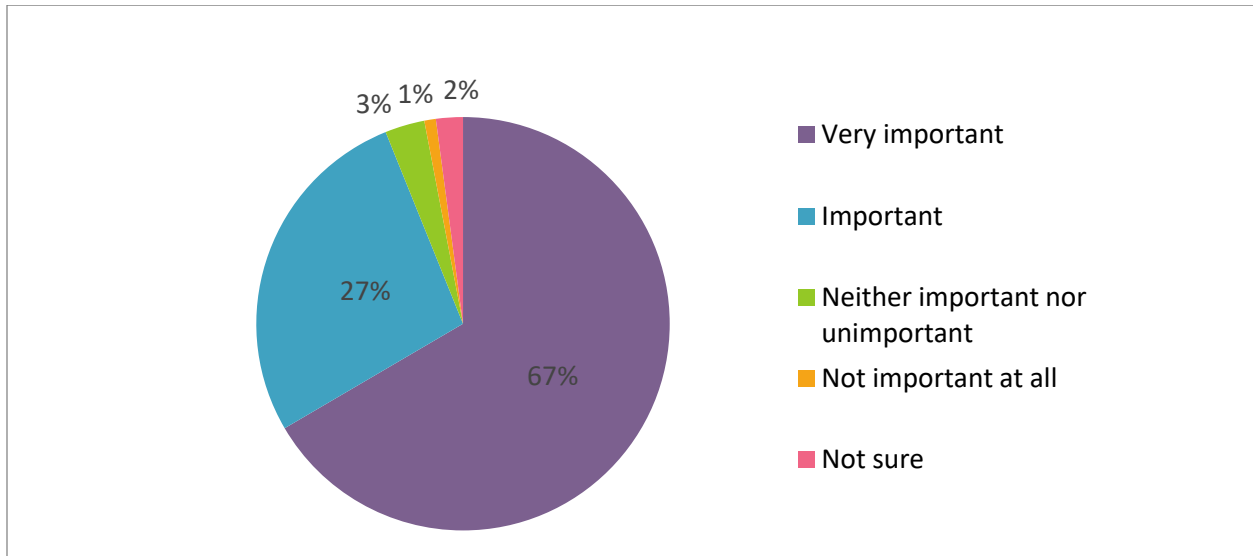


Figure 2. Importance of Greeley’s Water Conservation Programs.

These results are a strong indication that Greeley’s water conservation programs are valued amongst their customers and customers are largely aware of the various available programs. The exception to this high level of customer awareness is the online efficiency tools. There are benefits to continue additional outreach efforts, particularly since these education-based tools will practically cost the same to update and maintain regardless of how many customers utilize the tools.

Outreach Strategies

Figure 3 captures how respondents prefer to receive information about Greeley’s water conservation programs. Sixty-four percent (64%) indicated that they prefer email updates or updates through the monthly newsletter, followed by 37% that prefer bill inserts, and 30% that prefer the Greeley Water website. These results suggest that Greeley should continue – and perhaps increase – communications through email campaigns and the monthly newsletter, which is a relatively cost-effective and quick way to connect with customers.

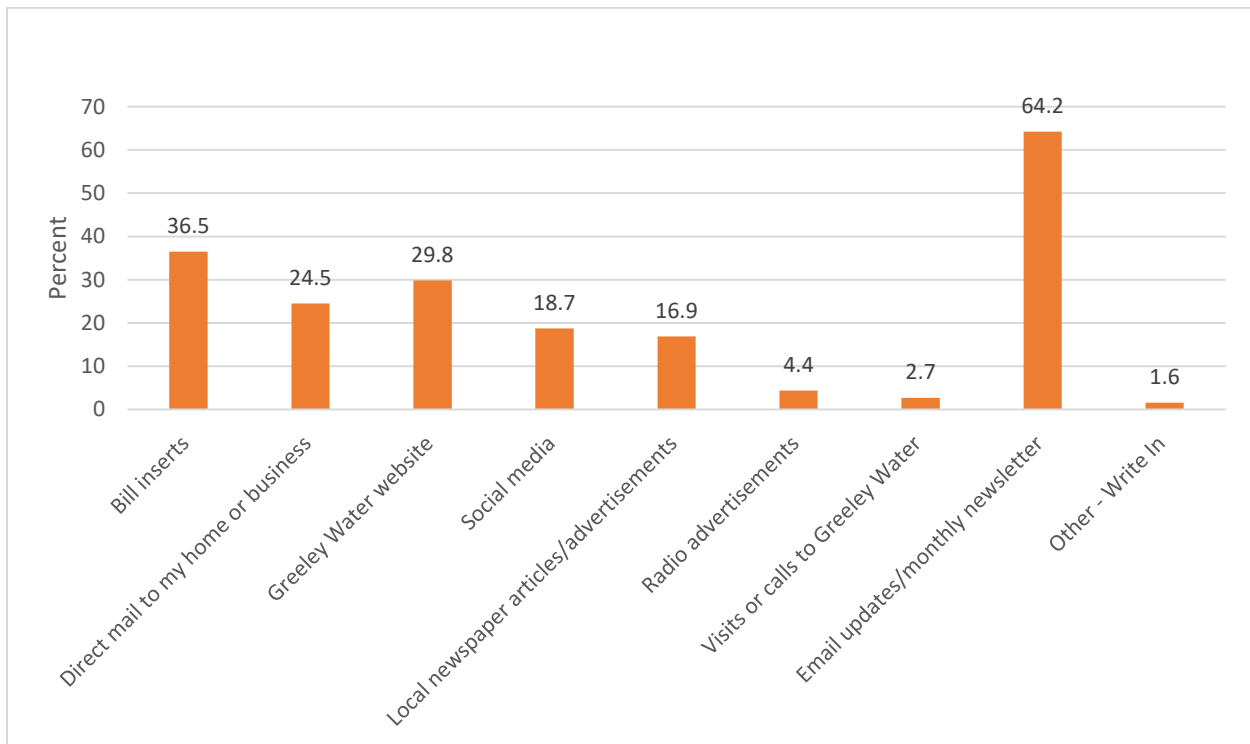


Figure 3. Preferred Contact Method for Greeley Water Conservation Information.

Communication through email updates and/or the monthly e-newsletters was the most popular for all age brackets except ages 18-24. For the 18-24 age bracket, social media was most preferred. If Greeley is interested in effectively reaching this target audience, investment in compelling and frequent social media content could be fruitful.

Participant Motivations

As Figure 4 illustrates, when survey respondents were asked what would motivate them to participate in a Greeley water conservation program in the future, the most common response was to save money on water bills (85%), followed by protecting Greeley’s limited water resources (65%), to reduce personal use (47%), and to support community values (38%). To save more water than my neighbors (14%) was the least frequently reported motivational values.

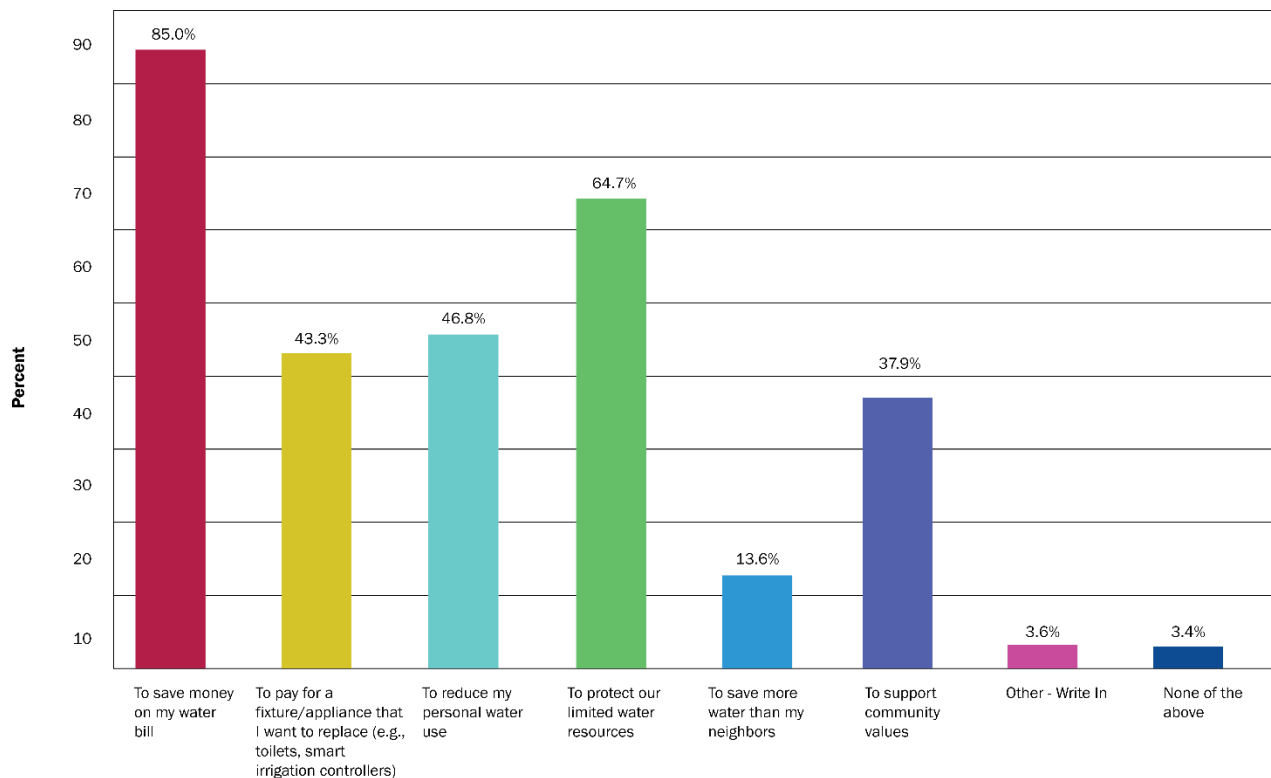


Figure 4. Motivation for participating in future water conservation programming.

Participant motivations remained consistent for both respondents that were unaware of Greeley’s water conservation programs prior to the survey and for respondents of Hispanic, Latino or Spanish origin compared to other respondents. While saving money on water bills was consistently the top response across all income levels, individuals in the lowest income bracket were next most motivated by supporting community values (60%).

Additionally, Figure 5 shows that 31% of survey respondents reported that they could reduce both indoor and outdoor water use easily. A slightly greater percentage (39%) felt it would be easier to reduce the amount of water they now use for outdoor landscaping and gardening. Notably, only 24% of respondents felt they could neither reduce their indoor nor outdoor water use easily. It’s unclear from the results whether respondents felt they couldn’t reduce their water use because they had already taken dramatic action to do so, they simply were unmotivated to reduce their use, or if they faced barriers that made it challenging to reduce

their use (e.g. cost, expertise, labor, etc.).

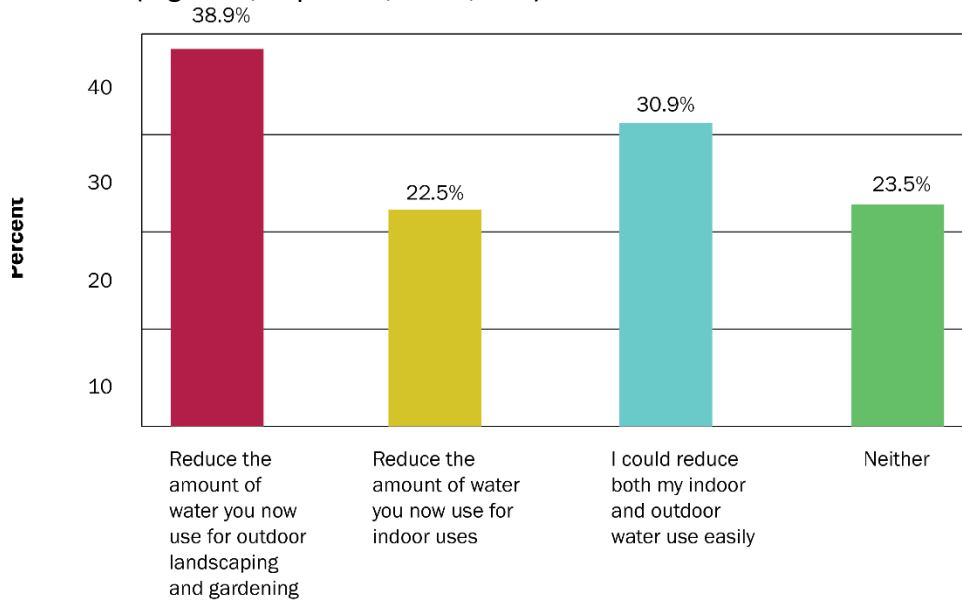


Figure 5. Ease of saving water indoors and outdoors.

Past & Future Program Participation

For each of the four primary categories of conservation programs (1) educational programs, 2) water audits, 3) water efficiency incentive programs, and 4) online water efficiency tools), respondents were asked:

- a. *Past Participation* - Which programs have you participated in over the past 5 years?
- b. *Water Savings Actions* - What water saving actions resulted from your program participation?
- c. *Rating* - How helpful did you find the the specific program on a scale of 1-5, with 1 being least helpful and 5 being most helpful?
- d. *Future Participation* - How likely are you to participate in the program within in the next 3 years?

Survey results are summarized below and additional information on past program participation can be found in the quantitative analysis results section.⁷

⁷ Section X summarizes results from the quantitative analysis of Greeley’s water conservation programs and includes some – but not all – of Greeley’s conservation programs. The quantitative analysis focuses on rebate and audit programs, rather than educational programming and online tools. The analysis also only includes programs with sufficient data that were active between 2013-2018, excluding some more recent program additions. Since the quantitative analysis results are not comprehensive of all Greeley conservation programs, the survey results can give us a comparative sense of participation levels. However, as noted above, it is clear from comparing survey

1. Educational Programs

a. Past Participation

Illustrated in Figure 6, the landscape lecture series (32%) and Xeriscape education (23%) were the most common programs for respondents to have participated in within the past five years. 56% of respondents had not participated in any educational programs.

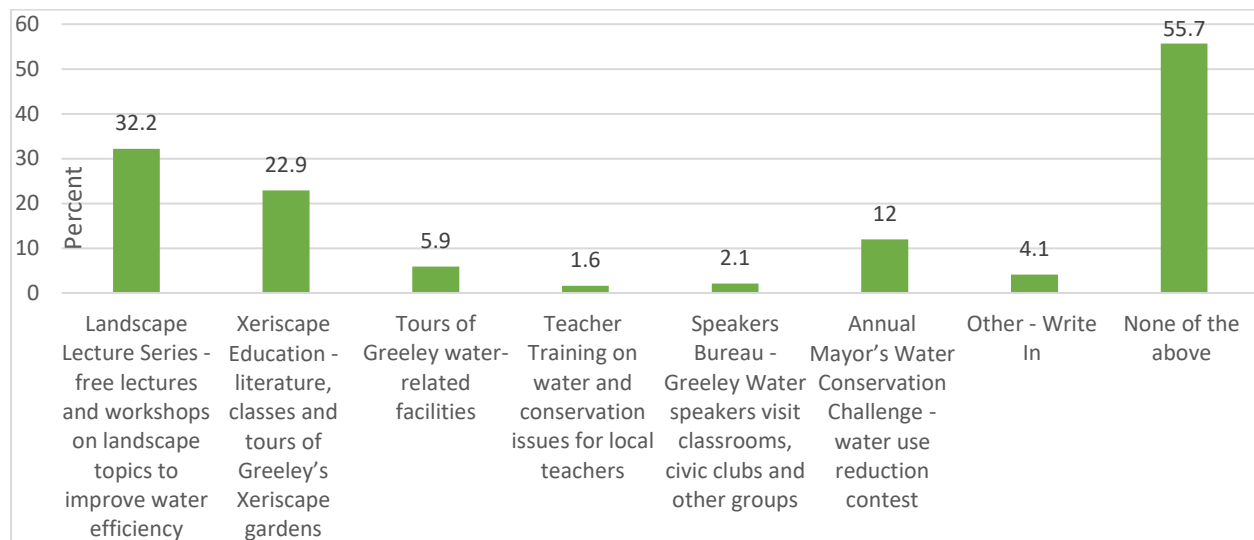


Figure 6. Past Participation in Education-Related Programs.

b. Water Savings Actions

As Figure 7 shows, while water savings associated with educational programs can be challenging to quantify, when asked if respondents had taken some kind of water savings action after participating in an educational program, the vast majority affirmed that they had taken one or more actions that included, but were not limited to:

- Changing their water use behavior in some way (57%)
- Switching to more waterwise plants or landscaping practices (55%)
- Updating or adjusting their irrigation system to improve water efficiency (54%)

results with actual participation numbers in Section X that survey respondents were more likely to participate in conservation programming than Greeley's general public.

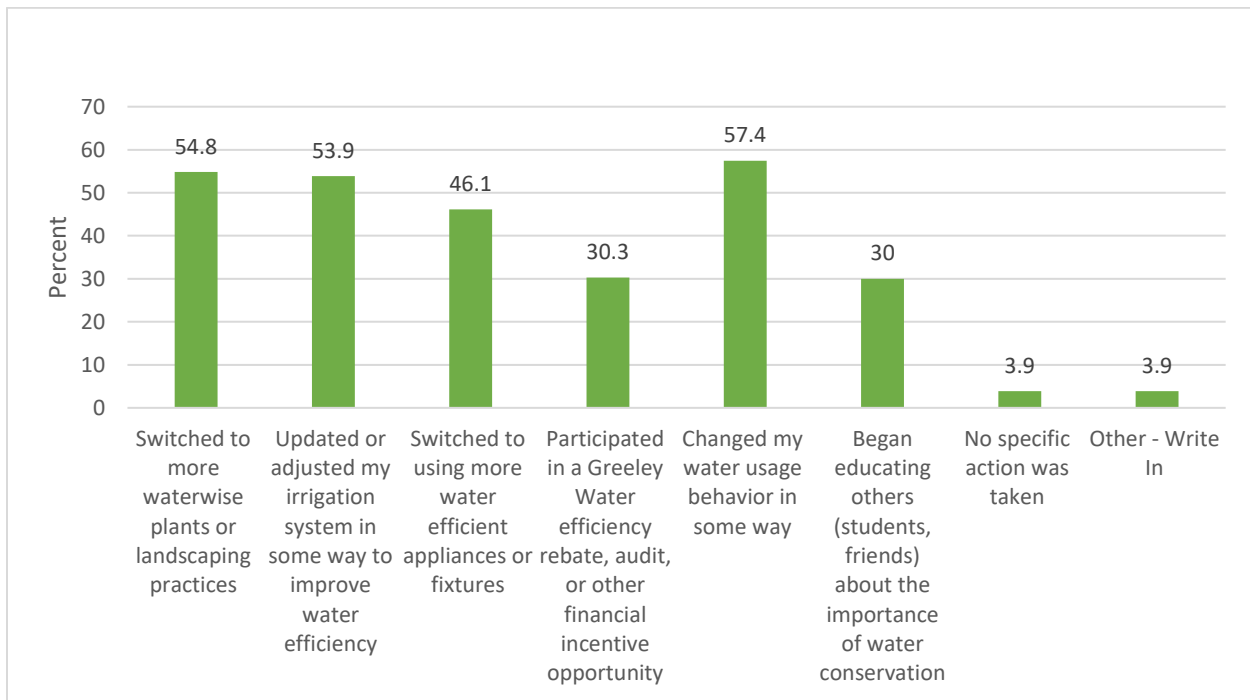


Figure 7. Water saving action taken after participating in and Educational Program.

c. Rating

Most respondents found the education programs they participated in to be helpful or very helpful on a scale of 1-5 with one being the less helpful and five being very helpful. The most popular programs for past participation were also the highest scoring programs, using this metric. Ninety-one percent (91%) of respondents rated the Landscape Lecture Series as helpful or very helpful, followed by the Xeriscape Education/Tour (89%). Tours of Greeley Water Facilities and the Annual Mayor’s Water Challenge had slightly lower responses, with 74% and 65% of respondents, respectively, ranking them as helpful or very helpful. Interestingly, while the Annual Mayor’s Water Challenge had larger participation numbers than the Tours of Greeley Water Facilities, it was reported as slightly less helpful than the facility tours.

d. Future Participation

Consistent with the past participation results, as Figure 8 illustrates, the Landscape Lecture Series (57%) and Xeriscape Education (53%) were the most common programs for respondents to express interest in participating in within the next 3 years. Interestingly, 26% of respondents were also interested in tours of Greeley water-related facilities, compared to just 6% of respondents who had participated in tours in the past (a 20-percentage point gap). Comparatively, while 12% of respondents had participated in the Mayor’s Water Conservation Challenge in the past, only 20% of respondents expressed an interest in participating in the future (an 8-percentage point gap). Seventy-seven percent (77%) of all respondents were

interested in participating in future educational programs, far more than the 44% that had participated in any of these programs in the past, suggesting a strong amount of interest in exploring more education programs among survey respondents.

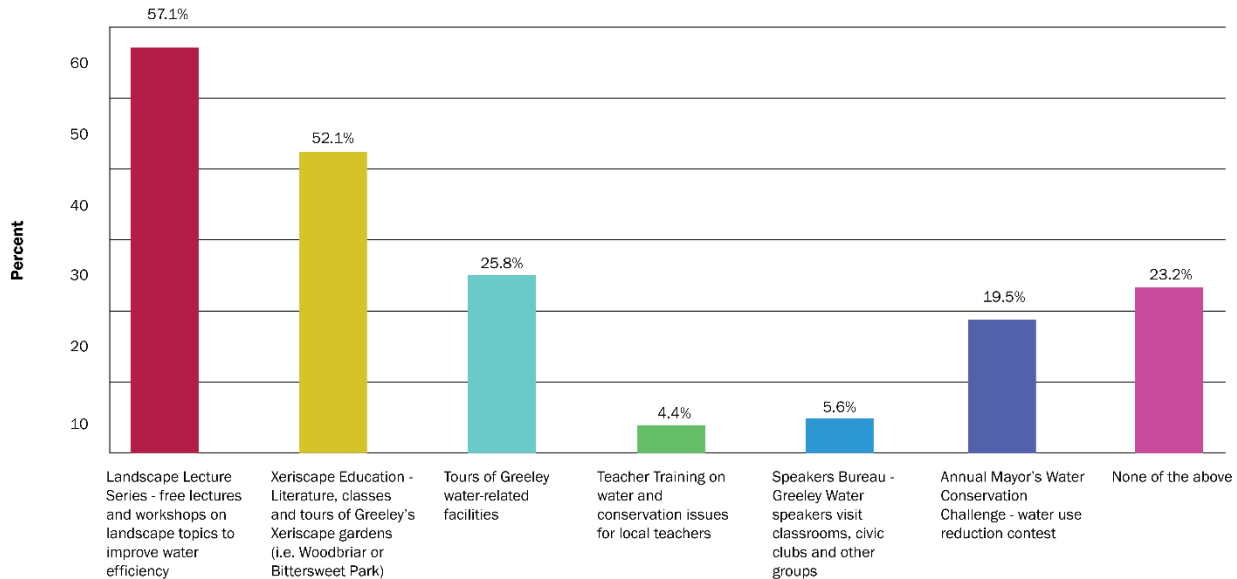


Figure H. Participant interest in future participation in Educational Programs.

Future participation results remained consistent amongst those respondents who were unaware of the educational programs prior to the survey. However, as one might expect, a greater percentage – 40% of these respondents, compared to 23% of all survey respondents – were not interested in participating in education programs in the future. Amongst survey respondents in the lowest income bracket, a slightly smaller percent was interested in the Landscape Lecture Series (36%) and Xeriscape Education (44%), however, respondents in this income bracket were slightly more interested in Tours of Greeley Water facilities (36%). Amongst respondents of Hispanic, Latino or Spanish origin, results were fairly consistent with overall survey responses, however, respondents expressed more interest in the Annual Mayor’s Water Challenge (28% compared to 20% for all respondents) and less interest in Xeriscape Education (44% compared to 53% for all respondents).

