AURARIA CAMPUS

WATER 2019 ACTION PLAN

Photo courtesy of Katie Kershman, Brendle Group

MAR 6, 2020

To Members of the Auraria Campus Community:

We are most pleased to share this 2019 Water Action Plan with students, faculty and staff members of the Auraria Campus community. We work and study in a unique area within downtown Denver – an approximately 150-acre expanse of academic buildings and green space in the heart of our capitol city. Nearly 50,000 students, and approximately 5,000 faculty and staff, call this place "home" during our time on campus when we study, teach, and support the missions of our academic institutions.

Water is a vital resource for our campus and community, and we all have the responsibility to act as stewards of our most precious natural resource. Did you know that 50 percent of the water we use in the Denver area originated in the Colorado River? The One World One Water Center, and the Auraria Sustainable Campus Program are important connectors on campus to raise awareness and lead responsible actions toward water sustainability and stewardship.

This Water Action Plan is an important step to assess the current state of water use on the Auraria Campus, and to provide information regarding water use and attitudes of our campus community. This Plan is a major step toward water use knowledge and awareness on campus and will be used to recommend improvements to current practices. In addition, this work will provide ideas for students, faculty and staff to try these water efficiency tools at home.

The Denver metropolitan area will grow by over one million new residents in the next 20 years. This population growth – along with climatic warming and changing precipitation patterns – will increase pressures on our scarce water supplies. The OWOW Center and the Auraria Campus Sustainable Campus Program are pleased and proud to provide you with the following 2019 Water Action Plan.

Sincerely,

Tom Cech, Co-Director & Nona Shipman, Associate Director
One World One Water Center
MSU Denver

ACKNOWLEDGEMENTS

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EXECUTIVE SUMMARY

The Auraria Campus represents a truly unique higher education community in the dynamic downtown urban environment of Denver, Colorado. The approximately 150-acre campus is home to three public institutions of higher learning: Community College of Denver, Metropolitan State University of Denver, and University of Colorado Denver. The campus community has grown to around 50,000 students, faculty, and staff across all entities, representing the largest public higher education campus in Colorado.

The OWOW Center secured grant funding for the development of this Water Action Plan in partnership with the Auraria Sustainable Campus Program and the Auraria Higher Education Center. In 2018-2019, more than 20 stakeholders participated in the development of this Plan by attending workshops, supporting data gathering, and undergoing interviews. The Plan presents a framework that Auraria Campus students, staff, and faculty will use to partner together to be responsible and wise water stewards on campus and in the broader community.

OUR WATER VISION

Auraria Campus will be a role model in sustainable water management and use for higher education institutions in a way that is pragmatic, collaborative, and actionable so that faculty, students, staff, and visitors are motivated to reduce consumption and to support efficiency.

Auraria Campus's annual water supplies include about 73,000 kgal from three water sources: (1) potable water from Denver Water; (2) well water from an on-campus well; and (3) augmentation water provided by Denver Water. Potable water is essential to campus operations as it serves all indoor uses, some outdoor uses, and all cooling uses. Potable water delivered to campus by Denver Water costs on average about $240,000 per year. Well water is currently being used for irrigation even though its high salinity content has adverse impacts on certain plants and trees as well as building facades. Augmentation water is not technically used on campus. Rather, it is used to replace well pumping that is out of priority under Colorado's water rights system.

Water is used indoors, for outdoor irrigation, and for cooling. Indoor use and outdoor irrigation use are estimated to be essentially equivalent (37% and 39% of the total, respectively),followed by augmentation water at 13%, and cooling at 11%.

The ASCP and AHEC have invested nearly $190,000 across four past projects to reduce water consumption on campus. These projects together have reduced water consumption on campus by more than 5 million gallons per year, with a cumulative water savings of nearly 70 million gallons over the lifespan of the projects. These water savings translate to cost savings of almost $390,000.