2. Water Audits

a. Past Participation

Figure 9 shows that of the survey respondents, 24% had participated in an outdoor irrigation audit, 13% had participated in an indoor water audit, and just 2% had participated in commercial audits. 72% of respondents had not participated in any water audit programs.

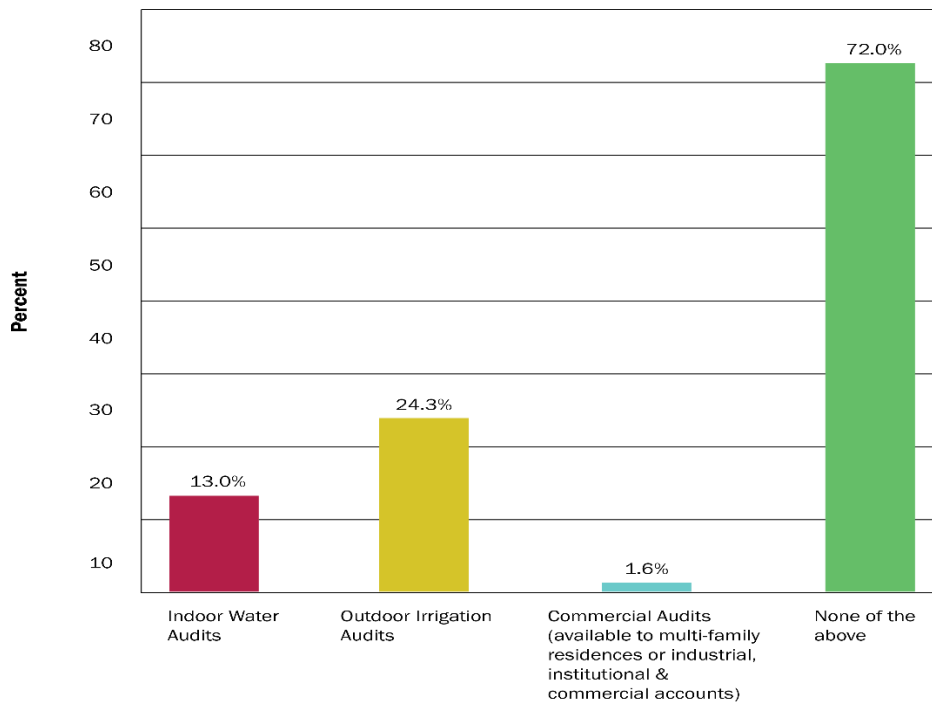


Figure 9. Past Participation in Water Audits.

b. Water Savings Action

After completing a water audit, most respondents took some type of water saving action. Captured in Figure 10, for indoor audits, such actions included: receiving and installing a free low flow showerhead(s) and/or faucet aerator(s) (79%), changing their water use behavior in some way (59%), and upgrading an old high-water use appliances/fixture to a water efficient appliance/fixture (41%). For outdoor irrigation audits, captured in Figure 11, common actions included: adjusting their irrigation watering schedule (74%), adjusting their irrigation system to improve water efficiency (48%), receiving a rebate from Greeley Water to install a smart sprinkler controller (31%), and switching to more water wise plants or landscaping practices (31%).

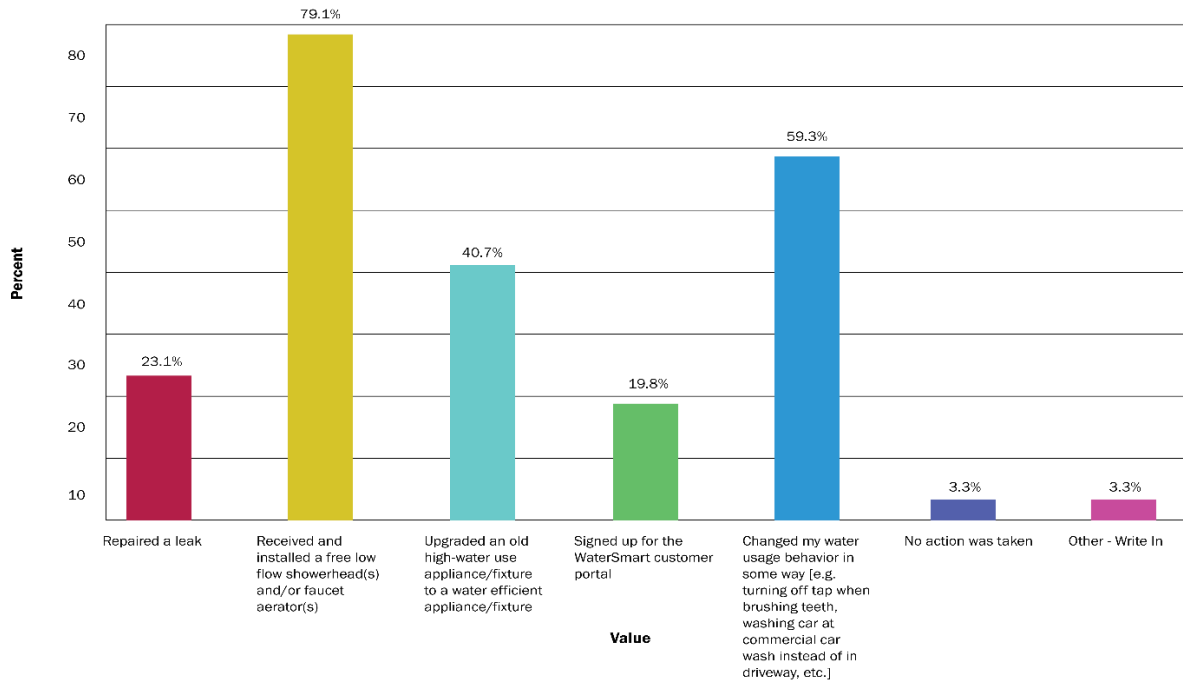


Figure 10. Water savings actions taken as a result of indoor water audit.

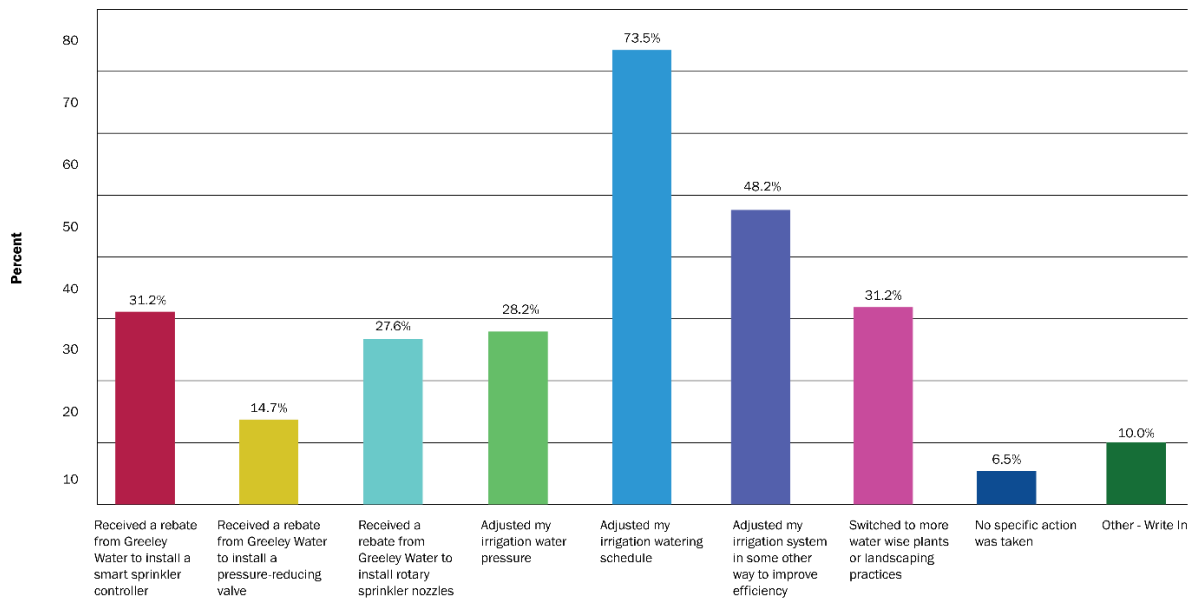


Figure 11. Water savings action taken as a result of outdoor water audit.

c. Rating

The vast majority of survey respondents who participated in a water audit found the program to be helpful or very helpful (i.e., scoring them a 4 or 5 on a scale of 1-5 with 5 being very

helpful). Residential Outdoor Irrigation Audits scored the highest (86% of respondents who participated ranking them as helpful or very helpful), followed closely by Commercial Audits (Indoor and/or Outdoor) (83%) and Residential Indoor Audits (81%). Additionally, 89% of respondents that received an outdoor irrigation rebate following their irrigation audit found that rebate to be helpful or very helpful (i.e., scoring them a 4 or 5 on a scale of 1-5).

d. Future Participation

Consistent with the past participation results, Figure 12 shows that the Residential Outdoor Irrigation Audit (45%) was the program that respondents expressed the most interest in participating in in the future. Forty percent (40%) of respondents were also interested in taking advantage of Outdoor Irrigation Rebates, available to those that have participated in a Residential Outdoor Irrigation Audit. Thirty-one (31%) of respondents were interested in participating in Residential Indoor Water Audits in the future.

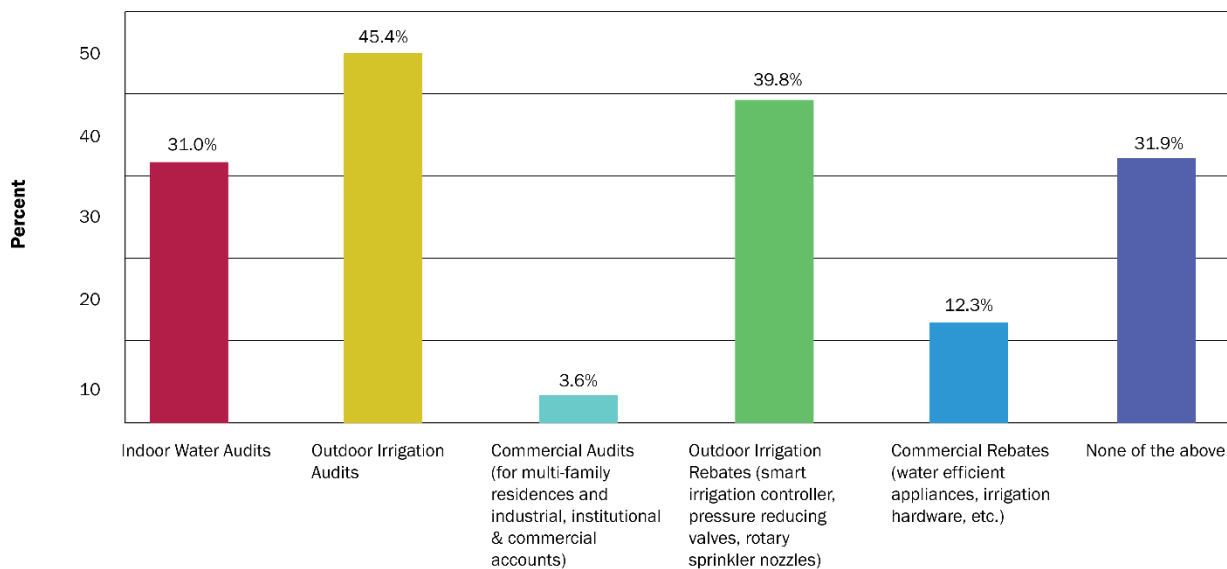


Figure 12. Participant interest in future participation in Water Audits.

For those that were unaware of Greeley’s audit program prior to this survey, outdoor irrigation rebates (36%) and residential irrigation audits (32%) remained the most popular opportunities for future participation. Survey respondents in the lowest income bracket expressed less interest in all audits compared to higher income respondents. Whereas respondents of Hispanic, Latino or Spanish origin expressed slightly more interest in outdoor irrigation rebates (50% compared to 26% for those of non-Hispanic, Latino or Spanish origin) and more interest in commercial rebates (26% compared to 11% for those of non-Hispanic, Latino or Spanish origin).

3. Water Efficiency Incentives

a. Past Participation

Captured in Figure 13, the Free Low-Flow Showerhead Exchange was the most common water efficiency program for survey respondents to have participated in (22% of respondents), followed by the High Efficiency Toilet Rebate (17%), and the discounted Garden in a Box Kit (15%). The Showerhead Exchange and Garden in a Box program, in particular, are perhaps most well-utilized since they have very low barriers to entry as they are open to both homeowners and renters and only require having a shower or a space to grow a garden. On the other hand, the Life After Lawn Program was the least common for past participation (8%) perhaps due to the fact that this program only launched in 2020 during the COVID pandemic and requires a more significant investment of time and funding from the participant.

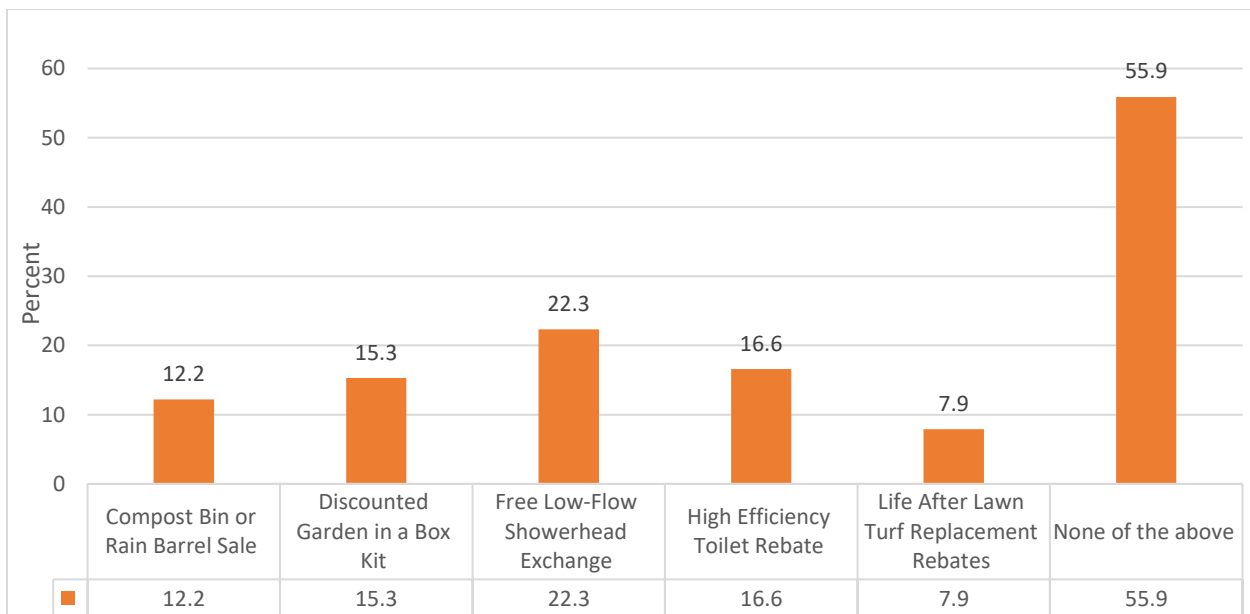


Figure 13. Past participation in Water Efficiency Incentives.

b. Rating

The vast majority of participants – at least 84% of participants for all programs – found the Water Efficiency Incentive to be valuable or very valuable (indicated by rating programs a 4 (valuable) or 5 (very valuable) on a scale of 1-5). The high efficiency toilet rebate ranked the highest at 94%, followed by the Garden in a Box program at 92%. The program that the most respondents had participated in – the Low-Flow Showerhead Exchange – was rated as slightly less valuable (88%).

c. Future Participation

Figure 14 shows that discounted Garden in a Box kits (48%) and Life After Lawn turf replacement rebates (39%) rose to the top as the most popular incentive opportunities for future participation. Free Low-Flow Showerheads were less popular (19%), perhaps due in part to community saturation, given the greatest percentage of survey respondents had participated in showerhead exchanges in the past (22%) and the perceived economic value (cost is approximately \$20-\$40). Only 19% were not interested in any efficiency incentive programs.

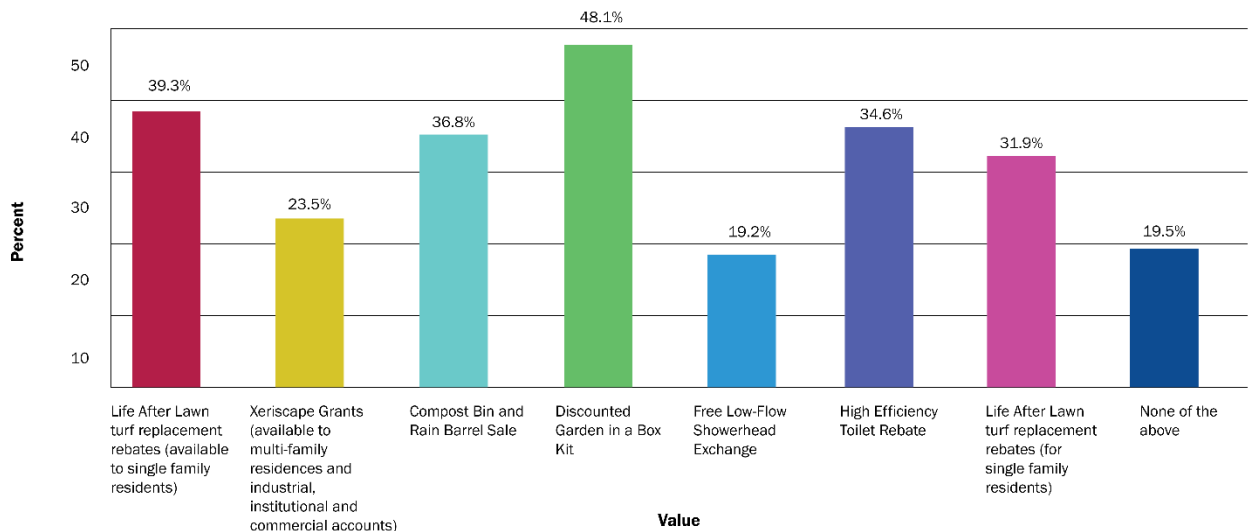


Figure 14. Participant interest in future participation in Water Efficiency Incentives.

For those that were unaware of efficiency incentive programs, respondents were most interested in high efficiency toilet rebates (38%), followed closely by compost bin and rain barrel sales (36%) and discounted Garden in a Box kits (36%). For respondents in the lowest income bracket, a larger percent (43%) expressed that they were not interested in any of the incentive programs, compared to 19% for all survey respondents. However, for those in the lowest income bracket that *were* interested in incentive programs, respondents expressed the most interest in Life After Lawn (32%) and High Efficiency Toilet Rebates (32%).

For most programs, respondents of Hispanic, Latino or Spanish origin, expressed slightly more interest in efficiency incentives than those of non-Hispanic, Latino or Spanish origin, particularly the High Efficiency Toilet Rebate (52% compared to 34% for non-Hispanic, Latino or Spanish Origin) and the Life After Lawn program (46% compared to 39% for those of non-Hispanic, Latino or Spanish origin). The reverse was true for the Compost Bin and Rain Barrel Sale in which just 24% of respondents of Hispanic, Latino or Spanish origin were interested in participating in the future, versus 38% of non-Hispanic, Latino or Spanish origin respondents.

d. Life After Lawn Results

In conversation between the Project Team and Greeley Water staff, Greeley staff expressed a targeted interest in potentially expanding its existing Life After Lawn Program. Thus, the survey included several questions specific to this program. Encouragingly, Figure 15 shows 59% of survey respondents said they would be “very willing” or “may consider” removing grass from their front yard, while only 16% said they would not consider this. Figure 16 shows that when asked what the primary barriers keeping them from replacing grass with low water landscaping were, the most common responses were cost (62%) and physical labor involved (52%), both barriers that can be mitigated, in part, through expanded Life After Lawn Program funding opportunities.

Interestingly, 28 individual respondents wrote-in under the “Other” category that HOA rules and restrictions were their biggest barrier to replacing some or all of their grass. In Colorado, as of 2021, HB 21-1229 increases protections for property owners in HOA-guided communities and does not allow for HOAs to mandate turf grass or prohibit water wise landscaping.⁸ It’s most likely that these respondents were not aware of this policy change and it may be fruitful for Greeley Water to conduct a targeted outreach campaign to both homeowners and HOA governing bodies to update them on this change.

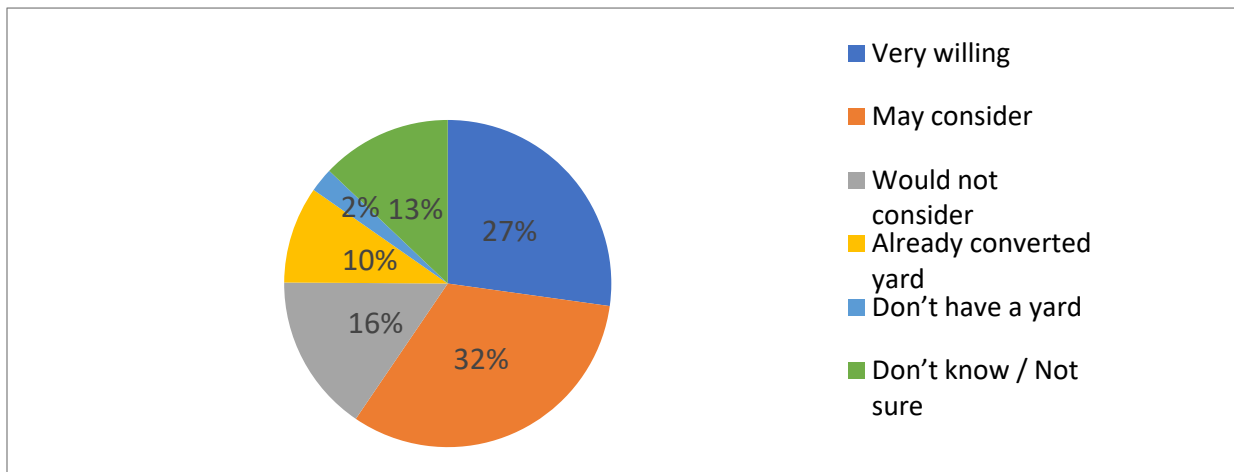


Figure 15. Participant willingness to remove grass from their front yard.

⁸ <https://leg.colorado.gov/bills/hb21-1229>

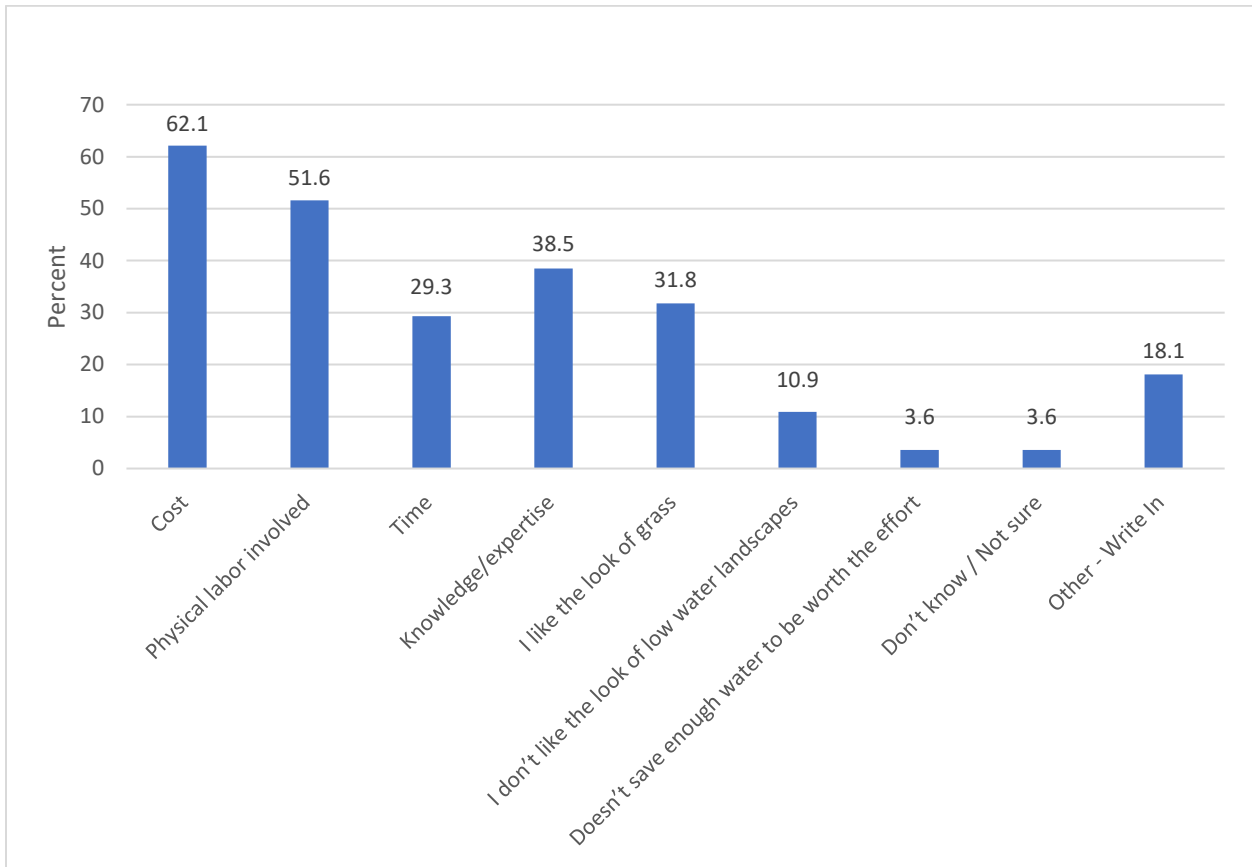


Figure 16. Primary barriers to replacing turf.

4. Online Water Efficiency Tools

a. Past Utilization

Figure 17 shows that of those respondents that had used Greeley’s online tools, Greeley’s Water Conservation webpage was most common (26%) followed by the Online Plant Database (20%). The Water Budget Portal (15%) and WaterSmart Customer Portal (11%) were less commonly used. 59% of respondents had not used any of Greeley Water’s online tools.

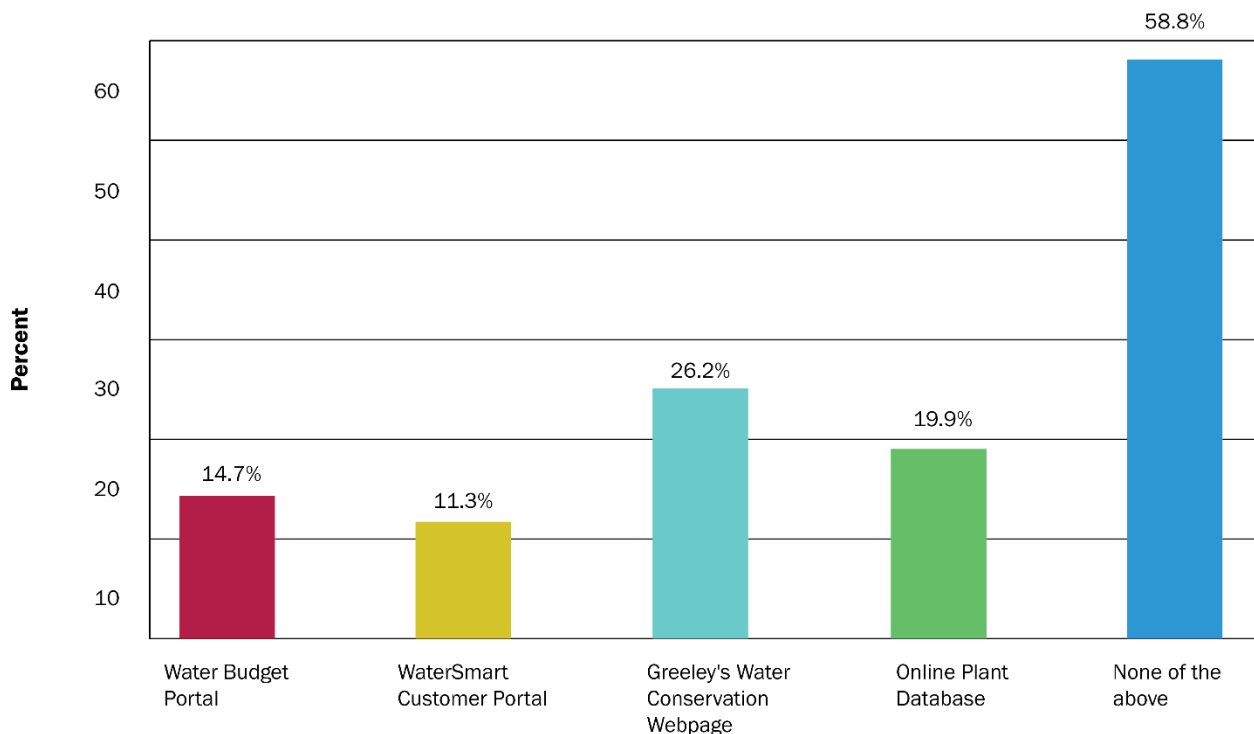


Figure 17. Past Utilization of Greeley Water Online Water Efficiency Tools.

b. Rating

The majority of respondents who had used Greeley’s Online Water Efficiency Tools found them to be helpful or very helpful (i.e., scoring them a 4 or 5 on a scale of 1-5). The Online Plant Database scored the highest (92%), followed by the Water Conservation Webpage (86%), the WaterSmart Customer Portal (76%) and the Water Budget Portal (76%).

c. Motivation for using WaterSmart Portal

The WaterSmart Portal was of particular interest to Greeley staff as this is a relatively new tool and staff have been conducting a significant outreach effort around the tool. Thus, an

additional question was asked to determine why respondents were utilizing the WaterSmart Portal. Of those that utilized the customer portal, most respondents used it to learn more about their water use (73%) and to find out what the water budget was and better understand the portal (71%).

d. Future Utilization

Unlike past participation results, Figure 18 illustrates that respondents were most interested in using the Online Plant Database in the future (53%) compared to the Water Budget Portal (44%), WaterSMART Customer Portal (43.3%), and Water Conservation Webpage (42%). The results remained consistent for respondents that were unaware of Greeley’s Online Water Efficiency Tools prior to the survey, with the largest percentage interested in using the Online Plant Database (44%). Since the Online Plant Database, in particular, was less likely to have been used in the past, these results suggest that participants may be more interested in utilizing this resource once they are reminded of it or made aware of it.

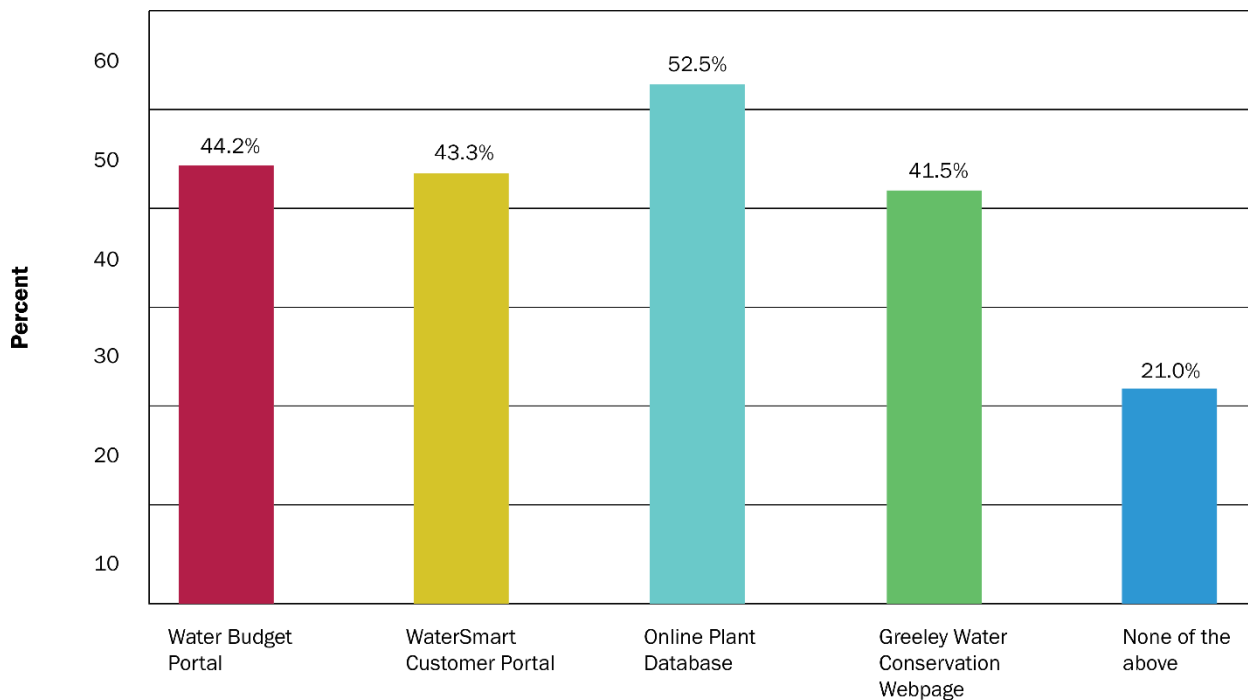


Figure 18. Participant interest in future participation in Online Efficiency Tools.

Compared to other income brackets, the lowest income bracket was most interested in Greeley’s Water Conservation Webpage (57% compared to 42% for all survey respondents). Respondents of Hispanic, Latino or Spanish origin were more interested in the Water Budget Portal (59% compared to 43% of those of non-Hispanic, Latino or Spanish origin) and the WaterSMART customer portal (56% compared to 43% of those of non-Hispanic, Latino or Spanish origin). Those of Hispanic, Latino, or Spanish origin were less interested in using the

Online Plant Database (43% compared to 54% of those of non-Hispanic, Latino or Spanish origin).

Key Findings from the Customer Survey

Importance & Effectiveness of Conservation Programming

Survey results demonstrate that Greeley's Water Conservation Program is popular, impactful, and highly valued. Overwhelmingly, survey respondents found Greeley's Water Conservation program to be important, with 94% reporting that the programs are important or very important. This finding is perhaps even better exemplified by the numerous respondents that chose to write-in on the survey with positive feedback on the various programs. For example, one respondent said, "I'm impressed by the efforts the water education program is making and their foresight given our growing population in a dry climate. Programs are very accessible for residents." Another wrote, "Please continue to offer these types of programs. Conserving water is critical here in the West." Still another noted, "It does not matter how many times I interact with a Greeley water official. They are always very informative and willing to help." In fact, several Greeley Water Conservation staff members were even mentioned by name in these positive comments.

Across the board, the survey results indicate a strong degree of awareness of, interest in, participation in, and value derived from Greeley's current portfolio of Water Conservation Programs, as demonstrated in the analysis below. Compared to those that had participated in programming in the past, for almost all programs the percentages increased when asked whether respondents wanted to participate in programming in the future.

Outreach Strategies

Greeley Water can most effectively reach their customers with conservation opportunities through email updates and the monthly newsletter, bill inserts, and the Greeley Water website. It should be noted that for younger demographics, ages 18-24, investment in compelling and frequent social media content could be fruitful. Messages that may resonate with Greeley Water customers, based on survey participants water conservation motivations, include: saving money on water bills, protecting Greeley's limited water resources, reducing personal use, paying for a fixture or appliance, and supporting community values.

Educational Programs

The Landscape Lecture Series and Xeriscape Education were consistently the most common programs for respondents to have participated in the past, the programs that were rated as most helpful and the most common programs for respondents to be interested in participating in within the next 3 years. Interestingly, there was a strong increase in interest for future participation in tours of Greeley Water Facilities, compared to those that had participated in the past (26% compared to 6%). And respondents in the lowest income bracket were slightly more interested in these tours than other income brackets (36% compared to 26%). The Annual Mayor's Water Challenge, on the other hand, scored the lowest of the Educational Programs on interest in future participation and the rating of how helpful the program was for those that

had participated in the past. Respondents of Hispanic, Latino or Spanish origin expressed greater interest in the Mayor’s Water Challenge than those of non-Hispanic, Latino, or Spanish origin (28% compared to 20%).

While the water savings benefits associated with educational programs can be challenging to quantify, the vast majority of respondents affirmed that they had taken some kind of water savings action as a result of participating in an educational program, including switching to more waterwise plants or landscaping practices and updating or adjusting their irrigation system to improve water efficiency, among other actions.

The Educational Program results suggest that Greeley Water should prioritize – and perhaps even expand – its Landscape Lecture Series and Xeriscape Education offerings. There’s also a strong interest in participation in tours of Greeley Water facilities. The Annual Mayor’s Water Challenge was slightly less popular. However, given the relatively low cost of participation in the program by the City and Greeley’s history of scoring consistent high for resident participation compared to other cities in the region, it is likely worthwhile to continue this annual tradition.

Water Audits

The Residential Outdoor Irrigation Audit was consistently the most common program for respondents to have participated in in the past, the program that was rated as most helpful and the most common program for respondents to be interested in participating in within the next 3 years (45%). The Outdoor Irrigation Rebates, available to those that have participated in an Outdoor Irrigation Audit, were also widely of interest to respondents for future participation (40%). Respondents of Hispanic, Latino or Spanish origin, in particular, expressed slightly more interest in Outdoor Irrigation Rebates than those of non-Hispanic, Latino or Spanish origin (50% and 40%, respectively).

Residential indoor audits were reported as less popular, though 31% of respondents were still interested in participating in the future. Notably, since this survey was administered, Greeley Water has seen a significant increase in sign-ups for Residential Indoor Audits related to the City’s roll-out of Advanced Metering Infrastructure and leak detection notifications.

Commercial Audits and Rebates were more challenging to compare in this survey as 96% of respondents identified as Greeley residents and only 4% identified as Greeley business/commercial customers. Thus, the relatively low Commercial Audit program interest is directly correlated to the low number of overall commercial customers that participated in the survey.

Across the board, the majority of past water audit participants reported that they had taken some kind of water saving action as a result of the audit (e.g. receiving and installing a low flow showerhead and/or faucet aerator or adjusting their irrigation watering schedule). Based on

these findings, Greeley Water should continue to prioritize its Residential Outdoor Irrigation Audit program and associated Irrigation Rebates. The results do not suggest that the City should discontinue any of its water audit offerings at this time.

Water Efficiency Incentives

While the Free Low Flow Showerhead Exchange was the most common program for respondents to have participated in within the last five years (22%), discounted Garden in a Box kits (48%) and Life After Lawn turf replacement rebates (39%) rose to the top as the most popular incentive opportunities for future participation. The Free Low Flow Showerheads were reported as the least popular for future participation (19%). The vast majority of past participants found all programs to be very valuable (at least 84%), however the high efficiency toilet rebate ranked the highest (94%) followed by the Garden in a Box program (92%).

Respondents that were unaware of efficiency incentive programs prior to taking the survey expressed more interest in high efficiency toilet rebates (38%), followed closely by compost bin and rain barrel sales (36%) and discounted Garden in a Box kits (36%). Respondents in the lowest income bracket, expressed the most interest in Life After Lawn (32%) and High Efficiency Toilet Rebates (32%). And those of Hispanic, Latino or Spanish origin, expressed slightly more interest in efficiency incentives than those of non-Hispanic, Latino or Spanish origin, particularly the High Efficiency Toilet Rebate (52%) and the Life After Lawn program (46%).

The majority of respondents (59%) also expressed a willingness to replace all or some of their lawns with water efficient landscaping and indicated that cost and physical labor were the primary barriers keeping them from taking this step. One could expect that participation in the Life After Lawn Program and Garden in a Box Program would help to negate these barriers.

The results suggest that the Life After Lawn program, the Garden in a Box program, and the High Efficiency Toilet Rebate program (due to its interest among the lowest income bracket and those unaware of conservation programming) should be prioritized by Greeley Water moving forward. Greeley Water may wish to assess participation at upcoming events in its Low Flow Showerhead Exchange Program to determine, as this survey suggests, whether this program may have reached community saturation at this time. Still, the Low Flow Showerhead Exchange Program is one of the more accessible programs to all Greeley residents, including renters, and can readily be “coupled” with other conservation program offerings (e.g. giveaways at a Landscape Lecture Series).

Online Water Efficiency Tools

Of the four main categories of programming, respondents were least aware of the Online Water Efficiency Tools compared to other programming categories, suggesting a potential benefit of increased outreach and communication efforts around these specific tools. The Online Plant Database, however, scored consistently high for respondents that had used the

tool in the past (20%), were interested in using it in the future (53%) and found the tool to be helpful or very helpful (92%).

Compared to other income brackets, respondents in the lowest income bracket were most interested in Greeley's Water Conservation webpage (57%). Respondents of Hispanic, Latino or Spanish origin were more interested than those of non-Hispanic, Latino and Spanish origin in the Water Budget Portal (59%) and the WaterSmart customer portal (56%).

The results do not suggest that any of Greeley's Online Water Efficiency Tools should be discontinued, however, should limited capacity and resources exist for tool updates, it may be most beneficial to prioritize the Online Plant Database. Outreach and communication efforts should expand, to the extent possible, for all the online tools.

Future Water Conservation Programming Opportunities

Some respondents also chose to write-in recommendations for additions or modifications to Greeley Water Conservation programming. Some common themes included:

- Expand the Life After Lawn program to provide financial incentives for back yards, not just front yards.
- Provide graywater kits.
- Encourage and provide rebates for residents to do more mulching.
- Provide brochures on various water conservation programming to real estate agents.
- Provide yards signs to individuals participating in Outdoor Irrigation Audits and Life After Lawn.

Considerations for Future Surveys

Greeley's Water Conservation Program should endeavor to complete a Water Conservation Customer Survey every 5-7 years to stay informed on customers' values and interests, and to analyze trends and changes in respondent answers over time. To the extent feasible, the majority of the questions should remain fairly consistent between surveys to demonstrate any changes or trends over time. However, questions will likely be adjusted based on changes to the Water Conservation Program Portfolio and Greeley Water priorities.

Without asking specific questions on new programming or recommendations, this survey garnered a number of written responses with suggestions for updates to Greeley's Water Conservation Program portfolio. Because of this, in the future, Greeley may also consider adding questions about potential conservation programs under consideration by the City. For example, if the City adopted a graywater ordinance and wanted to consider providing free Laundry-to-Landscape parts kits, they could ask respondents about their interest in this program and what resources they would need to make their participation feasible.

Additionally, while the survey garnered 720 completed responses, it also had a 21% abandonment rate (meaning 191 additional people started the survey and did not complete it). This abandonment rate is typical for longer questionnaires and since respondents did not drop-off at a particular question or questions, we can deduce that the drop-offs were not due to survey design or technical issues and instead were primarily due to survey length.⁹ Survey abandonment both reduces a survey's sample size for analysis and can result in a less representative sample. While the project team was aware of the abandonment challenges of a longer survey from the outset, it was determined that asking all questions in this initial survey would be important to determining what data might be most significant. Given the outcomes of the survey, the project team would like to make the following recommendations for scaling-back this survey in future iterations:

- *Remove awareness questions* – Respondents were asked at the beginning of the survey which specific Greeley Water Conservation program they were “aware of” prior to completing the survey. These questions were primarily included in order to analyze results alongside interest in future programming (i.e. of those customers that Greeley Water hasn't effectively been reaching, how many are now interested in participating in a given program in the future once they're made aware of that program). However, in almost all cases, the future participation results remained consistent between those that were aware of the program prior to the survey, and those that weren't.
- *Remove most written response boxes* – Past participants of the four main categories of conservation programs were provided an optional write-in box to share more about their participation. While many respondents took advantage of providing feedback and positive comments, a single write-in box for additional comments at the end of the survey would likely be sufficient to garner these responses while moving respondents more quickly through the survey.
- *Remove Life After Lawn Questions* – Specific Life After Lawn questions were included in the survey since this is a new Greeley Water Program and thus, more limited information would be gathered under the past participation and awareness results. While the findings may support program outreach efforts, the specific questions will likely not need to be included in future surveys as sufficient information will be gleaned from responses related to future participation.

Finally, given the City's interest in connecting with Hard-to-Reach populations, Greeley should consider translating the survey, and associated outreach materials, into Spanish and offering the survey bilingually.¹⁰ If this approach is taken, the City could analyze results based on those

⁹ Industry research shows that on average 15% will abandon a survey at 10 minutes and 20% will abandon at 60 questions: https://issuu.com/marymala/docs/survey_abandonment_rates

¹⁰ According to the National Library of Medicine, “Hard-to-Reach is a term used to describe those sub-groups of the population that are difficult to reach or involve in research or public health program due to their physical and geographical location . . . or their social and economic situation”:

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3963617/#:~:text=Introduction->

, 'Hard%2Dto%2Dreach'%20is%20a%20term%20used%20to,and%20economic%20situation%20%5B1%5D.

that participated in the survey in Spanish and determine which, if any, Water Conservation Programming might be most impactful to offer bilingually.

Survey Conclusion

The City of Greeley should be very proud of its efforts to build an extensive and valuable Water Conservation Program. The customer survey results will allow the City to expand on the success of its existing program and further hone in on how to reach their target audience. The survey results should be considered in unison with the quantitative analysis sections described below.

Quantitative Analysis of Greeley’s Water Conservation Programs

To complement the information gathered on Greeley’s Water Conservation Programs directly from participants through the survey, this project also analyzed geographic trends in participation among participants and quantified the water savings that resulted from participation in these programs. The following sections describe each of these approaches in greater detail.

Spatial Trends in Water Conservation Program Participation

This analysis used the 2019 U.S. Census Bureau’s American Community Survey (ACS) data,¹¹ combined with data tracking participation in Greeley’s water conservation programs, to explore if and how participation varies according to demographic characteristics, such as community members’ preferred language, identification as Hispanic or Latino by race and/or by origin, home ownership status, median household income, and internet access, among other characteristics. The goal of this analysis is to identify any trends or patterns in participation that could help to inform future outreach.

Participation in Greeley’s water conservation programs was compared to key demographic data from the US Census Bureau’s American Community Survey (ACS) dataset. For more details and descriptions of each data source included in this analysis, please see Appendix E.

This data was analyzed at the block group scale. Block groups are statistical divisions of census tracts, generally defined to contain between 600 and 3,000 people.¹² Block groups are the smallest geographical unit for which the US Census Bureau publishes sample data (data which is sampled from a portion of all households, rather than collected for each household). The analysis used block groups since they represented the most recent and most granular census data available at the time of the analysis.

¹¹ The American Community Service (ACS) data reflects information gathered annually by the U.S. Census Bureau. The Bureau poses questions to randomly sampled addresses each year, and then uses this information to calculate community demographic information. This ACS data complements the Decennial Census the Bureau conducts every 10 years, which seeks responses from every resident. For information, see: <https://www.census.gov/programs-surveys/acs/about.html>.

¹² U.S. Census Bureau. (2021). “Glossary.” Available: https://www.census.gov/programs-surveys/geography/about/glossary.html#par_textimage_4.