OUR GOALS

The ASCP has established a goal to reduce campus water use by 10% by 2022 as compared to the 2017 baseline year. Additionally, Auraria Campus supports a "One Water" approach to promoting alternative water supplies where allowable, feasible, and cost-effective.

Thirteen water efficiency activities were identified for Auraria Campus. Projects were identified from campus staff during the planning process; from students during a campus-wide water competition; and from an engineering analysis of campus water use. These activities are summarized in Table 1 along with their potential to save water and money. Water and cost savings were estimated from a cost-benefit analysis based on baseline water use, typical water savings from water efficiency activities, and water billing rates. The resulting water and cost savings cannot be summed across the activities, as some of the activities are overlapping. Promoting alternative water supplies will serve to reduce potable water use on campus, but not total water use.

Table 1. Efficiency Activity Summary

Efficiency Activity	Activity Type	Estimated Water Savings (kgal/yr)	Estimated Cost Savings ($/yr)
Campus Submetering and Leak Detection	Foundational Activities	2,000	$5,100
Annual Water Use Reporting	Foundational Activities	700	$2,600
Water Use Data Integration and Monitoring	Foundational Activities		
Water Use Benchmarking	Foundational Activities		
Irrigation Audit and Equipment Retrofits	Technical Assistance	4,000	$11,000
Steam to Natural Gas Conversion	Technical Assistance	5,000	$0
Evaporative Cooling Upgrades	Technical Assistance	n/q*	n/q*
Cooling Tower Operations	Technical Assistance	400	$1,400
Brewery Operations	Technical Assistance	22	$80**
Outdoor Watering Guidelines	Ordinance and Regulations	7,400	$15,000
One Water (Promoting Alternative Water Supplies)	Ordinance and Regulations	27,000	$100,000
Campus-Wide Water Efficiency and Conservation Program	Education	300	$1,400
Higher-Education Cross-Learnings	Education	700	$2,600

*n/q = not quantifiable with available information

**This cost savings represents water conservation only and does not reflect the total benefits from other types of savings.

Staff members from the OWOW Center, AHEC, and ASCP will work together to implement this Plan beginning in 2019.

INTRODUCTION

Colorado faces many challenges affecting our water resources – drought, wildfire, flooding, climate change, and rapid growth. These challenges are placing stress on our limited water resource supplies and necessitating action from the State to the local level to meet our future needs. In response, Governor Hickenlooper's 2013 executive order for the creation of Colorado's first water resource plan led to the completion of Colorado's Water Plan in 2015 calling on all who have a stake in Colorado's water future to help implement the Plan. The One World One Water (OWOW) Center at Metropolitan State University of Denver (MSU Denver) was tapped as a key partner in accomplishing the goals of Colorado's Water Plan for wise water use and public outreach at higher education institutions.

Responding to the call to action for leadership in responsible water management, the OWOW Center received a grant from the Colorado Water Conservation Board (CWCB), the State's water policy and planning department, to establish the Colorado Water Collaboratory. The Colorado Water Collaboratory is a partnership among higher education institutions and their water providers focusing on campuses as living laboratories for innovating better ways to manage water resources. The Water Collaboratory also serves as a catalyst for broader sharing of information and resources related to understanding water use and conservation.

About the OWOW Center

The OWOW Center is a collaboration between MSU Denver and Denver Botanic Gardens (MSU Denver, 2019). The partnership seeks to expand joint initiatives on water issues with three major functions:

1) Expand the reach and breadth of educational programs on water and environmental issues;
2) Attract funding for joint research in these areas;
3) Raise awareness of water and the environment through collaborative water stewardship.

For more information, visit our website at www.msudenver.edu/owow.

The work of the Colorado Water Collaboratory is multi-phased. Phase 1 was completed in 2017 and included data gathering and analysis of water use on participant campuses. In addition, a survey was administered to assess the attitudes and perspectives of students, faculty, and staff toward water use and stewardship on campus. The current phase, Phase 2, will be completed in late 2020. The objective of this phase is to promote water action planning on participant campuses. Future phases will continue the successful implementation of campus water action plans and seek to expand to the water/energy nexus to consider energy conservation as a tool to reduce water use.