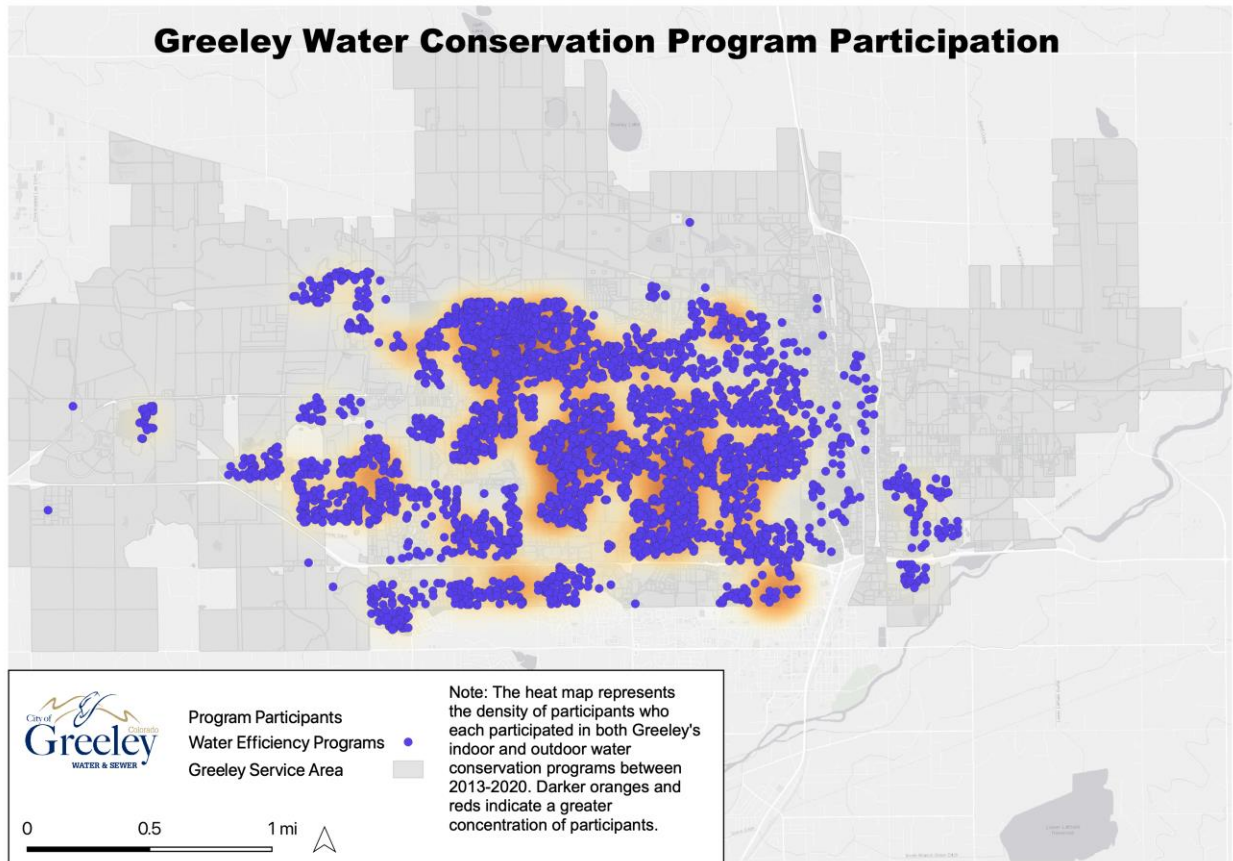


Figure 19. Greeley Water Conservation Program participation from 2013-2020.

As Figure 19 illustrates, participation in Greeley’s water conservation programs is densest in the center of the City, and sparser in the outer sections of Greeley’s service area, in the southwest quadrant of the city’s center, and in the northeast quadrant of the city’s center.

Figures 20 and 21 compare these geographic patterns in participation with different demographic characteristics. In the northeast and southwest quadrants of the City’s center, areas of sparser water conservation program participation are also areas with higher percentages of renter-occupied housing; with lower household income; and (particularly in the northeast section of the city’s center) with high percentages of residents speaking Spanish, Asian American or Pacific Islander (AAPI) languages, or Indo-European languages.

Around the perimeter of Greeley’s service area, water conservation program participation is also sparser, in part reflecting a lower population density in these areas of the City. New builds typically occur in the perimeter of the City, and are therefore likely to be water efficient indoors; however, there may still be opportunities for these customers to reduce their water use further, particularly through outdoor water conservation. These perimeter areas also differ somewhat in their demographics, as they represent areas with greater median household

income; lower percentages of residents speaking Spanish, an AAPI, or Indo-European language. The percentage of renter-occupied housing in these neighborhoods is lower overall, though it varies by block group. In general, the northern edge of the service area has larger percentages of renter-occupied housing, and the southwest corner of the service area has lower percentages of renter-occupied housing.

These demographic trends suggest that strategies for increasing participation within the City’s core might require strategies such as language translation (e.g., through partnerships with local community groups or non-profit organizations) and a particular emphasis on programs that renters are eligible to participate in. In-person events may be especially helpful, providing the opportunity for in-person translation to occur in a face-to-face setting and avoiding the need for Internet access, which may be lower in areas with lower median incomes. Engaging the outer perimeter of the city, in contrast, might be most effectively done through other forms of outreach, such as direct mail, bill inserts, or email outreach, that target participants spread across a wider area. This outreach might also highlight programs aimed at both renters and homeowners and include a focus on outdoor water use (reflecting the fact that outdoor water use may be higher in higher income, more sparsely populated areas).

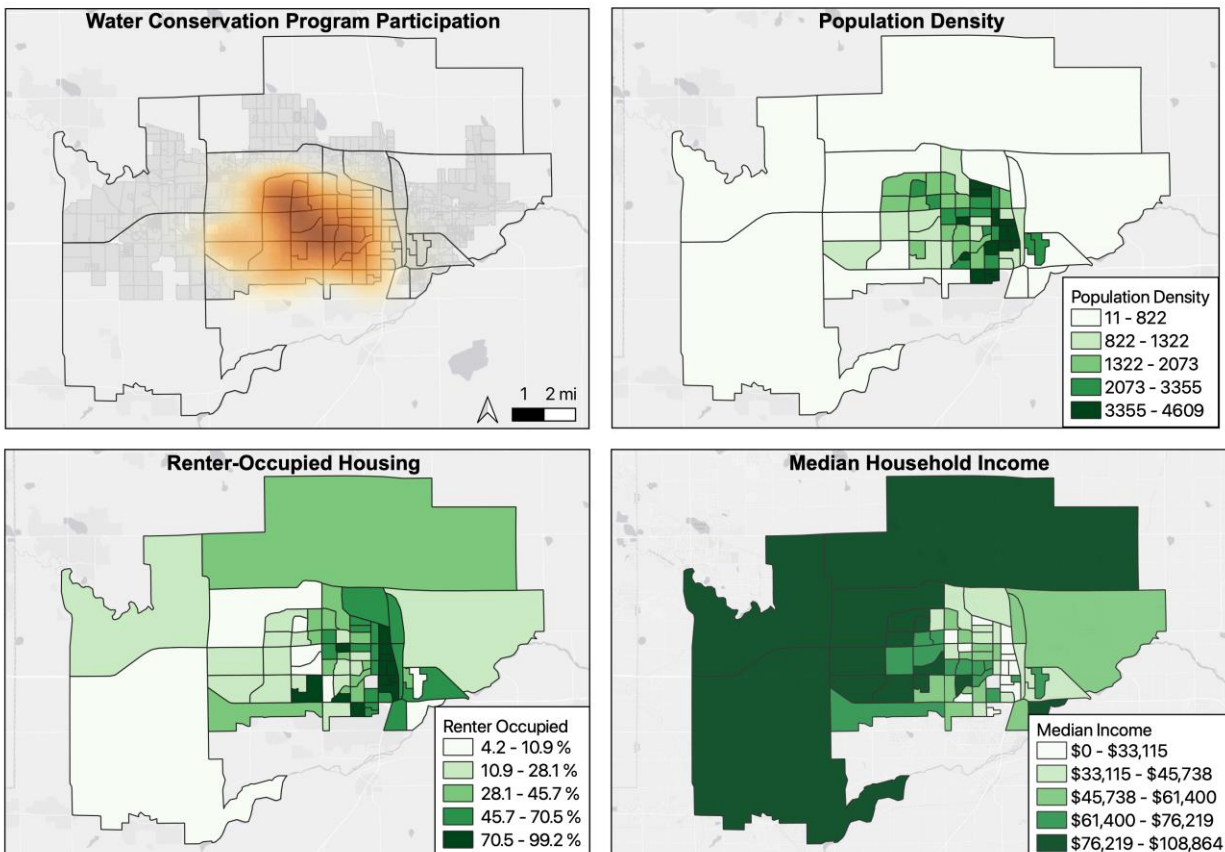


Figure 20. Greeley Water Conservation Program participation (top left), compared with population density, percentage of renter-occupied housing, and median household income for US Census block groups in Greeley’s service area.

Unsurprisingly, many trends in these demographic characteristics correspond with each other. For instance, areas with lower median income often have higher percentages of renter-occupied housing. The trends in residents speaking languages other than English also offer some interesting points of comparison. Spanish is the language, aside from English, that is most commonly spoken in Greeley, ranging from 3-76% of residents in a block group, compared to a maximum of 10% of residents in a block group speaking an AAPI language, and a maximum of 8% speaking an Indo-European language. Figure 22 shows the neighborhoods with the highest percentages of each language spoken across the City. Many neighborhoods have distinct languages that are especially prominent, but the neighborhood shown in orange, in the City’s northwest corner, has high percentages of residents speaking all three languages, suggesting that approaches that provide translation or engagement in a number of different languages might be most effective here.

As Figures 22 and 23 illustrate, participation in water conservation programs is lower in neighborhoods where more residents speak Spanish. However, it’s important to note that water conservation program participation is not low in all neighborhoods with high percentages of Spanish-speaking residents. For instance, water conservation participation is fairly high in the southern-most dark green neighborhood (showing large percentages of Spanish speakers) in Figure 22. Understanding what contributed to higher levels of participation here could offer insights into strategies that could be replicated in demographically similar neighborhoods.

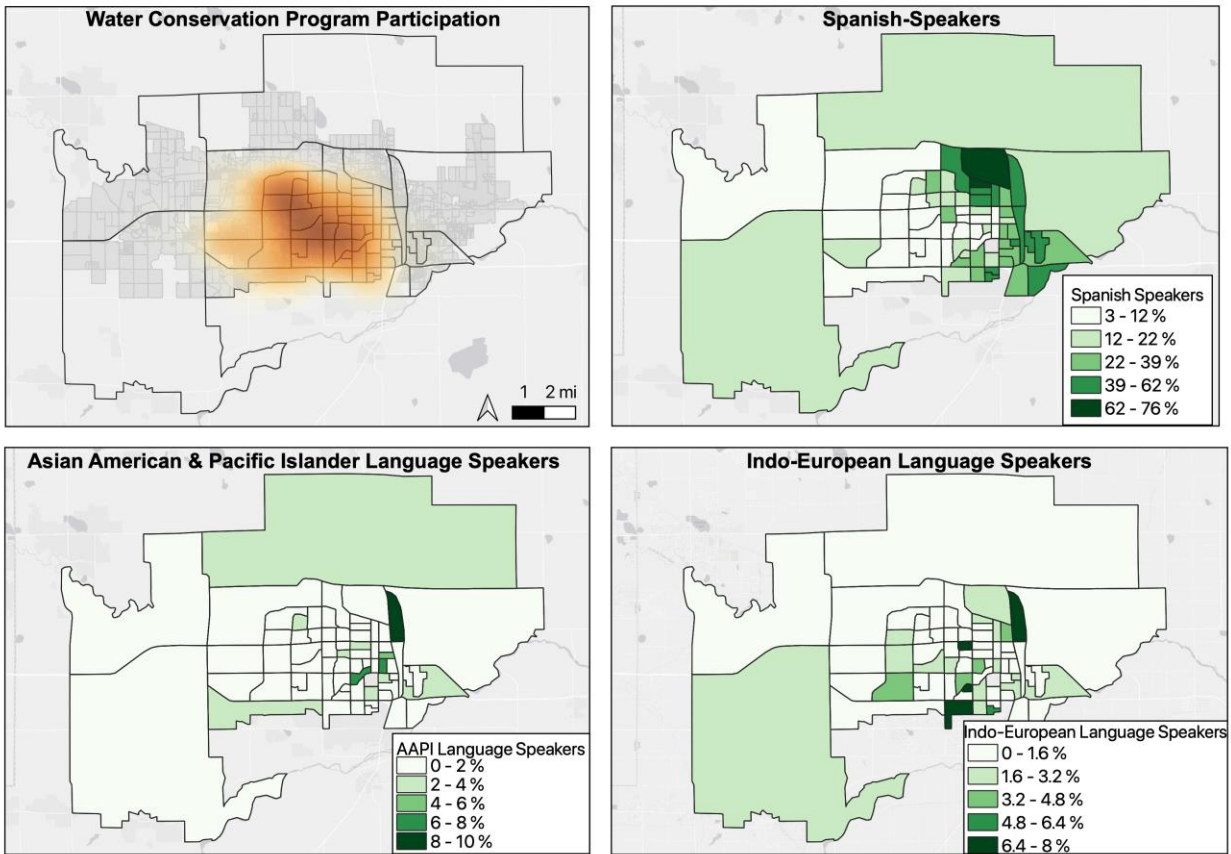


Figure 21. Greeley Water Conservation Program participation (top left, shown in terms of population density), compared with percentage of Spanish, Asian American and Pacific Islander, and Indo-European speakers for US Census block groups in Greeley’s service area.

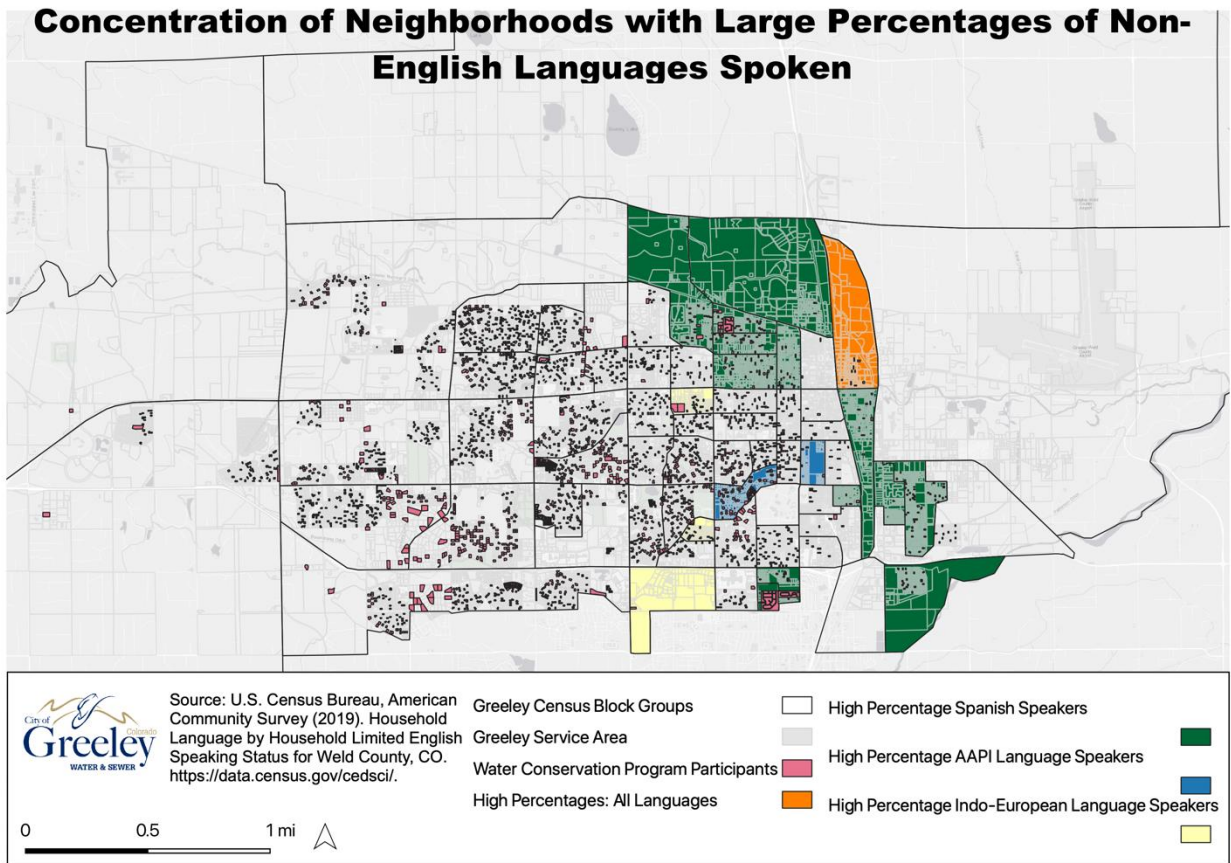


Figure 22. This map shows the block groups or neighborhoods with the largest concentrations of residents speaking languages other than English, including Asian American and Pacific Islander (AAPI) Languages (shown in blue), Indo-European Languages (shown in yellow), and Spanish (shown in green). The legend indicates what percentage of residents in block group speak each language. The orange neighborhood has high percentages of residents speaking each of these languages.

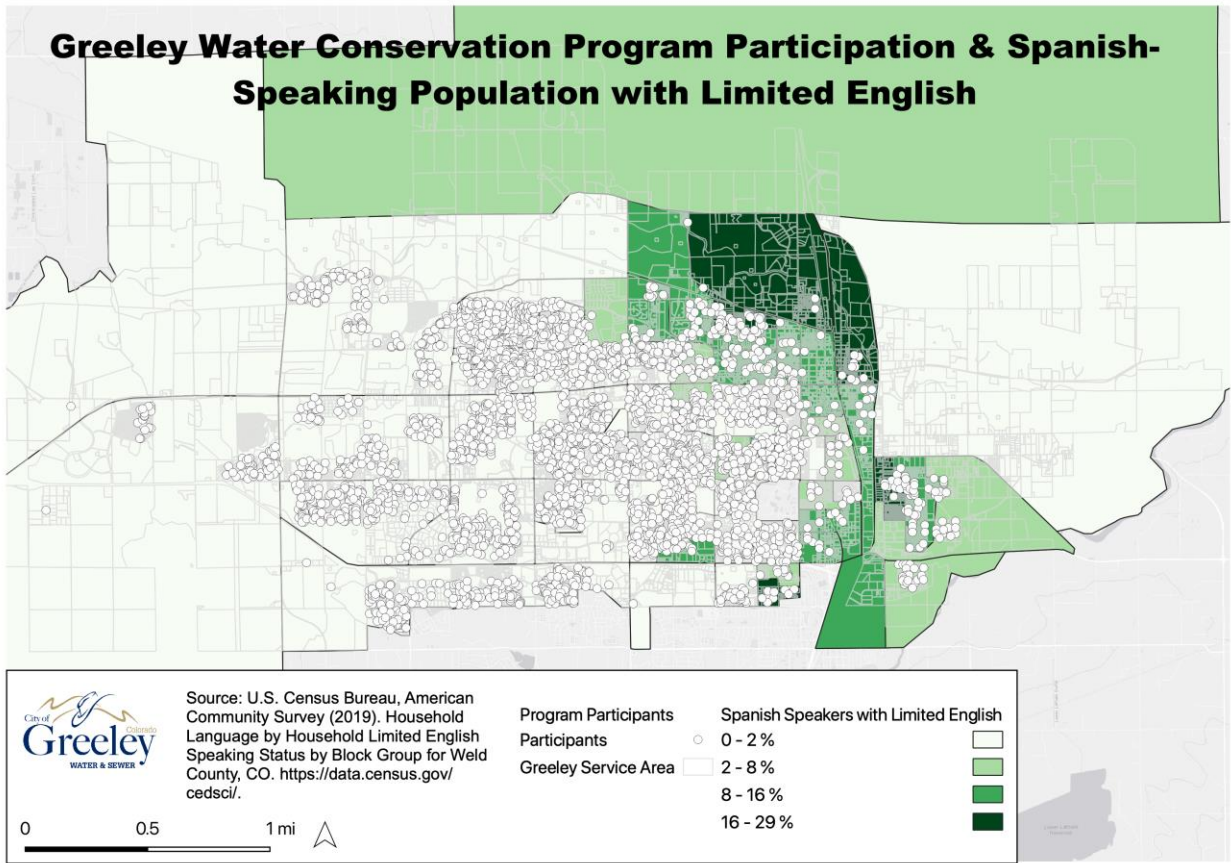


Figure 23. Greeley Water Conservation Program participation compared with the percentage of Spanish speakers with limited English in a US Census block group.

Water Use Change Resulting from Water Conservation Programs

In addition to analyzing geographic trends, this project analyzed the water use change resulting from participation in a subset Greeley’s water conservation programs, focusing in particular on incentive and audit programs. Measuring the water efficiencies resulting from participation in one of Greeley’s water conservation program sheds light on the return on investment in these programs and provides relevant business impact metrics. Also through this analysis, customers’ participation in each water conservation program is tracked over time.

Table 1 captures the water programs included in this analysis. The programs included in the water savings analysis were limited to programs that had at least 50 participants with sufficient data to calculate the change in water use resulting from their participation in this program (for more details about this approach, see the following Methodology section).

Program	Participation Analysis	Water Savings Analysis
Life After Lawn (formally Cash for Grass)	√	
Commercial Audits (Indoor + Outdoor)	√	√
ET Sensor Rebate	√	
Front Loading Washer Rebate	√	√
Irrigation Controller Rebate	√	
PRV Rebate	√	√
Residential Audits (Indoor + Outdoor)	√	√
Rotary Nozzles Rebate	√	√
Showerhead Exchange	√	
Smart Controller Rebate	√	√
Spray Head Sprinkler Exchange	√	
Toilet Rebates	√	√

Table 1. A list of programs included in this report’s analysis of participation trends and water use changes. See Appendix G for more detailed descriptions of each program.

The methodology followed approaches from other Colorado municipalities on water efficiency program studies. To better understand the methodology used in conducting these water efficiency program analyses, interviews with other Colorado agencies were conducted, and reviewed materials and reports from similar studies. A review of the key findings from this research and these conversations is provided in the Appendix F.

Methodology

In consultation with Greeley, WaterNow and WRA focused a subset of Greeley’s water conservation programs, which were primarily audit and rebate programs. Please see Appendix G for more detailed descriptions of each program.

This study covers participation in water efficiency programs during the years 2013-2018. Given the unusual factors such as the COVID19 pandemic and stay-at-home orders, 2020 water use is not included in these calculations. The water use change for participation in programs during 2018 is analyzed using only 2019 water use data.

The first step conducted was to calculate the change in annual water use resulting from a customer account’s participation in a water conservation program. To do this, we compared customers’ average annual water use pre- and post- participation in a water conservation program. Within the excel spreadsheet “Greeley Water Efficiency Programs_Water Savings Analysis,” water consumption comparisons of pre- and post- participation were based on two-year averages. For example, if a water audit was conducted in 2016, the average from 2014 and

2015 consumption was compared to 2017 and 2018 water consumption. This average annual water savings was then applied to each year a customer was active in a program (e.g., if a customer participated in a program 2014, we applied the average annual water savings to the years 2014-2018). For some programs, specifically the Commercial and Residential Audits, we applied a five-year limit on water savings and a 20% annual discount on savings, based on the literature review reflected in the AWE Water Conservation Tracking Tool.¹³ This same tool indicated lifetime savings for other programs that went beyond the six years included in this analysis (see Appendix H for more details).

This approach was applied to programs, focusing on a customer's indoor and/or outdoor water use depending on the type of water use addressed by the program. Indoor water use was determined as the total water use during the months of January, February, March, November, and December. Outdoor water use was defined as water use during the months of April through October, that was greater than the average indoor water use for that year. Outdoor water consumption was normalized for changing weather conditions using Greeley's annual Irrigation Water Requirement (IWR). A more detailed description of this methodology is included in Appendix F.

Customer accounts were filtered if sufficient data were present and if participation in a program was greater than 50 accounts. For example, the Spray Head Sprinkler Exchange was removed from the analysis because there were only 6 past participants in this program between 2013-2018. The cost of each program reflects both the cost of equipment and rebate, in addition to an estimated cost for the staff time needed to implement the program (see Appendix G for more details on cost calculations).

While many other methodologies could also provide helpful insight into the change in water use resulting from water conservation program participation, this approach was determined to be the best match for Greeley's existing data and data format.

Results and Discussion

Water Use Change

Results are represented in Table 2 and compared to literature and the Alliance for Water Efficiency's Water Conservation Tracking Tool's model default values.

¹³ The AWE Water Conservation Tracking Tool is an Excel-based spreadsheet tool for evaluating the water savings, costs, and benefits of urban water conservation programs and for projecting future water demands. The tool includes a review of literature assessing the anticipated average water savings, savings duration, and annual savings decay rate of a different conservation programs. See: Alliance for Water Efficiency (AWE). Water Conservation Tracking Tool. Available: <https://www.allianceforwaterefficiency.org/resources/topic/water-conservation-tracking-tool>.

While each program shown in Table 2 generated water savings during the 2013-2018 time period, the amount of savings varies significantly across different programs. Three programs resulted in especially large savings for the period of the study: the Residential Audit (19.5 AF/year), the Front Loading Washing Rebate (17.1 AF/year), and the Toilet Rebates (14.7 AF/year). The programs with the largest water savings reflect high levels of interest and participation in these programs, in addition to the water savings generated by these interventions. Water savings were also generated by the following water conservation programs: Smart Controller Rebates (4.3 AF/year); the Pressure Reducing Valve (PRV) Rebate and Rotary Nozzles Rebate (3.2 AF/year) and the Commercial Audits (2.9 AF/year).

Programs' overall water savings are heavily influenced by the number of customers who participate in a program. The Front Loading Washer Rebate, for instance, has both high total savings and high levels of water savings per customer account. The Smart Controller Rebate, PRV Rebate, and Rotary Nozzles Rebates have comparatively lower levels of total participation, but a high level of water savings for each participating account. In other words, despite their low cumulative savings, it may be worth maintaining or exploring the additional demand for these programs – to determine if additional outreach could grow participation and expand the programs' overall water savings beyond individual customers' water savings. Additionally, an important consideration is that the number of participants included in this analysis is lower than the total number of program participants in Greeley's water conservation programs. Many participants simply did not have sufficient water use data to be included in the calculations. Using a conservative approach, if a conservation program had less than 50 customer accounts with sufficient data, those accounts were excluded from the final calculations. Bear in mind, their inclusion would also increase the total AF of water saved through conservation programs.

In terms of the return on investment (ROI) or the cost invested for each AF of water a program saves, all individual water conservation cost less than \$625 per acre-foot. The Front Loading Washer Rebate is cheapest (\$181 per AF), followed closely by the PRV Rebate (\$188/AF), and the Rotary Nozzles Rebate (\$190/AF). Commercial Audits (\$285/AF) and Residential Audits (\$341/AF), along with the Smart Controller Rebate (\$403/AF) make up the middle of the pack. The Toilet Rebates (\$625/AF) are the most expensive program. The analysis defined costs as the raw cost of providing a rebate in addition to the staff time needed to review a rebate or administer an audit. Additional costs – such as the cost to advertise or create programs – are not reflected in this analysis.

Please note it is not recommended to simply sum the total saved water from all programs. For a single customer account, there may have been times when the account participated in multiple programs; combining water savings values would lead to potential double-counting. A summation approach does give a rough estimate of the approximate savings across the selected programs, which is roughly 65 acre-feet per year, or 389 acre-feet between 2013-2018. Dividing the total cost of the included programs by the water savings realized by their participants estimates a cost per acre foot of \$1,350 per AF. Water conservation programs far

exceed the cost per acre foot when compared to water right acquisitions from the Colorado Big-Thompson Project (estimated to be \$62,500 per share as of July 2020, according to the *Loveland Reporter-Herald*).¹⁴ While the savings from water conservation do not continue into perpetuity, many have a fairly long expected lifetime of savings, ranging from 5 years (for audit programs) to 25 years (for toilet rebates). For a more detailed description of the estimated duration of each program’s water savings, see Appendix H.

To ensure Greeley’s estimated water savings were reasonable, the results were compared to published values found in the AWE Water Conservation Tracking Tool (see Appendix H). For most programs, the results are similar. The most notable exceptions are the Commercial and Residential Audit programs, where the values found through the analysis are lower than what would be expected based on the AWE model default values. However, participation in audits includes a wide range of variables, such as individual behavior change and different weather conditions. For example, even while normalizing for weather by using IWR, conditions may still affect resident’s behavior and attitudes towards water use. For the Commercial Audit program, it is also possible that participants are overall using water more efficiently, but the water demand is higher because their business grew. Participation in these audits is an educational opportunity which may also lead to participation in other rebates, playing a role in generating the larger individual savings seen in some of the other programs.

Conservation Program*	Number of Accounts	Annual Water Savings (AF)	Annual ROI (\$/AF/Year)	Estimated Annual Savings Per Account (Gallons/Year)
Residential Audits (Indoor + Outdoor)	1294	19.5	\$341	4,903
Front Loading Washer Rebate	994	17.1	\$181	33,714
Toilet Rebates	756	14.7	\$625	6,271
Smart Controller Rebate	132	4.3	\$403	10,682
PRV Rebate	149	3.2	\$188	7,093
Rotary Nozzles Rebate	147	3.2	\$190	7,013
Commercial Audits (Indoor + Outdoor)	182	2.9	\$285	5,118

¹⁴ Amundson, Ken. (17 June 2020). “NoCo Real Estate Summit: Water drives home prices, but can be controlled.” *Loveland Reporter-Herald*. <https://www.reporterherald.com/2020/06/17/noco-real-estate-summit-water-drives-home-prices-but-can-be-controlled/>.

*For Residential and Commercial Audits, participants could select either or both the indoor and outdoor audits.
 ** The Toilet Rebate program encompasses the 0.8 GPF Toilet, Dual Flush Toilets, Low Flow Toilet, and Ultra Low Flow Toilet programs. See Appendix G for more details about these programs.
 ***Only accounts with sufficient water use data were included in these calculations, and only programs with at least 50 participants with sufficient water use data are presented in this table.

Table 2. Estimated water savings achieved by selected water conservation programs. Study period from 2013-2018.

Participation in Water Conservation Programs

Total program participation from 2013-2018 is shown in Figures 24-26. During the study’s time period, there is a noted rate of decay along with a period of stabilization in the total participation. This fluctuation may have occurred based on multiple independent factors, including the following:

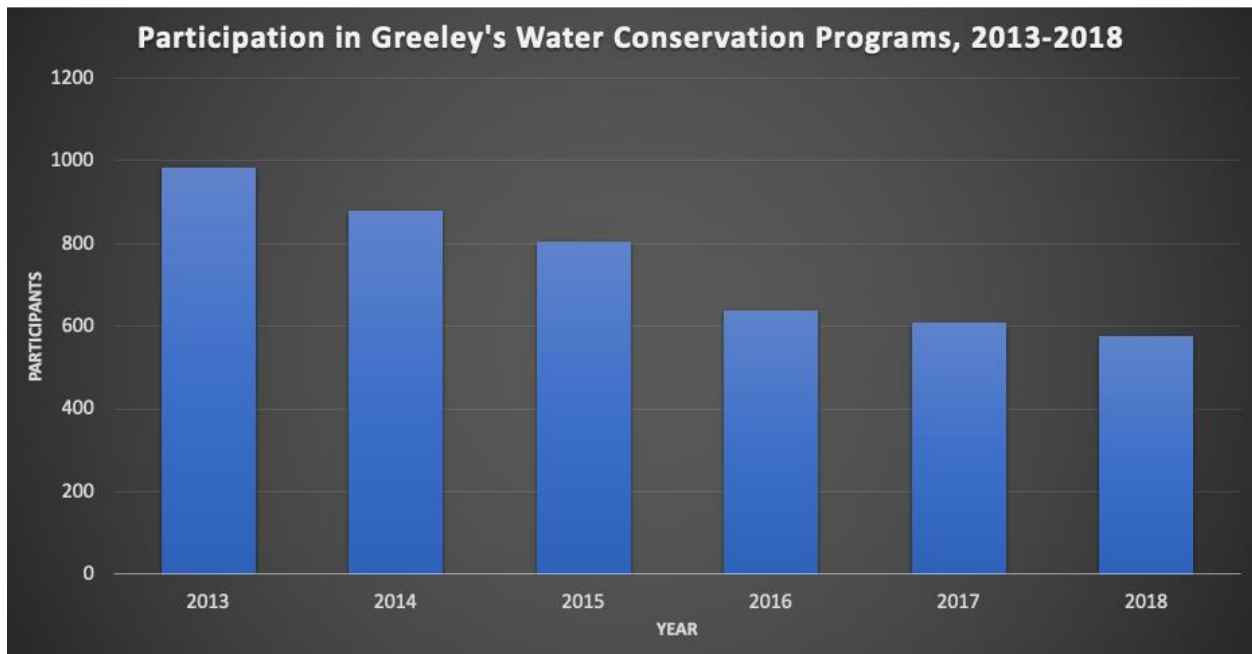
1. Weather conditions: the 2012 drought may have caused an increase in participation in Water Conservation Programs that waned over time.
2. Marketing campaigns: outreach can spark interest that fades over time.
3. Staffing levels: Greeley’s ability to conduct audits is dependent on staffing levels, which have fluctuated over the years.
4. Change in programs: Program fluctuation is a key component of participation. For instance, if a new program is initiated there may be a surge in participation or a sense of urgency to alter behaviors.
5. Rates: Increasing rates may affect program participation; similarly, as customers take control of their own water budgets, their behavior and interest in conservation programs may change.
6. Natural saturation: Programs focused on fixtures and appliance will have a saturation period.
7. Local, state, or federal changes: Regulatory changes have occurred, and have focused on limiting water use for fixtures and appliances. As a result, new builds within a community naturally would have more water efficient products.

Figure 26 breaks down the program participation according to each program during the study period. The highest total participation was in the Residential Audit Program (1,670), followed by the Front-loading Washer Rebate (1,050), and Toilet Rebates (770). These programs are followed by the Showerhead Exchange and Commercial Audit Programs (220 each), the PRV Rebate (175), and the Rotary Nozzles Rebate (160), the Smart Controller Rebate (140), the ET Sensor Rebate (55), and the Irrigation Controller Rebate (15).¹⁵ Note the Cash for Grass program, now referred to Life After Lawn, started as a pilot project in 2018. The relatively low participation in Cash for Grass (7 participants in 2018) reflects the earlier stage of the pilot project. Participation in the Spray Head Sprinkler Exchange Program started off very low, with

¹⁵ The Smart Controller Rebate Program included the installation of these devices by Greeley Water Conservation Specialists; the Irrigation Controller Rebate was installed by participating customers.

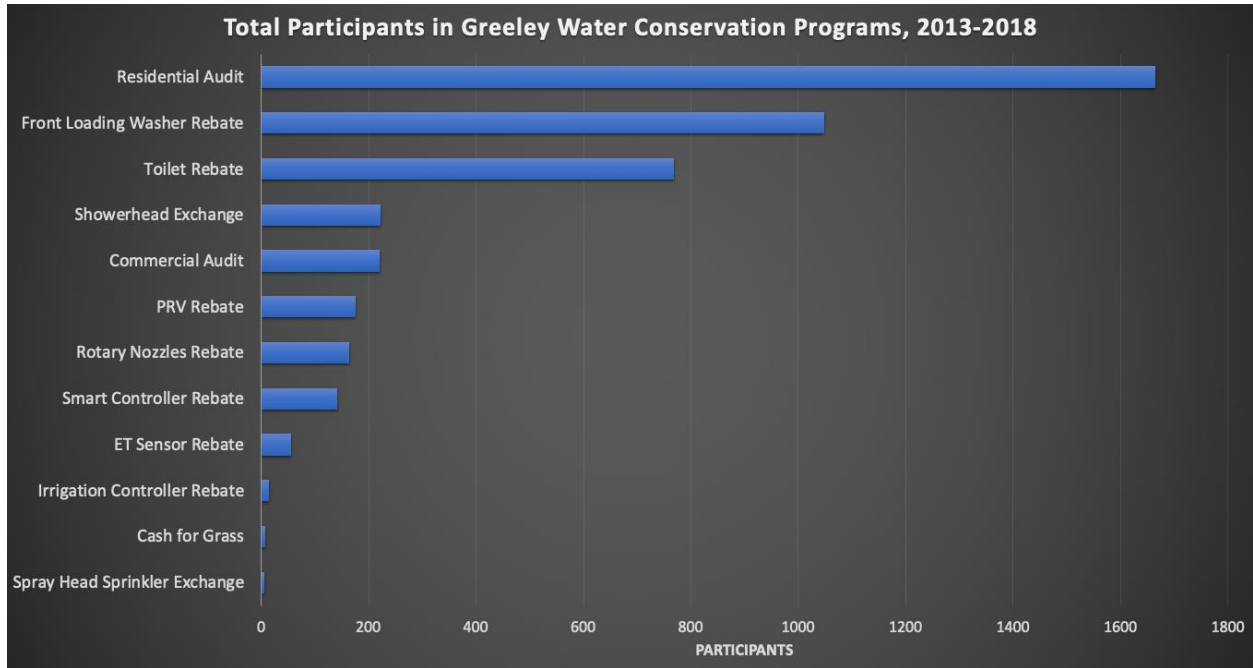
just 6 participants in the program when it was getting started during 2016-2018, but increased significantly in 2019, jumping to over 50 participants.

The trends in participation within each program can shed light on future outreach and engagement decisions. Other independent factors as mentioned above (such as weather conditions, marketing campaigns, and staffing levels, etc.) do influence trends. It is important to note that though trends should be monitored and considered for water conservation program management. Specifically, as Figure 26 shows, demand for many programs including the Residential Audit, Commercial Audit, Smart Controller Rebate, Rotary Nozzles Rebate, and PRV Rebate, remained relatively consistent from 2013-2018, suggesting a continued interest in and need for these programs. For the Audit programs, which have an estimated water savings lifetime of five years, water demands may be renewed as new business managers or homeowners take over water management on an account, and as water use appliances and behaviors change and shift over time. The decline in some programs may reflect a natural saturation of customer needs, or other shifts in customer demand. For instance, the Front Loading Washer Program was phased out by Greeley in response to market changes. The Toilet Rebate program shifted to support only hyper-efficient toilets in the wake of updated state regulations mandating the sale of water-efficient toilets.¹⁶



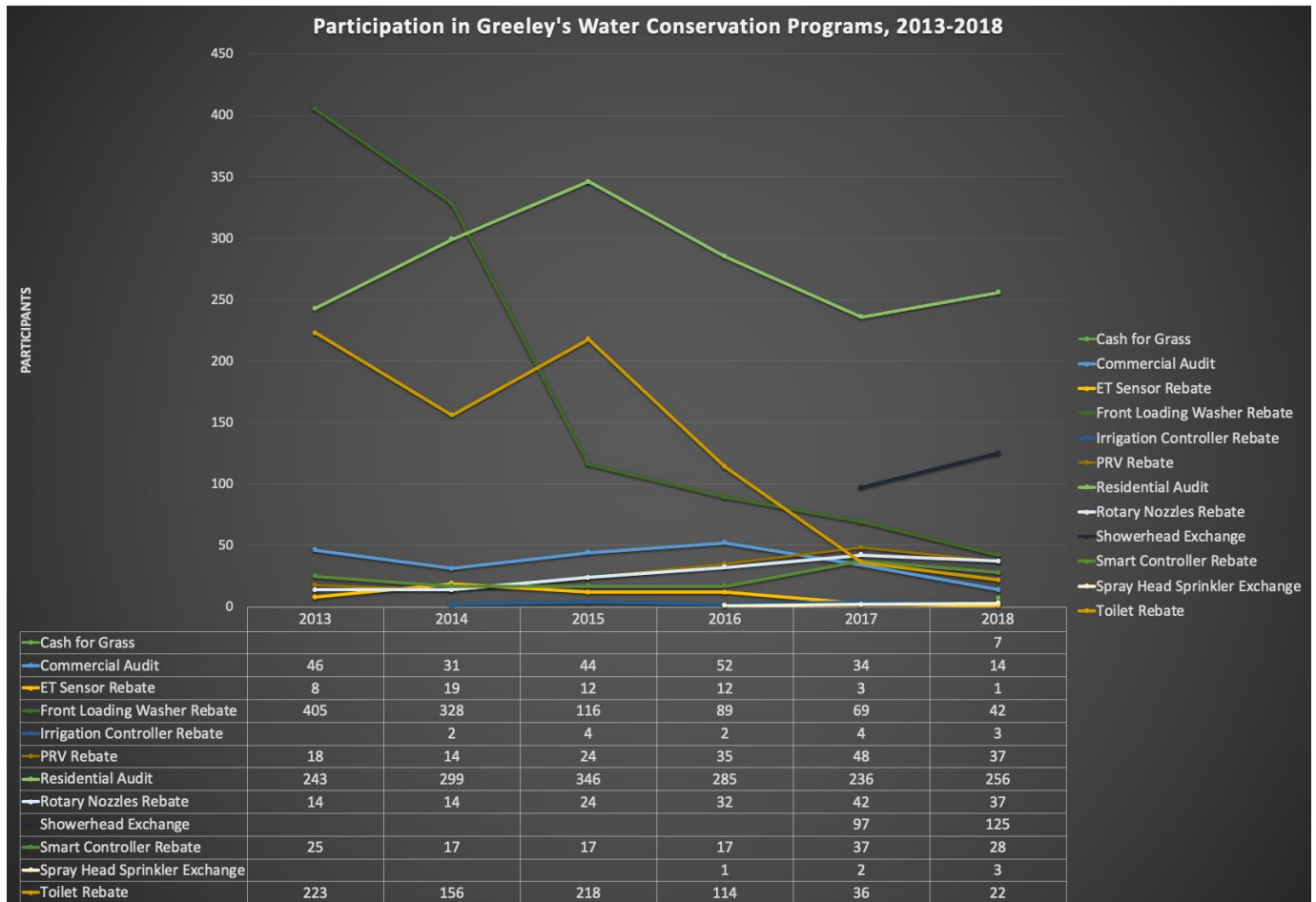
¹⁶ Senate Bill 14-103, which took effect in 2016, requires all new applicable fixtures (including lavatory faucets, toilets, urinals and showerheads) sold in Colorado to be in compliance with federal WaterSense standards. For toilets, this means using 1.28 gallons of water or less per flush, as opposed to the federally mandated maximum of 1.6 gallons per flush. (See: Concerning the Phase-out of the Sale of Certain Low-Efficiency Plumbing Fixtures, SB 14-103, (2014). Available: https://www.statebillinfo.com/bills/bills/14/103_rev.pdf).

Figure 24. Participation in Greeley’s water conservation programs from 2013-2018.



*For Residential and Commercial Audits, participants could select either or both the indoor and outdoor audits.
 ** The Toilet Rebate program encompasses the 0.8 GPF Toilet, Dual Flush Toilets, Low Flow Toilet, and Ultra Low Flow Toilet programs. See Appendix G for more details about these programs.

Figure 25. Participation in Greeley’s water conservation programs from 2013-2018.



*For Residential and Commercial Audits, participants could select either or both the indoor and outdoor audits.

** The Toilet Rebate program encompasses the 0.8 GPF Toilet, Dual Flush Toilets, Low Flow Toilet, and Ultra Low Flow Toilet programs. See Appendix G for more details about these programs.

Figure 26. Program-specific trends in participation in Greeley’s water conservation programs from 2013-2018.

Table 3 captures the amount of overlap, among customers participating in multiple programs. Highlighted values in Table 3 represent the highest participation overlap. Approximately 30% of all participants in water conservation programs between 2013-2018 participated in multiple programs. Unsurprisingly, participants in the Residential Audit overlap with many other conservation programs targeting both indoor water use (e.g., the Front Loading Washer Rebate, Showerhead Exchange, and Toilet Rebate) and outdoor water use (e.g., the Smart Controller Rebate, PRV Rebate, Rotary Nozzles Rebate). The low number of overlaps between the Commercial Audit and other programs makes it difficult to draw firm conclusions. Most overlaps occur in programs focused on indoor water use, including the Toilet Rebate, Front Loading Washer Rebate, and Showerhead Exchange. This might reflect the primary water uses

of participating businesses; it could also suggest an opportunity to engage more commercial, industrial, and institutional (CII) customers in outdoor water efficiency programs.

Many of the customer accounts that participated in the Toilet Rebate also participated in the Front Loading Washer Rebate, suggesting multiple appliances were replaced simultaneously (e.g., as part of a larger home renovation or construction project). There is also a fair amount of overlap on outdoor water efficiencies rebates, including the ET Sensor Rebate, Smart Controller Rebate, and Rotary Nozzles Rebate, and PRV Rebate, with especially high levels of overlap between the PRV Rebate and Rotary Nozzles Rebate. This suggests these residents may be either be participating in a holistic upgrade to their irrigation systems, or incrementally adding improvements over time. In either case, the results suggest that there are opportunities to engage participants in one program in additional conservation activities.

	Cash for Grass	Commercial Audit	ET Sensor Rebate	Front Loading Washer Rebate	Irrigation Controller Rebate	PRV Rebate	Residential Audit	Rotary Nozzles Rebate	Showerhead Exchange	Smart Controller Rebate	Spray Head Sprinkler Exchange	Toilet Rebate
Cash for Grass	NA	0	0	0	0	0	2	1	0	1	0	1
Commercial Audit		NA	2	8	1	3	1	4	6	2	0	10
ET Sensor Rebate			NA	7	3	27	36	22	1	44	0	9
Front Loading Washer Rebate				NA	1	12	150	17	18	15	0	76
Irrigation Controller Rebate					NA	2	7	2	0	1	1	2
PRV Rebate						NA	104	127	11	45	3	24
Residential Audit							NA	103	129	84	3	143
Rotary Nozzles Rebate								NA	11	45	1	26
Showerhead Exchange									NA	8	1	21
Smart Controller Rebate										NA	1	21
Spray Head Sprinkler Exchange											NA	0
Toilet Rebate												NA

*For Residential and Commercial Audits, participants could select either or both the indoor and outdoor audits.

** The Toilet Rebate program encompasses the 0.8 GPF Toilet, Dual Flush Toilets, Low Flow Toilet, and Ultra Low Flow Toilet programs. See Appendix G for more details about these programs.

Table 3. Overlap between participations in Greeley’s Water Conservation Programs, 2013-2018.

Recommendations

Effectiveness of Water Conservation Programs

Across the board, Greeley's Water Conservation Programs have saved both water and money, engaging nearly 5,000 participants between 2013 to 2018, and saving water ranging from 2.9 to 19.5 AF per year per program. These programs' average cost per acre foot savings is \$1,350, far below the current cost for Colorado Big-Thompson Project water shares. While the data analysis suggests that these programs are effective, it also provides insight into the projects it may make sense to expand or condense.