WHY A WATER ACTION PLAN?

Auraria Campus, with support from the OWOW Center, the Auraria Sustainable Campus Program (ASCP), and the Auraria Higher Education Center (AHEC), has pursued the development and implementation of this Water Action Plan. This Water Action Plan presents the framework that Auraria Campus students, staff, and faculty will use to partner together to be responsible and wise water stewards on campus and in the broader community.

THE PLANNING PROCESS

The Water Conservation Act of 2004 (HB04-1365) requires covered entities (defined as retail water providers that sell more than 2,000 ac-ft per year) to have a State-approved water efficiency plan

(Colorado General Assembly, 2004). While Auraria Campus does not meet the State's definition of a covered entity, the campus supports the spirit and intent behind water conservation planning. Therefore, this Water Action Plan was developed using the State of Colorado's *Municipal Water Efficiency Plan Guidance Document* (AMEC Environment & Infrastructure, 2012; Castle & Rugland, 2019). The Water Action Plan was drafted using information and guidance provided by various stakeholders on water efficiency goals, water efficiency activities, and implementation actions on campus. In 2018-2019, more than 20 stakeholders participated in the development of this Plan by attending workshops, supporting data gathering, and undergoing interviews.

OUR WATER VISION

At an Earth Day event in 2019, the OWOW Center surveyed students, faculty, and staff about their vision of Auraria campus's water future. Full survey results are included in Appendix B: Student Survey Results. Figure 1 shows a summary of responses through a word cloud. Based on the survey responses, a vision statement was developed to guide the campus' efforts in water conservation and efficiency:

OUR WATER VISION

Auraria Campus will be a role model in sustainable water management and use for higher education institutions in a way that is pragmatic, collaborative, and actionable so that faculty, students, staff, and visitors are motivated to reduce consumption and to support efficiency.

Figure 1. Visioning Word Cloud from Survey Responses

ABOUT AURARIA CAMPUS

This section describes the defining characteristics of Auraria Campus, perceptions of water efficiency on campus, and related local and regional plans.

CAMPUS CHARACTERISTICS

SITE OVERVIEW AND PHYSICAL CONTEXT

The Auraria Campus represents a truly unique higher education community in the dynamic downtown urban environment of Denver, Colorado. The approximately 150-acre campus is home to three public institutions of higher learning:

- Community College of Denver
- Metropolitan State University of Denver
- University of Colorado Denver

The AHEC, governed by the Auraria Board of Directors, is a separate State entity providing the facilities, land, and shared services supporting these prominent academic institutions. The services encompass all needs for the shared portion of campus including categories such as custodial, grounds, planning, project management, and parking, among others. The AHEC is committed to providing an effective, efficient, and supportive environment to facilitate the missions of the three institutions.

Located in downtown Denver within the triangle created by Colfax Avenue, Speer Boulevard, and Auraria Parkway, the Auraria Campus is in the heart of the city (Figure 2). The campus is broken up into three 'neighborhoods' that cater to the specific needs of each school and have a shared campus area that houses tri-institutional buildings like the Tivoli Student Union and the Auraria Library. The campus topography is relatively flat with diverse vegetation. There are multiple xeriscape garden areas, large areas of turf grass, and different groupings of various tree species. There are two bioswales and about ten retention ponds.

Figure 2. Auraria Campus facing downtown Denver (Photo by Metropolitan State University of Denver)

CLIMATE

The climate on campus is semi-arid with seasonal temperatures ranging from an average high of 47°F in December to 92°F in July (US Climate Data, 2019). The average annual rainfall for the area is 15.5” while the average annual snowfall is 55”.