Program Prioritization

1. *Residential Audits:* The Residential Audits (Indoor and Outdoor) saved an estimated 19.5 AF per year, which is encouraging because the customer survey results suggest continued interest in further participation in this program, particularly the Outdoor Irrigation Audit. The quantitative analysis also shows that participation in the Residential Audit often overlaps with participation in other indoor and outdoor water conservation programs, suggesting that this program is an effective "gateway" to utilizing other water conservation tools and resources. Survey results support this finding in that 95% of Residential Audit participants reported taking some kind of water saving action as a result of their audit. Separate from this analysis, Greeley Water is experiencing a recent increase in demand for indoor audits due to AMI leak detection services.
2. *Outdoor Efficiency Incentives:* The survey showed particularly large interest in outdoor water efficiency rebates and incentives. There may be an opportunity to expand participation in programs like the Smart Controller Rebate, PRV Rebate, and Rotary Nozzles Rebate. These programs have high water savings per account but have seen lower levels of overall participation, compared to other programs. The outdoor Life After Lawn and Garden in a Box programs – though not captured by the water use change analysis – were the most popular incentive opportunities for future participation according to the survey results.
3. *Educational Programs & Online Efficiency Tools:* Per the survey results, Greeley's array of educational programs and online tools were, for the most part, well utilized by Greeley residents and of interest to respondents for future participation. Many past participants reported taking specific water savings actions as a result of participation in an educational program. While data on staff resources and cost for educational programs and online efficiency tools was not included in the scope for this project, one can assume that most of these programs and tools are less expensive and time intensive than residential audits and outdoor efficiency incentive programs.

Communications and Outreach

In addition to the potential benefits of targeting outreach to specific neighborhoods and communities within the City, there may be opportunities to continue to harness synergies across conservation programs. Recommended steps are listed below:

4. Lower participation in Greeley's water conservation programs often coincides with areas that have higher percentages of renter-occupied housing; lower household income, and higher percentages of residents speaking Spanish, Asian American or Pacific Islander (AAPI) languages, or Indo-European languages. The primary areas of these populations are located in the northeast and southwest areas of the City's center. These trends suggest that increasing participation within the city's center might require strategies such as language translation (e.g., through partnerships with local community groups or non-profits) and a particular emphasis on programs that renters are eligible to participate in. In-person events may be especially helpful, providing the opportunity for in-person translation and avoiding the need for Internet access, which may be lower in areas with lower median incomes.
5. Around the perimeter of Greeley's service area, participation is also sparser, in part reflecting a lower population density in these areas of the City. These neighborhoods tend to have larger median household income; lower percentages of residents speaking Spanish, AAPI, or Indo-European languages; and lower percentages of renter-occupied housing. Engaging these perimeter neighborhoods might be most effectively done through other forms of outreach, such as direct mail, bill inserts, or email outreach, that target participants spread across a wider area, and include programs aimed at both renters and homeowners.
6. In addition to the potential benefits of targeting outreach to specific neighborhoods and communities within the City, there may be opportunities to continue to harness synergies across conservation programs. Approximately 30% of residents were part of multiple conservation programs, suggesting there may be ways to further encourage participants to take advantage of other relevant programs. Strategies may include continuing to encourage participants to complete an audit as an entry point to other programs, as well as reaching out to past participants to suggest additional or complementary programs.
7. Survey results suggest some differences in program preferences among Hispanic and Latino respondents. For example, respondents of Hispanic, Latino or Spanish origin expressed more interest in the High Efficiency Toilet rebate. These insights could help target outreach around specific programs in neighborhoods with larger percentages of Hispanic and Latino residents as identified in the spatial analysis or help prioritize the translation of specific program materials.
8. Popular outreach methods, such as email updates and the monthly newsletters, offer ways to further promote and increase awareness of the conservation programs,

specifically Greeley’s Online Efficiency Tools with which respondents were generally less familiar.

9. Motivation in future water conservation programs is primary based on saving money on water bills, protecting Greeley’s limited water resources, reducing personal use, and supporting community values. Community engagement messaging may focus on these key points for better marketing strategies.

Considerations for Future Water Conservation Program Analysis

It is recommended for the Greeley’s Water Conservation Program to complete a Water Conservation Customer Survey every 5-7 years to stay informed on customers’ values and interests, and to analyze trends and changes in respondent answers over time. Keeping the questionnaire consistent (See Appendix B) is key for comparing results.

Updating the quantitative analysis on an annual basis could also enable Greeley Water to follow trends in participation in real time and shed light on the impact of different outreach and communication strategies. Documenting factors that may affect participation, such the number of program staff, outreach and communications activities, and introduction of AMI technology, could help interpret changes in participation over time. If resources allow, future analyses could also combine the spatial and water use change analyses, to visualize and showcase water use changes by neighborhoods and potentially foster friendly competition among different locations in the City.

Conclusion

It is important to keep in mind that Greeley’s substantial gains in water conservation – reducing water usage by 20% from 2007-2018 even as the City’s population has grown– are not entirely captured by the water savings associated with the conservation programs analyzed for this project. Water demand in Greeley is also influenced by state and local water use policies and regulations, rates, and market trends. Integrated water and land use planning approaches, such as conservation-oriented system development charges, plumbing codes, zoning standards, and landscaping ordinances, have likely resulted in significant water savings. Greeley’s water budget-based rate structure also provides residential customers with a price signal to incentivize conservation. And market trends and state regulations have led to the standardization of more water efficient appliances, fixtures, and equipment available for purchase. Finally, the introduction of AMI presents additional incentives and tools to enhance water conservation behavior and program participation. While comparing the value of policies and regulations with the impact of water conservation programs is beyond the scope of this project, it is important to recognize their importance to Greeley’s water supply resiliency goals.

The City of Greeley should be very proud of its efforts to build a popular, impactful, and highly valued Water Conservation Program. This performance analysis – including the customer survey, spatial analysis on participation, and change in water use analysis – is intended to provide the City with new data and information to prioritize its Water Conservation Program spending and to inform its forthcoming Water Efficiency Plan update. Greeley may also elect to use the tools and methodologies established through this project in upcoming years to assess program performance over time.

Appendix

Attachment A – Summary of Greeley’s Water Efficiency Portfolio from 2013-2020

The following section provides an overview of Greeley’s four primary categories of conservation programming: 1) Education programs, 2) Water Efficiency Incentives, 3) Water Audits, and 4) Online Efficiency Tools.

1. *Education Programs*

Landscape Lecture Series: Free lectures and workshops are offered January through September on a variety of landscape topics to improve water efficiency outdoors.

Xeriscape Education: Literature and tours of Greeley’s Xeriscape garden provide tools and resources to help residents implement water-wise landscaping principles and reduce water use.

Tours: Tours of Greeley’s water-related facilities are offered seasonally, for groups of 10 or more.

Teacher Training: Greeley sponsors training programs on water and conservation issues for local teachers (e.g., Project WET provides water resource education materials that are appropriate for many different age groups and cultures and offer comprehensive coverage of the broad topic of water.¹⁷)

Speakers Bureau: Speakers for classrooms, civic clubs, and other groups are available upon request. Presentations can be tailored to a specific age group, topic or learning objective (e.g., watersheds, water conservation, water law, water quality, water sources, xeriscape).

Mayor’s Challenge for Water Conservation: The annual, national Mayor’s Challenge for Water Conservation runs from April 1- 30. This non-profit national community service campaign encourages leaders to inspire their residents to make a series of simple pledges at mywaterpledge.com to use water more efficiently, reduce pollution and save energy.

2. *Water Efficiency Incentives*

Irrigation Rebates (Residential and Commercial)

¹⁷ Project WET (Water Education Today). (2020). <https://www.projectwet.org/>.

Customers who have completed an irrigation audit can qualify for rebates that reduce the cost of irrigation equipment – including smart sprinkler controllers, pressure-reducing valves, and rotary sprinkler nozzles – by up to 50 percent of the cost.

Pressure-Reducing Valves

A pressure-reducing valve reduces misting -- a fine spray that results from irrigation systems that apply water at a very high pressure, resulting in excessive evaporation and water drifting away from the intended irrigation area. By regulating water pressure and preventing misting, these valves make irrigation systems more efficient.¹⁸

Rotary Nozzles

Rotary nozzles increase uniformity and reduce overspray in irrigation systems. They operate by rotating a stream of water over the landscape, in contrast to the mist produced by spray-head sprinklers.¹⁹

Smart Controllers

Smart controllers (also called ET Controllers) use information about site conditions (rain, wind, slope, soil, plant type, etc.) to apply the right amount of water to maintain healthy growing conditions. Because smart controllers can be more efficient than traditional time-based irrigation controllers, they often reduce use by at least 25 percent, saving both money and water. Rebates for smart controllers cover half of the cost with customers pay the remaining \$300.²⁰

Typically, a Greeley Water employee will conduct an irrigation audit, and share the report with participants within a few days. In the past, once the participant had purchased any irrigation equipment, a Greeley Water employee would return to the site to help the participant set up the new equipment (e.g., schedule a new smart sprinkler controller) and to teach the participant how to use it. (This direct installation component has been phased out in 2022, but was a part of the program during the years included in the quantitative analysis.)

Commercial Rebates (available to multi-family residences and industrial, institutional and commercial accounts)

Rebates are available for a variety of indoor and outdoor water-using devices, including: bathroom fixtures; kitchen and restaurant equipment; laundry appliances (including washing machines); industrial devices; and irrigation hardware.²¹ Free commercial audits help customers

¹⁸ City of Greeley, CO. “Water Conservation Rebates.” Available: <https://greeleygov.com/services/ws/conservation/water-conservation-rebates>.

¹⁹ Ibid.

²⁰ Ibid.

²¹ For a detailed list of possible commercial rebates, please see: City of Greeley, CO. “Water Conservation Rebates.” Available: <https://greeleygov.com/services/ws/conservation/water-conservation-rebates>.

determine which products may be appropriate for their facility. Customers are strongly encouraged - but not required - to go through a commercial audit before receiving any rebates.

Front Loading Washer Rebates (available single-family residences, multi-family residences and industrial, institutional, and commercial accounts)

Rebates are available for a variety for high-efficiency front loading clothes washers which used less water and energy than standard top loading clothes washers. For each eligible washers purchased, a customer can receive a \$100 rebate. In 2018, the residential front-loading washer rebates stopped.

Professional Landscape Certification (available to landscape contractors)

Rebates are available to landscape Contractors who works in Greeley to obtain training and continuing education to obtain their Certified Landscape Technician certification.

Showerhead Exchanges (available to all customers)

At showerhead exchanges, which are held periodically at events, customers can exchange their old showerheads for new low-flow models at no cost. New showerheads are also available through Greeley's Indoor Water Audits.

Toilets

Toilets that use 0.8 gallons per flush or less are eligible for rebates from the City of Greeley. For each eligible toilet purchased, a household can receive a \$50 rebate, with a two-toilet rebate per household limit. An additional \$25 is given for recycling the old toilet in conjunction with the rebate. To participate, residents need only a receipt and a completed application.²²

Lawn Replacement Incentives

Cash for Grass Rebates/Life After Lawn Bluegrass Replacement Program²³

Greeley water customers can get cash for replacing their lawn with low water use plants. This pilot program aims to replace lawns with more sustainable landscapes, including Xeriscape, rain gardens, and pollinator plants. The program provides rebates – of up to \$2 per square foot – for 500 to 2,000 square feet of lawn removed per single-family residence, and 5,000 to 20,000 square feet at a non-residential or HOA property. The converted Xeriscape area must be irrigated using drip irrigation, micro spray irrigation or hand watering. While in theory this program seeks to target users who are exceeding their outdoor water budget, in practice these types of customers make up a small minority of participants in this program. Most participants are single-family residents, but this program also includes larger customers, such as HOAs, churches and other commercial properties.

²² City of Greeley, CO. "Water Conservation Rebates." Available:

<https://greeleygov.com/services/ws/conservation/water-conservation-rebates>.

²³ City of Greeley, Colorado. (2020). "Life After Lawn: Bluegrass Replacement Program." Available:

<https://greeleygov.com/services/ws/home/blog/water/2020/01/16/life-after-lawn-turf-replacement-program>.

This pilot grew out of a 2018 pilot study.²⁴ While the program was mostly dormant in 2019, approximately 30 customers participated in 2020.

Xeriscape Grants (available to multi-family residences and industrial, institutional, and commercial accounts)

Matching grants (of up to \$2,500 per year) are available to replace turf with Xeric plantings that require little or no water. This program can also install Xeric plantings in locations that did not previously have any landscaping in place. Multi-phase projects can receive additional funding in subsequent years. These grants can fund smaller HOA projects, small businesses, schools, places of worship, and other areas that have a maintenance plan in place. Many churches have been particularly interested in this program.

Seasonal Offerings

Compost Bin and Rain Barrel Sale (available to all customers)

Greeley periodically offers its customers discounted compost bins, which helps with soil drainage, and rain barrels, that capture water to be used for watering the customer's landscape.

Garden in a Box (available to all customers)

During the spring and fall, Greeley offers discounted Garden In A Box kits that enable customers to plant low water-use gardens at home. Kit options vary to fit different sizes and levels of sun exposure, and include low-water plants; a professionally designed plant-by-number map; and plant care instructions.

3. *Water Audits*

Greeley's free, voluntary water audits help customers identify ways to conserve water, and are targeted to indoor, outdoor, and commercial water use.

Indoor Water Audits (available to all customers)

A Greeley Water Auditor will come to a property to:

- Look for leaks and other sources of water waste
- Check high water use appliances
- Provide low-flow showerheads and faucet aerators at no cost
- Make recommendations for repairs and upgrades

Outdoor (Irrigation) Audits (available to all customers)

²⁴ City of Greeley, Colorado. (2020). "Life After Lawn: Bluegrass Replacement Program." Available: <https://greeleygov.com/services/ws/home/blog/water/2020/01/16/life-after-lawn-turf-replacement-program>.

From the months of April through October, Greeley Water specialists will come to a property to:

- Inspect watering zones and identify problems
- Measure how much water is being applied
- Check water pressure and recommend adjustments
- Develop a custom watering schedule

Typically, a Greeley Water employee will conduct the audit, and share the report with participants within a few days. The participant will often then participate in Greeley's rebate program for, e.g., a smart sprinkler controller.

Commercial Water Audits (available to multi-family residences and industrial, institutional and commercial accounts)

During a commercial water audit, a Greeley Water specialist will:

- Review how a facility is using water
- Identify areas of water waste
- Provide recommendations and custom water use targets

The specifics of an audit often depend on the industry the customer is working in, but typically includes an examination of any water heaters, laundry rooms, toilets, or leaks

4. *Online Water Efficiency Tools*

Water Budget Portal (available to those customers on a water budget)

Greeley calculates water rates for single-family homes using water budgets (the amount of water a single-family residence needs each billing period, as determined by persons per household, landscape size, and real-time weather conditions). On the Water Budget Portal,²⁵ customers can change their indoor water use profile, view their outdoor map, and get answers to common questions.

WaterSmart Customer Portal (available to all customers)

The WaterSmart Program is an online portal²⁶ that allows customers to view and understand their home water use. Using the portal, it's possible to see when and where a customer is using the most water, and how their water usage compares to similar households in the area. This offers a starting point for identifying ways to be more efficient.

Online Plant Database (available to all customers)

²⁵ Available at: efficiencyrewarded.com.

²⁶ Available at: greeleygov.com/watersmart.

This online plant database²⁷ helps customers select low water-use plants that are well-suited to Greeley’s semi-arid climate. It includes over 350 plants along with photos, descriptions, and planting tips.

Water Conservation Webpage (available to the public)

Greeley’s water conservation webpage contains a wide variety of resources, tools, and tips for indoor and outdoor water conservation, including the City’s available rebates, audits, and educational programs.

Other

In 2020, Greeley started implementing advanced metering infrastructure (AMI), and sharing data gathered through AMI with participating customers. This is worth noting AMI was not used for analyses in this report but may be a tool to assist in future efficiency analyses.

Appendix B – Customer Survey Questionnaire: Water Efficiency Program Performance

Description in beginning: The City of Greeley is currently evaluating its Water Conservation Program to determine what programs are most beneficial to the City’s water conservation goals and of most value to Greeley Water customers. Your feedback will help the City update its conservation programs to best serve Greeley Water customers. This survey will take approximately 10-15 minutes. As a token of appreciation, you will be entered into a raffle to receive a \$50-\$100 gift card to a local restaurant.

1. Please tell us who you are [check all that apply]
 - a. Greeley resident
 - b. Greeley business/commercial customer
 - c. Other [Please specify]

*Note: This survey is intended for **Greeley Water Customers only.***

2. The City of Greeley currently offers all of the following water efficiency programs, tools and incentives to customers. Prior to this survey, which of the following programs were you aware that Greeley Water offered to their customers? Note: This question is asking only if you are aware of these programs, not if you have participated in them. [Mark all that apply or “None”]

Education Programs:

- a. Landscape Lecture Series - free lectures and workshops on landscape topics to improve water efficiency
- b. Xeriscape Education - Literature, classes and tours of Greeley’s Xeriscape gardens (I.e. Woodbriar or Bittersweet Park)
- c. Tours of Greeley water-related facilities
- d. Teacher Training on water and conservation issues for local teachers
- e. Speakers Bureau - Greeley Water speakers visit classrooms, civic clubs and other groups

²⁷ Available at: plantsforgreeley.com.

- f. Annual Mayor’s Water Conservation Challenge –water use reduction contest
- g. None, I was not aware that Greeley Water offered any of the above programs

Water Audits:

- h. Indoor Water Audits
- i. Outdoor Irrigation Audits
- j. Commercial Audits (for multi-family residences and industrial, institutional & commercial accounts)
- k. Outdoor Irrigation Rebates (smart irrigation controller, pressure reducing valves, rotary sprinkler nozzles)
- l. Commercial Rebates (water efficient appliances, irrigation hardware, etc.)
- m. None, I was not aware that Greeley Water offered any of the above programs

Other Efficiency Incentives:

- n. Life After Lawn turf replacement rebates (available to single family residents)
- o. Xeriscape Grants (available to multi-family residences and industrial, institutional and commercial accounts)
- p. Compost Bin and Rain Barrel Sale
- q. Discounted Garden in a Box Kit
- r. Free Low-Flow Showerhead Exchange
- s. High Efficiency Toilet Rebate
- t. Life After Lawn turf replacement rebates (for single family residents)
- u. None, I was not aware that Greeley Water offered any of the above efficiency incentives

Online Water Efficiency Tools:

- v. Water Budget Portal
- w. WaterSmart Customer Portal
- x. Online Plant Database
- y. Greeley Water Conservation webpage
- z. None, I was not aware that Greeley Water offered any of the above water efficiency tools.

- ***In Section 1, respondents will automatically skip over each of the programs which they replied “None” to***

SECTION 1: CURRENT PROGRAMS (Customers who have participated)

A. EDUCATION PROGRAMS

- 3. **Education Programs:** In the past 5 years, which of the following Greeley water efficiency education-related programs have you participated in? [Please select all that apply, or “None” if you haven’t participated in any of these programs]
 - a. Landscape Lecture Series - free lectures and workshops on landscape topics to improve water efficiency
 - b. Xeriscape Education - Literature, classes and tours of Greeley’s Xeriscape gardens (I.e. Woodbriar or Bittersweet Park)

- c. Tours of Greeley water-related facilities
- d. Teacher Training on water and conservation issues for local teachers
- e. Speakers Bureau - Greeley Water speakers visit classrooms, civic clubs and other groups
- f. Annual Mayor’s Water Conservation Challenge - water use reduction contest
- g. None
- h. Other [Please specify]

- *If none, page skip to Water Audits section*
- *If they marked any of these programs move to Q#4 which will present **only** the education program(s) they selected*

4. **Education Programs:** On a scale of 1-5, how helpful did you find the specific Water Efficiency Education Program(s) indicated below. (1 = not helpful at all, 5 = very helpful)

	1 (not helpful)	2	3	4	5 (very helpful)	Not sure
Landscape Lecture Series						
Xeriscape Education/Tour						
Tours of Greeley Water facilities						
Teacher Training						
Speakers Bureau						
Annual Mayor’s Water Conservation Challenge						
[Other]						

5. **Education Programs:** What type of action, if any, was taken as a result of participating in _____?

[Mark all that apply]

- a. Switched to more waterwise plants or landscaping practices (e.g. replaced turf grass with native plants)
- b. Updated or adjusted my irrigation system in some way to improve water efficiency
- c. Switched to using more water efficient appliances or fixtures (e.g. faucet aerators, low-flow showerhead, low-flow toilet)
- d. Participated in a Greeley Water efficiency rebate, audit, or other financial incentive opportunity
- e. Changed my water usage behavior in some way (e.g. turning off tap when brushing teeth, washing car at commercial car wash instead of in driveway, etc.)
- f. Began educating others (students, friends) about the importance of water conservation
- g. No specific action was taken

h. Other [Please specify]

Blank is the specific program(s) they indicated in Q3. Repeat question if they indicated a change associated with more than one Education Program

6. **Education Program:** Is there anything else you'd like to share with us about your participation in a Greeley Water Education Program? [Optional]

WATER AUDITS

7. **Water Audits:** Greeley's free, voluntary water audits help customers identify ways to conserve water, and are targeted to indoor, outdoor, and commercial water use. In the past 5 years, which of the following Greeley Water Audit programs have you participated in? [Mark all that apply]

- a. Indoor Water Audits
- b. Outdoor Irrigation Audits
- c. Commercial Audits (available to multi-family residences, industrial, institutional & commercial accounts)
- d. None

- *If none, page skip to Other Efficiency Programs*

8. **Water Audits:** On a scale of 1-5, how helpful did you find the water audit program indicated below? (1 = not helpful at all, 5 = very helpful)

	1	2	3	4	5	Not sure
Indoor Water Audits						
Outdoor Irrigation Audits						
Commercial Audits						

Include only the audits they indicated participating in in Q8

9. **Indoor Water Audits:** What type of action, if any, was taken as a result of participating in an **Indoor Water Audit**? [Select all that apply]

- a. Repaired a leak
- b. Received and installed a free low flow showerhead(s) and/or faucet aerator(s)
- c. Upgraded an old high-water use appliance/fixture to a water efficient appliance/fixture
- d. Signed up for the WaterSmart customer portal
- e. Changed my water usage behavior in some way [e.g. turning off tap when brushing teeth, washing car at commercial car wash instead of in driveway, etc.]
- f. No action was taken
- g. Other [please specify]

Only for those who indicated in #8 that they had participated in an indoor audit

12. Water Audits: Do you have any recommendations for Greeley Water on improving the indoor audit program? [Optional]

13. Outdoor Water Audits: What type of action, if any, was taken as a result of participating in an Outdoor Irrigation Audit? [Select all that apply]

- a. Received a rebate from Greeley Water to install a smart sprinkler controller
- b. Received a rebate from Greeley Water to install a pressure-reducing valve
- c. Received a rebate from Greeley Water to install rotary sprinkler nozzles
- d. Adjusted my irrigation water pressure
- e. Adjusted my irrigation watering schedule
- f. Adjusted my irrigation system in some other way to improve efficiency
- g. Switched to more water wise plants or landscaping practices
- h. No specific action was taken
- i. Other [please specify]

14. Water Audits: On a scale of 1-5, how valuable did you find Greeley Water’s Outdoor Irrigation Rebate? (1 = not valuable, 5 = valuable)

	1	2	3	4	5	Not sure
Outdoor Irrigation Rebate						

- *Only if respondents received a rebate, identified in Q13*

15. Water Audits: Do you have any recommendations for Greeley Water on improving the irrigation audit and/or associated irrigation rebate program? [Optional]

16. Water Audits: What type of action, if any, was taken as a result of participating in a Commercial Water Audit? [Select all that apply]

- h. Repaired a leak
- i. Received and installed a free low flow showerhead(s) and/or faucet aerator(s)
- j. Received a pre-rinse spray nozzle
- k. Received a rebate from Greeley Water for bathroom fixtures, kitchen/restaurant equipment, laundry appliances (including washing machines), industrial devices, and/or irrigation hardware, etc.
- l. Upgraded an old high-water use appliance to a water efficient appliance
- m. Changed water usage behavior in some way
- n. Created a policy on water conservation or some other educational event for employees
- o. No specific action was taken
- p. Other [please specify]

17. **Water Audits:** On a scale of 1-5, how valuable did you find Greeley Water’s Commercial Rebate? (1 = not valuable, 5 = valuable)

	1	2	3	4	5	Not sure
Commercial Rebate						

- *Only if they received a rebate*

17. **Water Audits:** Do you have any recommendations for Greeley Water on improving the commercial audit and/or rebate program? [Optional]

18. **Water Audits:** Is there anything else you’d like to share with us about your participation in a Greeley Water Audit? [Optional]

OTHER EFFICIENCY INCENTIVE PROGRAMS

19. In the past 5 years, which of the following Greeley Water Efficiency Incentive programs have you participated in? [Select all that apply]

- a. Compost Bin and Rain Barrel Sale
- b. Discounted Garden in a Box Kit
- c. Free Low-Flow Showerhead Exchange
- d. High Efficiency Toilet Rebate
- e. Turf Retrofit: Life After Lawn
- f. None

If none, Skip to Online Efficiency Tools

20. **Efficiency Incentive Programs:** On a scale of 1-5, how valuable did you find the specific Water Efficiency Education Program(s) indicated below. (1 = not valuable at all, 5 = very valuable)

- *Only list the programs they indicated participating in*

Efficiency Incentive Program	1	2	3	4	5	Not sure
Compost Bin & Rain Barrel Sale						
Discounted Garden in a Box Kit						
Free Low Flow Showerhead Exchange						

High Efficiency Toilet Rebate						
Turf Retrofit: Life After Lawn						

22. Efficiency Incentive Programs: Do you have any recommendations for Greeley Water on improving the _____ program? [Optional]

- Only the program(s) they indicated participated in in Q #19

ONLINE WATER EFFICIENCY TOOLS

23. In the past 5 years, which of the following Greeley Water Online Water Efficiency Tools have you utilized? [Select all that apply]

- a. Water Budget Portal
- b. WaterSmart Customer Portal
- c. Greeley’s Water Conservation Webpage
- d. Online Plant Database
- e. None

If none, Skip ahead to next section

24. **Online Water Efficiency Tools:** On a scale of 1-5, how helpful did you find the specific Water Efficiency Education Program(s) indicated below. (1 = not valuable at all, 5 = very valuable)

- Only list the programs they indicated participating in

	1	2	3	4	5	Not sure
Water Budget Portal						
WaterSmart Customer Portal						
Greeley’s Water Conservation Webpage						
Online Plant Database						

25. Why did you choose to utilize the water budget portal? [Select all that apply in order of importance]

- a. To find out what the water budget was and better understand it
- b. To update my household information (e.g. people in my household, irrigable area)
- c. To learn more about my water use
- d. To save money on my water bill
- e. To reduce my personal water use
- f. To protect our limited water resources
- g. To save more water than my neighbors

- h. To support community values
- i. Other
- *Only if they used the water budget portal*

26. Why did you choose to utilize the WaterSmart customer portal? *[Select all that apply in order of importance]*

- j. To review my water bill
- k. Because I had a large bill or a leak
- l. To update my household profile
- m. To learn more about my water use
- n. To save money on my water bill
- o. To reduce my personal water use
- p. To protect our limited water resources
- q. To save more water than my neighbors
- r. To support community values
- s. Other
- *Only if they used the WaterSmart portal*

SECTION 2: WATER EFFICIENCY BEYOND GREELEY PROGRAMS

1. The following is a list of possible water saving actions for your home or business. What actions – if any – have you taken in the last 5 years (2015 – 2020) to reduce your water use? *[Select as many as apply]*

Outdoor Activities

- a. Adjusted irrigation system and timers
- b. Installed a rain sensor to shut off irrigation system
- c. Installed a smart irrigation controller
- d. Reduced/skipped watering
- e. Replaced lawn or garden with low water plants or other material (e.g. vegetable garden, rock, mulch, hardscape)
- f. Upgraded irrigation system with high-efficiency equipment
- g. Installed a rain barrel/cistern
- h. Started a compost bin or pile
- i. Began tracking rainfall on my site
- j. Began running my irrigation system manually
- k. Used a broom instead of a hose to clean paved areas
- l. Fixed outdoor leaks (sprinkler, spas, etc.)

Indoor Activities

- m. Purchased a high-efficiency clothes washer
- n. Installed faucet aerators
- o. Installed low flow showerheads
- p. Installed a water efficient toilet(s)
- q. Washed only full loads of clothes or dishes
- r. Took shorter showers

- s. Fixed indoor leaks (toilet, faucet, etc.)
 - t. I don't let the water run unnecessarily

 - u. Other [please specify]
 - v. None
2. Which of the following would be easier for you to do?
- a. Reduce the amount of water you now use for outdoor landscaping and gardening
 - b. Reduce the amount of water you now use for indoor uses
 - c. I could reduce both my indoor and outdoor water use easily
 - d. Neither

SECTION 3: LOOKING FORWARD / FUTURE PARTICIPATION & IMPROVEMENTS

1. What would motivate you to participate in Greeley's water conservation program? *[Select all that apply in order of importance]*
- a. To save money on my water bill
 - b. To pay for a fixture/appliance that I want to replace (e.g toilets, smart irrigation controllers)
 - c. To reduce my personal water use
 - d. To protect our limited water resources
 - e. To save more water than my neighbors
 - f. To support community values
 - g. Not applicable, I'm not motivated to participate
 - h. Other [please specify]
2. The City of Greeley currently offers all of the following water efficiency programs, tools and incentives to customers. What water efficiency programs, if any, are you most interested in participating in in the next 3 years, using a scale of 1 to 5, with 1 being not interested and 5 being very interested. *[Mark all that apply, if you have already participated or are not eligible for this specific rebate mark N/A]*

Education Programs:

- a. Landscape Lecture Series - free lectures and workshops on landscape topics to improve water efficiency
- b. Xeriscape Education - Literature, classes and tours of Greeley's Xeriscape gardens (I.e. Woodbriar or Bittersweet Park)
- c. Tours of Greeley water-related facilities
- d. Teacher Training on water and conservation issues for local teachers
- e. Speakers Bureau - Greeley Water speakers visit classrooms, civic clubs and other groups
- f. Annual Mayor's Water Conservation Challenge –water use reduction contest

Water Audits:

- g. Indoor Water Audits
- h. Outdoor Irrigation Audits

- i. Commercial Audits (for multi-family residences and industrial, institutional & commercial accounts)
- j. Outdoor Irrigation Rebates (smart irrigation controller, pressure reducing valves, rotary sprinkler nozzles)
- k. Commercial Rebates (water efficient appliances, irrigation hardware, etc.)

Other Efficiency Incentives:

- l. Life After Lawn turf replacement rebates (available to single family residents)
- m. Xeriscape Grants (available to multi-family residences and industrial, institutional and commercial accounts)
- n. Compost Bin and Rain Barrel Sale
- o. Discounted Garden in a Box Kit
- p. Free Low-Flow Showerhead Exchange
- q. High Efficiency Toilet Rebate
- r. Life After Lawn turf replacement rebates (for single family residents)

Online Water Efficiency Tools:

- s. Water Budget Portal
- t. WaterSmart Customer Portal
- u. Online Plant Database
- v. Greeley Water Conservation webpage

Only if they selected a program in Q1 of Sec. 3

3. How important do you feel the City of Greeley's water efficiency programs are?
 - a. Very important
 - b. Important
 - c. Neither important nor unimportant
 - d. Not important

4. How do you prefer to receive information about saving water and Greeley Water's efficiency programs?
[Select all that apply]
 - a. Bill inserts
 - b. Direct mail to my home or business
 - c. Greeley Water website
 - d. Social media
 - e. Local newspaper articles/advertisements
 - f. Radio advertisements
 - g. Visits or calls to Greeley Water
 - h. Email updates/monthly newsletter

5. How willing, if at all, would you be to adopt a low water use landscape by removing turf grass from your front yard?
 - a. Very willing
 - b. May consider
 - c. Would not consider

- d. Already converted yard (skip ahead)
 - e. Don't have yard (skip ahead)
 - f. Don't know / Not sure (skip ahead)
6. What are the primary barriers keeping you from replacing some or all of your grass with low water use landscaping? *[Select as many as apply]*
- a. Cost
 - b. Physical labor involved
 - c. Time
 - d. Knowledge/expertise
 - e. I like the look of grass
 - f. I don't like the look of low water landscapes
 - g. Doesn't save enough water to be worth the effort
 - h. Other [Specify]
 - i. Don't know / Not sure

SECTION 4: DEMOGRAPHICS

You may select prefer not to answer for any of the following questions

1. Do you own or rent your current place of residence?
 - a. Own
 - b. Rent
 - c. Other [Write in]
 - d. I do not live in Greeley
 - e. Prefer not to answer

2. What type of residence do you live in?
 - a. Apartment
 - b. Condo/townhome
 - c. Patio home
 - d. Duplex
 - e. Mobile home
 - f. Single-family detached
 - g. Other
 - h. I do not live in Greeley
 - i. Prefer not to answer

3. Which of the following best describes your age?
 - a. 18-24
 - b. 25-34
 - c. 35-54
 - d. 55-64
 - e. 65+
 - f. Prefer not to answer

4. Are you of Hispanic, Latino or Spanish origin?
 - a. Yes
 - b. No
 - c. Prefer not to answer

5. How would you describe yourself? *[Select all that apply]*
 - a. Black or African American
 - b. Asian
 - c. Native Hawaiian or Pacific Islander
 - d. Native American or Alaska Native
 - e. White
 - f. Other [Write in]
 - g. Prefer not to answer

6. Which of the following categories best describes your household income, that is from all persons in your household before all taxes?
 - a. Under \$25,000
 - b. \$25,000 - \$49,000
 - c. \$50,000 - \$75,000
 - d. \$75,000 - \$99,999
 - e. \$100,000 - \$149,999
 - f. \$150,000 - \$249,999
 - g. \$250,000 and above
 - h. Prefer not to answer

FINAL

7. Thank you so much for completing this questionnaire. To be entered into the raffle, please provide your name and email (preferred) or phone number. *Note: your contact details will not be correlated with your survey responses.*
 - a. Name
 - b. Email
 - c. Phone

To learn more about Greeley's water efficiency programs, please visit <https://greeleygov.com/services/ws/conservation/about>.

Appendix C – Greeley Water Conservation Bill Stuffer



*Greeley is looking for your opinion!
Turn over to learn more.
Greeleygov.com/conserve*



Your opinions on Greeley's water conservation efforts matter!

The City of Greeley is conducting an evaluation of its water conservation programs to determine which programs are most effective in helping the city meet its conservation goals.

Your feedback on these programs, regardless if you have participated or not, will help ensure that we can continue to improve our conservation programs and help you *save water and money*.

For participating in this 5-15 minute survey, you will be entered to win a \$100 gift card to a local restaurant and other prizes!

Type the URL below into a web browser or use the QR code with your smartphone camera to access the survey.

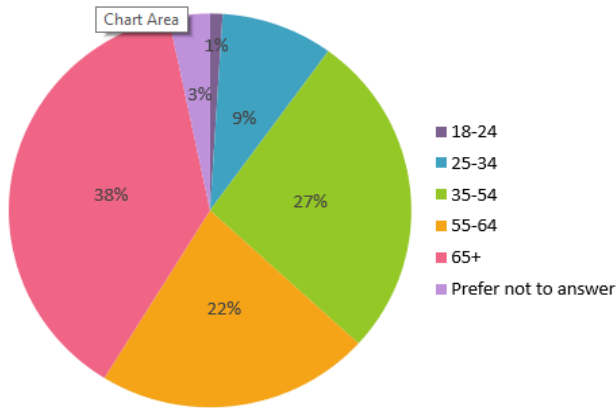
<http://bit.ly/GreeleyWater>



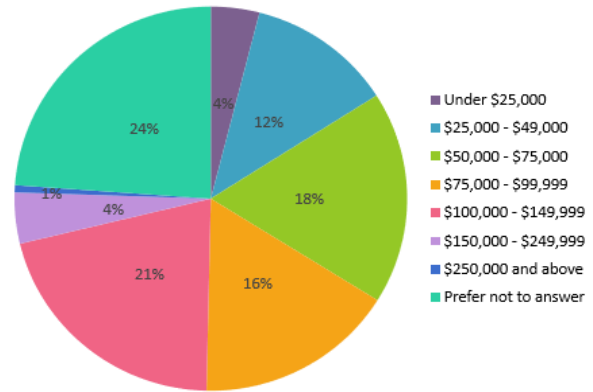
Thank you!

Appendix D – Demographic Survey Results

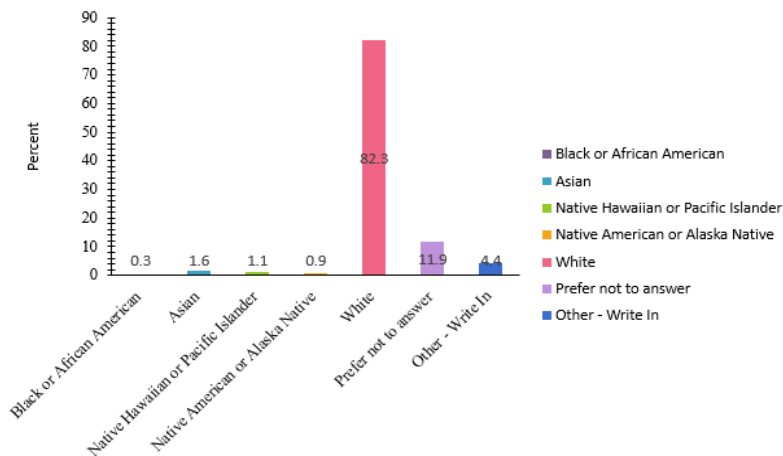
Which of the following best describes your age?



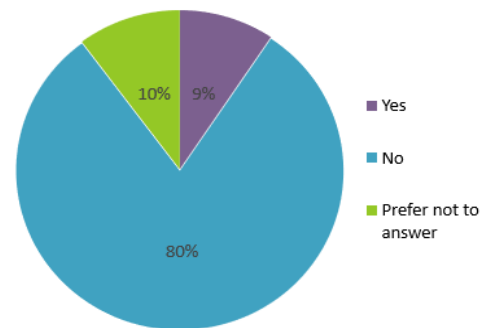
Which of the following categories best describes your household income, that is from all persons in your household before all taxes?



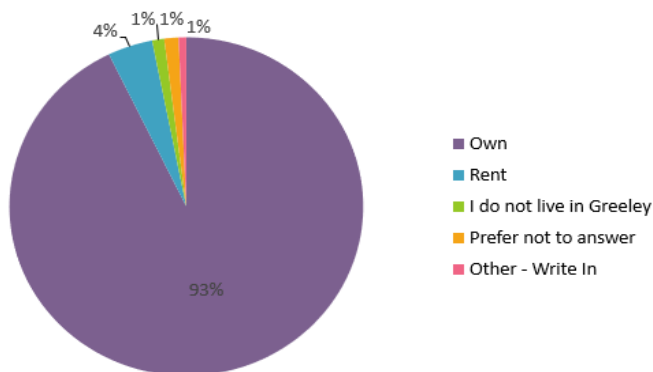
How would you describe yourself?



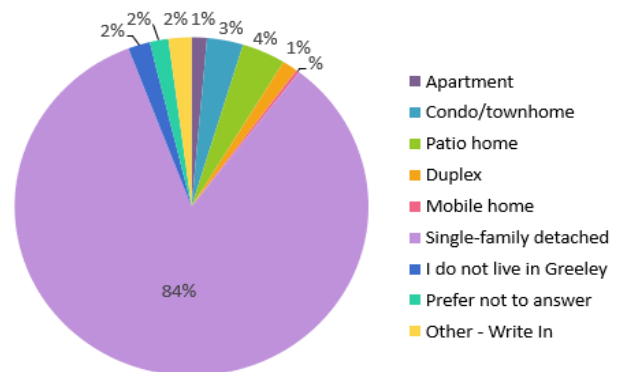
Are you of Hispanic, Latino, or Spanish origin?



Do you own or rent your current residence?



What type of residence do you live in?



Appendix E – Spatial Trends in Water Conservation Program Participation: Analysis and Data Sources

Additional details and maps visualizing the spatial analysis of participation in Greeley’s water conservation programs are available [here](#).

A detailed description of the U.S. Census Bureau’s American Community Survey (ACS) data underlying the analysis is summarized in Table A-1 below.²⁸

Demographics Visualized in Maps	Data Source
Percentage of Renter-Occupied Housing	US Census Bureau. (2020). 2015-2019 American Community Survey 5-Year Estimates. Total Population in Occupied Housing by Tenure by Units in Structure. https://data.census.gov/cedsci/ .
Population speaking an Asian American and Pacific Islander language	<p>US Census Bureau. (2020). 2015-2019 American Community Survey 5-Year Estimates. Household Language by Household Limited English Speaking Status. https://data.census.gov/cedsci/.</p> <p><i>Asian American and Pacific Islander languages are defined by the US Census Bureau as including Chinese (incl. Mandarin, Cantonese), Japanese, Korean, Hmong, Vietnamese, Khmer, Thai, Lao, or other Tai-Kadai languages, Tagalog (incl. Filipino), Ilocano, Samoan, Hawaiian, or other Austronesian languages, and other languages of Asia.</i></p> <p><i>Indo-European languages are defined by the US Census Bureau as languages spoken over the greater part of Europe and Asia as far as northern India (e.g., French, Armenian, Bengali, Nepali, Marathi, Telugu, Tamil, etc.).</i></p> <p><i>Spanish-Speaking Population includes all residents who speak Spanish (but may also, e.g., speak another language, such as English). Spanish-Speaking Population with Limited English includes residents who speak Spanish and who have limited fluency in English.²⁹</i></p>
Population speaking an Indo-European language	
Spanish-Speaking Population	
Spanish-Speaking Population with Limited English	
Percent of Population that Identifies as Hispanic or Latino by Race	<p>US Census Bureau. (2020). 2015-2019 American Community Survey 5-Year Estimates. Hispanic or Latino Origin by Race. https://data.census.gov/cedsci/.</p> <p><i>U.S. federal government agencies adhere to standards issued by the Office of Management and Budget, which specify that race and Hispanic origin (also known as ethnicity) are two separate and distinct concepts. The question underlying this data asks respondents if they view</i></p>

²⁸ The American Community Service (ACS) data reflects information gathered annually by the U.S. Census Bureau. The Bureau poses questions to randomly sampled addresses each year, and then uses this information to calculate community demographic information. This ACS data complements the Decennial Census the Bureau conducts every 10 years, which seeks responses from every resident. For information, see: <https://www.census.gov/programs-surveys/acs/about.html>.

²⁹ A more detailed explanation of how the US Census defines language categories is available at: <https://www.census.gov/topics/population/language-use/about.html>.

	<i>themselves as having racial identity that is Hispanic or Latino (which does not preclude also having additional racial identities).</i> ^{30 31}
Percent of Population that Identifies as Hispanic or Latino by Origin	<p>US Census Bureau. (2020). 2015-2019 American Community Survey 5-Year Estimates. Hispanic or Latino Origin. https://data.census.gov/cedsci/.</p> <p><i>U.S. federal government agencies adhere to standards issued by the Office of Management and Budget (OMB), which specify that race and Hispanic origin (also known as ethnicity) are two separate and distinct concepts. Hispanic origin can be viewed as the heritage, nationality, lineage, or country of birth of the person or the person’s parents or ancestors before arriving in the United States. OMB defines "Hispanic or Latino" as a person of Cuban, Mexican, Puerto Rican, South or Central American, or other Spanish culture or origin regardless of race. People who identify as Hispanic, Latino, or Spanish may be any race.</i>^{32 33 34}</p>
Median Household Income	US Census Bureau. (2020). 2015-2019 American Community Survey 5-Year Estimates. Median Household Income in the Past 12 Months (in 2019 Inflation-Adjusted Dollars). https://data.census.gov/cedsci/ .
Total Population Population Density	US Census Bureau. (2020). 2015-2019 American Community Survey 5-Year Estimates. Total Population. https://data.census.gov/cedsci/ .

Table A-1. 2020 U.S. Census Bureau American Community Survey (ACS) data included in the analysis of Greeley’s water conservation programs.

³⁰ U.S. Census Bureau. (2021). “About the Hispanic Population and its Origin.” Available: <https://www.census.gov/topics/population/hispanic-origin/about.html>.

³¹ U.S. Census Bureau. (2010). *Overview of Race and Hispanic Origin: 2010*. Available: <https://www.census.gov/content/dam/Census/library/publications/2011/dec/c2010br-02.pdf>.

³² U.S. Census Bureau. (2021). “About the Hispanic Population and it's Origin.” Available: <https://www.census.gov/topics/population/hispanic-origin/about.html>.

³³ U.S. Census Bureau. (2021). “Hispanic Origin.” Available: <https://www.census.gov/topics/population/hispanic-origin.html>.

³⁴ For additional context about this Census question and the nuances of how Hispanic and Latino race and origin are interpreted in the Census, please see: Pew Research Center. (23 September 2021). “Who is Hispanic?” Available: <https://www.pewresearch.org/fact-tank/2021/09/23/who-is-hispanic/>.

Appendix F – Review of Water Efficiency Program Analyses

The review of water efficiency program analyses highlighted several core elements in approaches to methodologies for calculating water use changes resulting from water conservation and water efficiency programs. These elements are listed here and described in greater detail in the sections below.

1. Data Included
2. Water Savings Methodologies
3. Baselines and Control Groups
4. Metrics Tracking Program Costs, Benefits, and Return on Investment
5. Methodologies for Understanding Participation in Conservation Programs
6. Analysis Applications & Key Findings

1. Data Included

The data underlying water efficiency program analyses often included:

- Water demand numbers/consumption data from billing information
- Population numbers
- Rebate program participation and available program details (number and type of dishwashers, toilets, clothes washers installed, etc.)
- Educational program participation details (monthly classes held, number of Garden in a Box kits distributed, etc.)
- Program costs

2. Methodologies: Water Savings

Analyses of water use change or water savings take a number of different forms. The sections below describe two approaches representative of different styles of conducting this analysis.

A. Example One: Program Performance Analysis

One study used R/R Studio to conduct its water efficiency program analysis; this software was chosen because of its free open-source nature, and because it enables the creation of replicable codes. The analysis team pulled water consumption data from customers' billing information, and combined (or joined) this with data on participation in water efficiency programs. This data informs two key sets of calculations around indoor water use and outdoor water use.

The general methodology applies the formula below:

Water use change = Water use the year prior to participating in program – water use the year after participating

To calculate **indoor water use**, the study uses the formula below:

Indoor water use = (Total use for Dec-Mar) + (WQA if month's use exceeds WQA, otherwise total use for Apr-Nov)

Where WQA (Winter Quarterly Average) = Average use December, January and February.

- This approach defines the winter quarter as including the billing data from January, February, and March. December billing data is excluded because, given the way Aurora's billing cycle is timed, January billing data encompasses most of the water use in December. March billing data is included to encompass water use in February.
- This approach calculates the winter quarter's average water use (WQA) and multiplies this by 12, to estimate water use in: (a) the year before and (b) the year after participation in a water efficiency program.
- This approach compares water use across years, rather than across months.