Photo on left by Mark Stahl for MSU Denver, Photo on right by Metropolitan State University of Denver

DEMOGRAPHICS

The campus community has grown to around 50,000 students, faculty, and staff across all entities, representing the largest public higher education campus in Colorado. The Community College of Denver serves roughly 15% of this population, CU Denver serves 30%, and MSU Denver serves 55%. Student enrollment has been declining since 2010 but individual institutional enrollment trends vary. The number of students consistently exceeds 40,000 while faculty and staff make up an additional 5,000-7,000 of campus community members.

Photo by Metropolitan State University of Denver

FACILITIES

The AHEC is a separate entity that provides the facilities, land, and shared services supporting the institutions. While this excludes institutionally owned buildings specific to one school, the shared space represents 82% of campus and amounts to over 4.5 million square feet of building space across the institutions (Figure 3). The Campus is made up of an eclectic group of spaces which encompasses classrooms, laboratories, recreation, the Library, and various historic buildings. Building ages range from

new builds, to buildings constructed in the 1970s. to historic buildings such as the Tivoli Student Union, St. Cajetan's Church, and Emmanuel Art Gallery that were built much earlier.

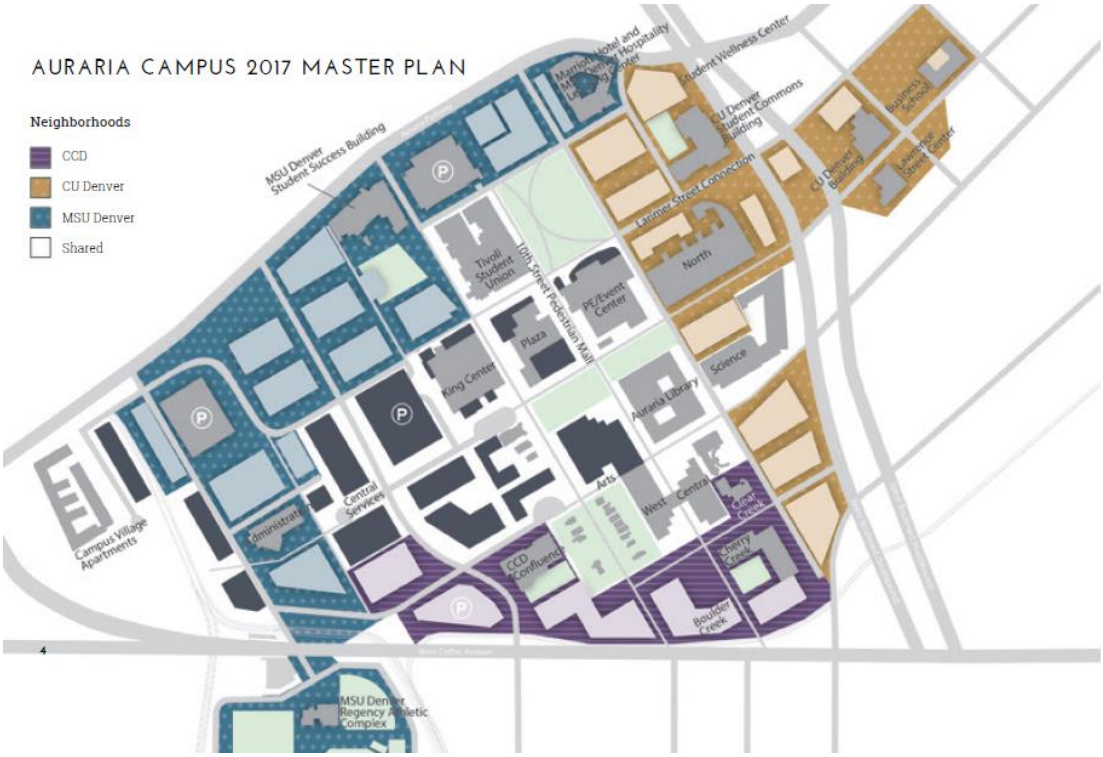

Figure 3. Auraria Campus Context Map (Auraria Higher Education Center, 2017)