To calculate **outdoor water use**, the study uses the formula below:

Outdoor water use = Apr – Oct water use greater than WQA. Outdoor water use is normalized for weather.

- This approach calculates the total water consumption during the year's outdoor months (April through November³⁵) and subtracts the average indoor water use (described above as the average water use during the winter quarter or WQA). The average indoor water use average was applied to all months of the year before it was subtracted from the total water consumption during the year's outdoor months.
- This approach normalizes the data based on weather conditions: specifically, Plant Water Requirements (PWR). The PWR of the year in question was compared to PWR in the year before, and to a 10-year rolling average. If PWR was higher in the year before, compared to the 10-year rolling average, a ratio was created to adjust consumption down to account for this.

Several additional steps also help prepare the data for analysis:

- Any outliers were removed from the analysis before it was conducted.
- Households in behavior-oriented programs were only included if the account was not transferred from a previously participating customer.
- Customers that had a leak or break investigation from field services were not included in the analysis.

³⁵ November meter reads are used to completely capture October water use data.

B. Example Two: Water Conservation Program Evaluation

In another example, a community partnered with and used a company's proprietary Sustainability Information Management System (SIMS) software to develop a spatial dataset including each customer's account and account number, address, customer class, and program participation. They focused their water savings analysis on a subset of customers: single-family households with data going back to at least 2005. This reflected the fact that single family households made up the majority (over 95%) of water efficiency participants. Monthly data from 2005 was necessary to pre-date customer involvement in water efficiency programs, though this criteria did limit the number of customers included in the analysis. Customers that met both criteria accounted for 38-69 percent of program participants.

This study's general methodology involved calculating the average daily water use/connection for each month, using the following approach for all customers included in the analysis:

Average daily water use for [month] = Sum of daily water use for all participants in the program of interest/number of available records for a particular month

The sum of participant's daily water use was divided by the number of available records, since not all participants had complete water records for the entire period of interest.

This data was used to estimate both (1) the annual water savings of water efficiency programs and (2) the accumulated water savings from January 2005 to January 2011.

To calculate the water savings of **indoor water use** programs, this study calculated the wintertime daily average water use:

Indoor water use = Average daily water use from December through March

Winter use was defined as December through March for all years except for 2005 (which used January - March) and 2020 (which used December and January).

This calculation measures changes in daily wintertime use per connection (units: gallons/day).

To calculate the water savings of **outdoor water use** programs, the analysis calculated the total summertime outdoor water use:

Outdoor water use = Sum of all customer daily water use from April through October - (estimated daily wintertime water use from the preceding winter * 214 days)

This calculation measures changes in seasonal water use per connection (units: gallons).

To account for the variable seasonal impact of wind, precipitation, and temperature, the summertime water use was compared to summertime water use in the previous year. Based on this comparison, a ratio was applied to normalize water use across different years. For instance, evaluations of one conservation program's participants summertime water use for each of the years between 2006 - 2011 were normalized to the summertime water use in the year 2005.

C. Additional Questions and Considerations

There are many different approaches to calculating the water savings from water use efficiency programs. Key questions include:

- How to **define “indoor” and “outdoor” water use** (for instance, what months are used to determine when outdoor water use is likely to occur).
- How to **adjust data to calculate indoor water use** (some programs, for instance, have meter reads that separate indoor and outdoor water use, making the calculations to distinguish between indoor and outdoor water use unnecessary).
- How to account for **variable temperature, wind and precipitation rates** and their impact on outdoor water use over time. For instance, while one city calculates the PWR from year to year, and uses this ratio to normalize outdoor water use across years, another used the ratio of water usage from year to year as the basis of a similar calculation.

Time frames: It can be challenging to account for the impacts of a particular program over time. One report took the approach of calculating savings on a one-time basis (rather than tracking them over the long term). This analysis is branded as a “change analysis” – rather than a water savings analysis – as the impacts of programs often vary widely across different years, and do not always result in water savings.

Another analysis, in comparison, calculates both the annual and the accumulated savings over the implementation of a water efficiency program. Its assessment also notes a wide range of savings across different years, which may reflect both variability in meter reading and billing across different time periods, as well as larger-scale water use trends.

Risk of Double-Counting: There is often a risk of “double-counting” water savings from participants who participate in multiple programs. Isolating program-specific savings was described as often very challenging across our informational interviews. Possible approaches to addressing this risk include:

- Using a hierarchy model. One approach involves assigning a different weight to different water conservation programs, to estimate how much each contributed to overall water savings, and to avoid double counting.
- Including a very clear disclaimer when presenting water savings numbers across different program types, noting that program-specific savings cannot simply be added up to get an overall total without a risk of double-counting and additional uncertainty.

3. Baselines and Control Groups

There are several different approaches to determine a reference point to measure the impact of water efficiency programs from.

One approach is to establish a control group, a group of customers with similar (1) water use and (2) seasonal variation in water use as customers participating in water efficiency programs.

An analysis by one community, for instance, mirrored the indoor and outdoor water use calculations for water efficiency programs for a group of 1,000 customers who did not participate in water efficiency programs, and had water usage data going back to 2005. Three-year rolling averages of water use were calculated across all control group participants, to smooth out some variability in gallons of water use/day/connection, due to variation in the dates of meter reads, among other factors. Outdoor water use data among control participants was also normalized according to the same method as treatment group participants (based on a ratio comparing current seasonal water use to seasonal water use in a control year).

Another approach is to measure changes in participating customers, prior to, during, and after their participation in water efficiency programs.

We found a number of analyses that took this approach. This methodology includes the caveat that many sources of variability – from the dates of meter reads and billing, to changes in weather conditions, to other larger trends in water use – can influence this data.

These approaches are not mutually exclusive; conducting both can offer complementary insights into the impact of different programs.

4. Metrics tracking program costs, benefits, and return on investment

A brief summary of common metrics used to calculate and communicate the costs, benefits and returns on investment for various programs follows below.

- Total annual program costs
- Water savings (gallons per day per unit or connection)
- Water savings (estimated gallons saved annually by a program)
- Water savings (estimated gallons saved over project lifetime)
- Water savings (total acre feet saved per year)
- Water savings (cumulative water savings across several years)
- Cost/AF (according to year, to indoor/outdoor water use, and to program)
- Rebate efficiency (AF/rebate)
- Average savings/customer per program
- For indoor rebates, years before the customer saved enough money to realize a return on their investment
- Deep dives into case studies of high-volume users

5. Methodologies for understanding participation in conservation programs (indoor, outdoor)

A. Spatial analysis

Cities often used spatial analysis to explore participation across different neighborhoods.

Several reports, for instance, display maps that visualize participation indoor and outdoor water efficiency programs across different neighborhoods.

Key visualizations include:

- The **rate of participation in indoor and outdoor water efficiency programs by neighborhood**. This can include neighborhood-by-neighborhood analyses, and/or a hot spot analysis of participation in indoor and outdoor water efficiency programs across the city.
- The **change in water use by neighborhood**. One community has displayed maps highlighting the 10-15 neighborhoods with the largest savings. The visualizations take the approach of celebrating savings, rather than naming and shaming neighborhoods with high water consumption. These maps explore water savings in terms of both aggregate and average water use changes.

These analyses only include customers who have several years of data available. It's also important to note that turnover and new developments can significantly affect neighborhood water use levels from year to year.

B. Customer and market segmentation analysis

In addition to mapping participation, one community has explored using U.S. Census data to develop customer and market segmentation. For instance, based on statistical analyses, it is possible to identify what kinds of distinct customer groups exist, based on considerations such as infrastructure, demographics, and water use levels and patterns. This kind of analysis can support targeted marketing; for instance, identifying different water use patterns across different cultures and targeting marketing towards specific water uses. It's important to have a way to flag changes in who lives at a property and to filter the analysis for this, when conducting this kind of analysis.

A number of analyses also track participation by customer category, such as: combined, commercial, irrigation class, multi-family, and residential, or more detailed categories such as: auto dealership, church, condo, cross-listed, duplex/triplex, manufactured home, hotel/motel, multifamily (4-8), multifamily (9+), office, other, recreational, retail, single family, warehouse, and undefined. For instance, one city found that their Slow the Flow program, which provides free irrigation consultations, efficiency tests, and customized irrigation schedules, initially had high levels of residential demand, necessitating budget increases for the program. Currently, however, the program mostly attracts larger customers, such as HOAs.

Analysis Applications and Key Findings

For the communities we spoke to, water efficiency analyses serve both internal and external purposes. These analyses help inform planning for future infrastructure and supply needs. Internally, they also help justify the use of staff time to implement efficiency programs, and benchmark the performance of different efficiency programs, to guide internal decisions about the future evolution and prioritization of different efficiency programs. For instance, one community found that while its toilet rebate program offered a strong return on investment initially, once the program had replaced most of the older toilets, it had a diminishing impact on water savings, unless it started to target larger customers (e.g., schools, apartment complexes).

Additional Advice and Best Management Practices

Several cross-cutting themes and best practices – described in greater detail below – emerged through interviews with communities who conducted a water use change analysis.

A. Starting points and scoping the analysis

The communities suggested considering several key points when developing an analysis, including:

- The future goals for data collection and analysis. Ideally, these considerations can also feed into the monitoring process – by starting with the question “how will we track this?” at the beginning of a program.
- Keeping analyses “simple but defensible,” and “only as complex as they have to be.” One respondent noted that while it’s easy to make evaluations of water use quite complicated, often in response to input from internal experts, it’s important to also take into account the considerations around maintaining the data and repeating analyses across different years, potentially under the direction of different team members. It’s also helpful to keep the intended audiences for the analysis in mind, and to consider what types of metrics will be most effectively communicated. Often, these are the most straightforward indicators.
- Updating analyses across different years. One respondent noted that they have worked to find a balance between updating methodology – to reflect lessons learned and to try new analytical approaches – and consistency with past methodologies, which makes it possible to easily compare program performance across different years.

B. Data Management

The interviews uncovered several recommendations around data management:

- Standardizing the process for entering, and cleaning and processed data is very helpful. It is ideal to devote some time to thinking through data input, data use, and the data infrastructure plan as part of the larger analysis process.
- It is vital to ensure the presence of joiner IDs (e.g., names, customer IDs, etc.) to match and combine information across different data sources.
- In terms of sharing data across analysts, it’s helpful when all analysts use the same program (e.g., Excel, R Studio, ArcGIS) to ensure consistency across different analyses and any data sets that feed into the analysis. Sometimes combining or manipulating information from different systems (e.g., accessing and analyzing data from a system tracking customer water use) creates challenges.

C. Communicating the Results

In terms of communicating the results, several overarching suggestions included:

- Tailoring the findings for different audiences; some metrics may be more interesting to internal planners or analysts who are most familiar with implementing water efficiency programs; other metrics may resonate more with public or policy-focused audiences.

- One City has branded its analysis as a “change analysis” rather than “water savings analysis,” since they do not always see water savings in the yearly analysis. Providing clear context to help viewers interpret the results and to understand what types of information they draw from is crucial.

Resources and Reports

Report	Description
Aurora Water. (2015). Aurora Water Conservation: 2015 Annual Report.	Summary of results of water efficiency analysis, in terms of both water savings and community participation in water efficiency programs.
Aurora Water. (2015). 2015 Municipal Water Efficiency Plan.	Summary of water efficiency programs, and calculation of water savings by program from 2002-2012. This memo references Aurora’s more recent methodology (which has been updated significantly since 2015), and also provides a detailed description of the program’s earlier approaches to measuring water savings from efficiency programs.
Alliance for Water Efficiency (AWE) Water Conservation Tracking Tool	The Alliance for Water Efficiency (AWE) has developed an Excel-based Water Conservation Tracking Tool ³⁶ that evaluates water savings, costs, and benefits for a water utility’s conservation programs, using a standardized methodology for water savings and cost-benefit accounting. It includes a list of pre-defined conservation activities users can select to guide their analysis. The program also estimates reduction in greenhouse gas emissions resulting from changes to plumbing and/or energy codes and conservation program activity.
City of Longmont, CH2MHill and Great Western Institute. (January 2013). Water Conservation Program Evaluation.	Assesses the effectiveness of water conservation programs supported by the City of Longmont, and recommends adjustments to make those programs more cost effective. Includes a detailed description of the methodology behind the assessment of water conservation programs.
City of Longmont, CH2MHill and WaterDM. (September 2017).	Section 4, “Current and Future Water Efficiency Efforts,” summarizes the history and intended future for Longmont’s

³⁶ For more details, visit: <https://www.allianceforwaterefficiency.org/resources/topic/water-conservation-tracking-tool>.

<p>Water Efficiency Master Plan: Update to the 2008 Water Conservation Plan.</p>	<p>water efficiency programs. It describes trends in gross and per capita residential water use and estimates future water savings from water efficiency programs.</p>
<p>Feinglas, S., Gray, C., and Mayer, P. (November 2013). Conservation Limits Rate Increases for a Colorado Utility. Alliance for Water Efficiency.</p>	<p>This study examines the long-term impact of water conservation on water rates and tap fees in the City of Westminster, Colorado and finds that rates would be substantially higher today if not for water savings achieved since 1980. Analysis draws on water demand records, water rates, tap fees, and capital project costs from 1980 through 2010.</p>
<p>Resource Central. (2020). 2019 Annual Report: Water Conservation Impact.</p>	<p>Overview of quantitative and qualitative metrics for different water conservation programs, including many educational programs.</p>
<p>Water Research Foundation. (April 2016). Residential End Uses of Water, Version 2: Executive Report.</p>	<p>The study identifies variations in water use by fixture or appliance (updating a 1999 study) and evaluates future conservation potential. It also includes predictive models to forecast residential demand.</p>

Appendix G – Water Use Change Analysis: Detailed Methodology

In consultation with Greeley, WaterNow and WRA identified a subset of Greeley’s water conservation programs to focus the participation and water use analysis on (the full list of these programs is described in greater detail in Table A-2 below).

The analysis covers participation in water efficiency programs during the years 2013-2018. Given the unusual factors – the COVID pandemic and resulting stay-at-home orders – affecting 2020 water use, 2020 water use is not included in these calculations, and the water use change for participation in programs during 2018 is analyzed using only 2019 water use data.

To conduct the analysis, we compared customers’ average water use two years prior to participation in Greeley’s water conservation programs, with their average water use two for two years following their participation in a water use program. While many other methodologies could provide helpful insight into the change in water use resulting from water conservation program participation (see the *Resources and Reports* section in Appendix F for a more detailed description of methodological approaches and related studies), this approach was determined to be the best match for Greeley’s existing data and data format.

Specifically, we applied the following calculation to participants in evaluated programs:

Water use change = Average water use for the two years prior to participating in program – average water use for the two years after participating

This approach was applied to programs targeting indoor and outdoor water use. Indoor water use was calculated as the total water use during the months of January, February, March, November, and December. For the remaining seven months of the year, it was assumed that indoor water use was the average monthly during these five winter months. A customer’s annual indoor water use was calculated using the approach below:

Indoor water use = (Total use in Jan., Feb., March, Nov., Dec.) + (WQA*7)

WQA (Winter Quarterly Average) = Average water use in Jan., Feb., March, Nov., Dec.

Outdoor water use was defined as water using during the months of April through October, that was greater than the average indoor water use. Outdoor water use was calculated using the approach below:

Outdoor water use = Apr. – Oct. water use, greater than WQA

Outdoor water use between years was normalized for weather, by using Greeley’s annual Irrigation Water Requirement (IWR).

Once participants’ indoor or outdoor water use (depending on the conservation program being evaluated) was calculated, the average water use change was first calculated, and then applied to the years that a participant was active in the program (e.g., if a customer participated in 2014, the average annual water savings was applied to the years 2015-2018). We referenced the default lifetime savings and annual savings decay rates cited in the AWE Water Conservation Tracking Tool; based on these values, only the Commercial and Residential Indoor and Outdoor Programs had a savings decay rate (of 20 percent annually) and a lifetime savings rate (of five years) that applied to the analyzed programs. The toilet rebates, for instance, had an estimated 25-years of savings – far beyond the six years included in this analysis (see Table A-3 for more details).

The cost calculations used for each program typically included both the cost of a rebate along with administrative costs. It is important to note that the estimates around staff time are limited to the installation of a particular program or rebate (e.g., the process of reviewing an application). Longer, more overarching processes – such as developing programs, transportation, equipment, or advertising to increase participation in a program – are not captured in this analysis’s cost calculations.

Program Name	Description	Indoor/Outdoor Water Use	Customer Types	Years Analyzed
Commercial and Residential Audits				
Commercial 2013-2018 Use: Commercial Audits 2013-2018	Indoor Water Audits: Greeley Water Specialists come to a property to: <ul style="list-style-type: none"> ● Review how a customer is using water ● Identify areas of water waste ● Provide recommendations and custom water use targets 	Indoor and/or Outdoor	CII, MFR	2013-2018
Residential 2013-2018 Use: Residential Audits 2013-2018	Outdoor (Irrigation) Audits: Greeley Water Specialists come to a property to: <ul style="list-style-type: none"> ● Inspect watering zones and identify problems ● Measure how much water is being applied ● Check water pressure and recommend adjustments ● Develop a custom watering schedule 	Indoor and/or Outdoor	SFR	2013-2018
Indoor Conservation Programs				
0.8 GPF Toilet Rebate	Toilets that use 0.8 gallons per flush or less are eligible for rebates (with a two-toilet rebate per household limit).	Indoor	CII, MFR, SFR	2014-2018
Dual Flush Toilet Rebate	Greeley provided rebates for dual flush toilets, a variation of the flush toilet that uses two buttons or a handle mechanism to flush different amounts of water.	Indoor	CII, MFR, SFR	2013-2018
Low Flow Toilet Rebate	A low-flush toilet (or low-flow toilet or high-efficiency toilet) is a flush toilet that uses significantly less water than traditional high-flow toilets	Indoor	CII, MFR, SFR	2016-2018
Ultra Low Flow Toilet Rebate		Indoor	CII, MFR, SFR	2013-2018

Toilet Rebates	Includes and summarizes the four programs listed above: an 0.8 GPF Toilet (2014-2018); a Dual Flush Toilet (2013-2018); a Low Flow Toilet Rebate (2016-2018); and an Ultra Low Flow Toilet Rebate (2013-2018).	Indoor	CII, MFR, SFR	2013-2018
Front Loading Washer Rebate	Greeley provided rebates for high-efficiency front loading clothes washers, which use less water and energy than standard top loading clothes washers. This program ended in 2018.	Indoor	CII, MFR, SFR	2013-2018
Showerhead Exchange	At showerhead exchanges, which are held periodically at events, customers can exchange their old showerheads for new low-flow models at no cost.	Indoor	CII, MFR, SFR	2017-2018
Outdoor Conservation Programs				
ET Sensor Rebate	An ET Sensor uses factors such as solar radiation, air temperature, relative humidity, and wind to calculate evapotranspiration and communicate it to the central software (e.g., to an irrigation controller) via the host controller's communication.	Outdoor	CII, MFR, SFR	2013-2018
Spray Head Sprinkler Exchange	Greeley enabled customers can exchange their old spray heads for more efficient models.	Outdoor	CII, MFR, SFR	2016-2018
Rotary Nozzles Rebate	Rotary nozzles increase uniformity and reduce overspray in irrigation systems. They operate by rotating a stream of water over the landscape, in contrast to the mist produced by spray-head sprinklers.	Outdoor	CII, MFR, SFR	2013-2018
Smart Controller Rebate	Smart controllers are automatic timing devices with nonvolatile memory used to remotely control valves that operate an irrigation system that is contractor grade quality. Smart controllers are able to self-adjust and reschedule irrigation events based on integrated instrumentation that measures evapotranspiration (weather-based) or soil moisture or flow or a combination.	Outdoor	CII, MFR, SFR	2013-2018
Irrigation Controller Rebate		Outdoor	CII, MFR, SFR	2014-2018

	Smart Controller Rebates were installed by Greeley’s Water Conservation Specialists, while Irrigation Controller Rebates were installed by the customer.			
Pressure Reducing Valve (PRV) Rebate	A pressure-reducing valve reduces misting, a fine spray that results from irrigation systems that apply water at a very high pressure, resulting in excessive evaporation and water drifting away from the intended irrigation area.	Outdoor	CII, MFR, SFR	2013-2018
Cash for Grass Rebate	Greeley water customers who are exceeding their outdoor water budget can get cash for replacing their lawn with low water use plants. This 2018 pilot program aims to replace lawns with more sustainable landscapes, including Xeriscape, rain gardens, and pollinator plants.	Outdoor	CII, MFR, SFR	2018

Table A-2. A summary of programs included in the analysis of program participation and water use savings. This list was narrowed down, and the final results only include programs if the number of customers with sufficient water use data was larger than 50. Year analyzed include all years that the program was active during the 2013-2018 window the analysis considers.

Appendix H – Comparison of Results to Reference Values

Greeley Water Conservation Program	AWE Conservation Program	AWE Model Values (gpd/unit)	AWE Model Values: Estimated Annual Savings Per Account (gpy/unit)	AWE Model Values: Estimated Annual Water Savings (AF)	Life of Savings (years)	Savings Decay (%/year)
Residential Audits (Indoor + Outdoor)	SFR Water Use Audit	33.9 gpd/unit	12,374	23	5	20
Front Loading Washer Rebate	SFR Washer Rebate	19.3gpd/unit	7,044.5	17.11	15	0
Toilet Rebates	SFR ULFT Replacement, SFR HET Replacement	20.9 gpd/unit - 27.8 gpd/unit	7,628.5 – 10,147	16.26	25	0
Smart Controller Rebate	SFR Smart Irrigation Controller Rebate	26.1 gpd/unit	9,527	3	10	0
PRV Rebate	ND	ND	ND	ND	ND	ND
Rotary Nozzles	SFR Irrigation Nozzle Replacement	1.6 gpd/unit	584	3.37	10	0
Commercial Audits (Indoor + Outdoor)	CII Large Landscape Water Audit	893 gpd/unit	325,945	87	5	20

**For Residential and Commercial Audits, participants could select either or both the indoor and outdoor audits.

** The Greeley Toilet Rebate program encompasses the 0.8 GPF Toilet, Dual Flush Toilets, Low Flow Toilet, and Ultra Low Flow Toilet programs. See Appendix G for more details about these programs.

***Only accounts with sufficient water use data were included in these calculations, and only programs with at least 50 participants with sufficient water use data are presented in this table.

****For the columns labeled “AWE Model Values: Estimated 6 Year Water Program Savings (AF)” and “AWE Model Values: Estimated Annual Water Savings (AF)” the AWE model values were substituted for the calculated average annual water savings, to compare the study’s results to the results that would have been realized using model values.

Table A-3. Estimates of water savings for included programs using the default values from the AWE Water Conservation Tracking Tool.

Table A-3 compares the values found in this analysis with the default model values used in the AWE Water Conservation Tracking Tool. For most programs, the results are similar, with a few exceptions, notably the Commercial and Residential Audit programs, where the values found through the analysis are lower than what would be expected based from the AWE model default values. However, participation in these programs includes an especially wide range of variables, such as individual behavior change and different weather conditions (even while normalizing for weather by using IWR, conditions may still affect resident’s behavior and attitudes towards water use). For the Commercial Audit program, in particular, it is also possible that while participants are using water more efficiently, their overall water use still increases (for instance, their customer base or production grows, increasing their total water use). Participation in these Audits may also lead to participation in other rebates, as seen in the especially high level of overlap between the Residential Audit and other conservation programs, playing a role in generating the larger individual savings seen in some of the other programs.