Recent remodels have been completed on several buildings and plans for future renovations are in place along with other developments and planned projects:

- **In the next two years, one project will be completed with a significant impact on campus water use:** CU Denver's new dormitory will house 500 students and will represent the first time that students are residing on campus. This is an exciting opportunity for students, but it will provide additional challenges to campus water conservation efforts
- **In the next five years, the following buildings will be renovated, receive an add-on, or will be built:** Arts Building, Aerospace and Engineering, Boulder Creek Expansion, CU Business School, CU Denver Building, Engineering and Physical Sciences Building, CU first-year housing/dining, Instructional Lab, and the King Center.
- **In the next 5-10 years the following buildings will be renovated, receive an add-on, or will be built:** CCD Academic Building, MSU Denver Academic Building, CU Denver Building, Central Services Complex, Engineering and Physical Sciences, Police Station, and the Science Building.

PERCEPTIONS OF WATER EFFICIENCY

During the planning process, faculty, staff, students, and key stakeholders identified a range of motivations, opportunities, and challenges that characterize current perceptions of water efficiency on campus. These perspectives are described in more detail in the sections below.

MOTIVATIONS AND OPPORTUNITIES

Motivations and opportunities to pursue water efficiency on campus that were identified during this planning process include:

- All life is sustained by water.
- As a headwater State, we have a responsibility to manage water responsibly.
- The arid West is experiencing water shortages and we are depleting a vital resource.
- We have a duty to sustain our water resources for future generations
- Higher education can lead the way on water through our connections with students.
- The campus has a responsibility to support the State's Water Plan.
- Our campus attracts outdoor enthusiasts and we should help preserve our natural resources.
- Water has been identified as one of seven focus areas for the ASCP.
- We can use the campus as a 'living laboratory' to innovate better ways to sustainably manage water resources.
- Part of our mission is to serve as community connectors for broad sharing of research and information related to water use and conservation.

CHALLENGES

Challenges to pursuing water efficiency on campus that were identified during the planning process include:

- The complexity of the urban water system, where water, wastewater, and stormwater services are provided by separate entities.
- The complexity of the water rights system, which dictates our access and use of campus water resources.
- The bureaucratic complexity of housing three institutions on a single campus.
- The difficulty of shifting campus attitudes and behaviors to improve water conservation.
- Outdated maps which make it difficult to identify water savings opportunities.
- The lack of a centralized database to store and analyze water use data, equipment at current facilities, and past or future projects.
- Aging infrastructure on campus and beyond, including irrigation systems and technology, pipes, and buildings.

RELATED PLANS AND POLICIES

The following sections describe related plans and policies that serve as local and regional drivers for water efficiency and sustainable water management on Auraria Campus.

COLORADO WATER PLAN (COLORADO WATER CONSERVATION BOARD, 2016)

The Colorado Water Plan was adopted by the Colorado Water Conservation Board on November 16, 2016. The Plan serves as a roadmap for the collaborative and sustainable management of the State's water supply. One key objective of the Plan is to reduce the projected 2050 municipal and industrial

water supply gap from up to 560,000 acre-feet per year to zero acre-feet per year by 2030. Institutional water efficiency strategies, such as are included in this Water Action Plan, contribute to a second key objective of the State Water Plan, which aims to save 400,000 acre-feet of water by 2050 through conservation. Finally, as home to three higher education institutions, Auraria Campus has the opportunity to contribute significantly to a third Plan objective of raising public awareness by 2020 and engaging Coloradoans on key water challenges by 2030.

DENVER WATER – WATER EFFICIENCY PLAN UPDATE (DENVER WATER, 2017)

Denver Water provides potable water service to campus. Denver Water's latest Water Efficiency Plan evolves from focusing on water savings and conservation towards helping customers use water efficiently. While the previous 10 years of Denver Water's conservation efforts focused on reducing per capita consumption to less than 156 gallons per capita per day, the latest Water Efficiency Plan focuses on increasing the percentage of customers that are using water efficiently.

Of particular use to Auraria Campus, the Water Efficiency Plan includes water use efficiency benchmarks for public use spaces that can be used to guide irrigation practices on campus (Table 2).

Table 2. Public Use Efficiency Benchmarks (Denver Water, 2017)

Public Use	Target Water Use (gallons per square foot per year
Event Areas	22
Athletic Fields	20
General Recreation	16
Aesthetic Areas	12
Farms and Gardens	10
Right of ways/Medians	10
Synthetic Fields	5
Irrigated Native Grass	5
Non-irrigated Area	0

DENVER WATER – DROUGHT RESPONSE PLAN (DENVER WATER, 2016)

As is true for most water providers, Denver Water's primary response to drought is to restrict customer water use so that supplies will last as long as possible and be available for the most essential uses. The Drought Response Plan outlines four drought stages (Watch, Stage 1, Stage 2, and Stage 3) with actions for each stage related to outdoor irrigation, water features, washing/events, and commercial/industrial processes. Implementing the proposed efficiency actions in this Water Action Plan will only serve to prepare the Auraria campus to better comply with drought restrictions when they occur.

AHEC – MASTER PLAN (AURARIA HIGHER EDUCATION CENTER, 2017)

The Campus Master Plan guides campus planning and future decisions, including infrastructure, connectivity, bus/light rail transit, bike/pedestrian access, and primary gateways. The Plan offers insights into how the building footprint on campus may change in coming years and the related changes in outdoor water use that may occur from changes in turf, permeability, stormwater

management, as well as changes in indoor water use as dormitories and other new buildings are integrated.

AHEC – DESIGN GUIDELINES (AURARIA HIGHER EDUCATION CENTER, 2009)

The AHEC Design Guidelines guide the development on campus with an emphasis on principles of sustainable urbanism, seamless integration with downtown Denver, and building vertically to achieve density. The Plan includes a section on sustainability with heavy emphasis on water use. Most notably, the Guidelines call for reducing overall water use; maximizing the proportion of non-potable water used; and using high-efficiency indoor water fixtures. Tree guidelines are under consideration as campus well water that is used for irrigation contains high mineral content that is detrimental to the health of the trees. Sculptures are recommended to promote water awareness. As a State-run entity, all new buildings on campus are required to be LEED Gold certified.

AHEC – STRATEGIC IMPLEMENTATION PLAN (AURARIA HIGHER EDUCATION CENTER, 2012)

The Strategic Implementation Plan is used to organize and prioritize planning efforts, streamline decision-making, and provide an integrated framework for managing change on campus in accordance with the 2012 Campus Master Plan. The Strategic Implementation Plan verifies buildable zones, density and capacity guidelines, campus character, adjacencies, and phasing within each institution's neighborhood, and focuses on strategies for shared areas on campus. While this Plan is dated, it directly addresses water-related utilities.

AURARIA CONSERVES REPORT (MSU DENVER ENV 290B, 2014)

This report was developed by an MSU Denver water conservation class following on the heels of two Denver Water audits: an irrigation audit that was conducted in 2012 and an indoor audit that was conducted in 2013. The report highlights key findings from the audits, catalogues past efforts taken to reduce water consumption on campus and suggests actions to further reduce campus water use. The report includes maps that show irrigated areas and vegetation type, priority watering areas, and five-year average water use by building.

PHASE I FINAL REPORT (COLORADO WATER COLLABORATORY, 2017)

In June 2017, MSU Denver, CU-Boulder, and Colorado Mesa University worked together under the first phase of the Colorado Water Collaboratory. As described previously, Phase 1 was completed in 2017 and included data gathering and analysis of water use on participant campuses. In addition, a survey was administered to assess the attitudes and perspectives of students, faculty, and staff toward water use and stewardship on campus.

CITY AND COUNTY OF DENVER GREEN BUILDING ORDINANCE (CITY AND COUNTY OF DENVER, 2018)

The Green Building Ordinance, enacted in November 2018, requires that new commercial buildings larger than 25,000 square feet include a cool roof plus one of the following green building elements: green roofing, payment to a green building fund, on-site solar panels, purchased off-site solar, energy conservation beyond building code compliance, green building certification or a combination of the aforementioned options. As a State-run entity with its own master plan and design guidelines, the Auraria Campus is not required to comply with this ordinance. However, campus planners are dedicated to green building principles and stay up to date on City and County of Denver requirements.

WATER SYSTEM PROFILE AND HISTORICAL USE

WATER SUPPLY

Almost all of Denver Water's supply comes from snowmelt in the Rocky Mountains. Primary water sources include the South Platte River, Blue River, Williams Fork River, and Fraser River watersheds. Secondary water sources include the South Boulder Creek, Ralston Creek, and Bear Creek watersheds. The collection system spans 4,000 square miles and runs through more than eight Counties (Appendix A: Denver Water's Water Collection System). The raw water storage capacity of this collection system totals 692,846 acre-feet spread among 15 reservoirs, with the five largest reservoirs accounting for more than 70% and Dillon Reservoir alone accounting for 37% (Denver Water, 2019).

WATER TYPES AND USAGE

Auraria Campus's annual water supplies include about 73,000 kgal from three water sources:

- Potable water from Denver Water
- Well water from an on-campus well
- Augmentation water provided by Denver Water

POTABLE WATER USE

Auraria Campus receives potable water service from Denver Water. Potable water is essential to campus operations as it serves all indoor uses, some outdoor uses, and all cooling uses. All buildings are individually metered but until recently, Auraria did not have submeters installed to differentiate between major end uses. There are two central chiller plants on campus that are individually metered and eight cooling towers.

RAW WATER USE

Auraria Campus has two groundwater wells. One is an alluvial well that produces water with high salinity content. It is known as the Flour Mill Well because it was drilled in 1958 for the Colorado Hungarian Flour Mill. The well was later relocated to accommodate the MSU Denver Aerospace and Engineering Sciences Building. The well is currently being used for irrigation even though its salinity content has adverse impacts on certain plants and trees. The second is a deep well (1,450 ft well depth) that is not being utilized. It was drilled in 1939 by the Tivoli Brewery Company for beer production. The Brewery closed in 1969.

AUGMENTATION WATER

During the 2002 drought, water rights holders downstream of campus were concerned about the amount of water AHEC was pumping from the well. The case went to District Court, where a ruling was made by the water court referee limiting the amount of water AHEC can pump from the well and requiring that a prorated amount must be augmented to mitigate potential damages for downstream users with more senior water rights. AHEC entered into an agreement with Denver Water that stipulates that Denver Water will provide up to 78 acre-feet of augmentation water each year. When AHEC pumps from the well out of priority, Denver Water is notified to release water into the Platte River upstream of the Farmer's Canal, usually from the Denver Wastewater Treatment Plant or Chatfield Reservoir. The Augmentation Plan (Decree Case No. 03CW083) limits AHEC to pumping no more than 97.5 acre-feet between March 1st and November 30th each year. Water provided through the Augmentation Plan is only used to replace well pumping volumes and is not consumed on campus.

HISTORICAL WATER USE

Water use data are available from Denver Water and the EnergyCAP system maintained by AHEC facilities. Historical data were collected and analyzed for the period 2013-2017. The most recent year of data at the time of analysis (2017) was established as the baseline year against which future progress will be assessed.

Did you know?

70,000 kgal would serve more than 500 houses.

It was assumed that total annual water use was equal to total annual water supply. Even though augmented water is not necessarily "used" by campus, it is part of the campus water system. The baseline analysis assumed that all water supplied to campus is beneficially used and that system losses and leaks past the point of the water meter are negligible.

The historical data were analyzed to answer the following questions:

- How much water is being used?
- Is water use going up or down?
- Is water use getting more or less efficient?
- What are the opportunities to save additional water?

The following sections present information that describes historical water use on campus.

ANNUAL SUPPLY

In 2017, the Auraria Campus was supplied by 70,099 kgal of water. Potable water from Denver Water represented nearly two-thirds of the supply (66%). Irrigation water from the campus well represented 21% of supplies, and augmentation water constituted the remaining 13% (Figure 4).

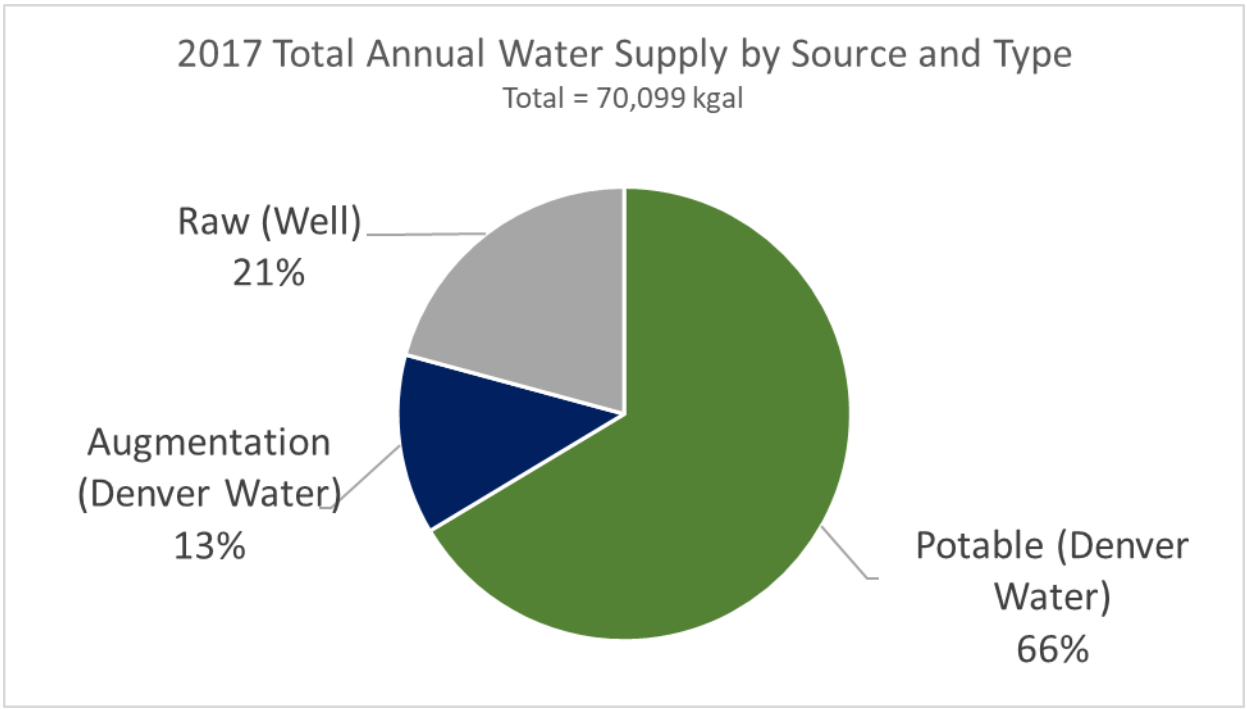

Figure 4. Total Annual Water Supply by Type and Source (2017)

Since 2013, potable water use has been trending upwards by 4% year-over-year (Figure 5). Well water use is trending downwards by 8% year-over-year. These trends are attributed to campus efforts to use potable water for irrigation for new landscaping, rather than well water, to improve vegetative health and building aesthetics. High salinity content in the well water has damaged tree health and blackened building facades in the past. Augmentation water varies considerably from year to year. In some years, no augmentation water is needed.

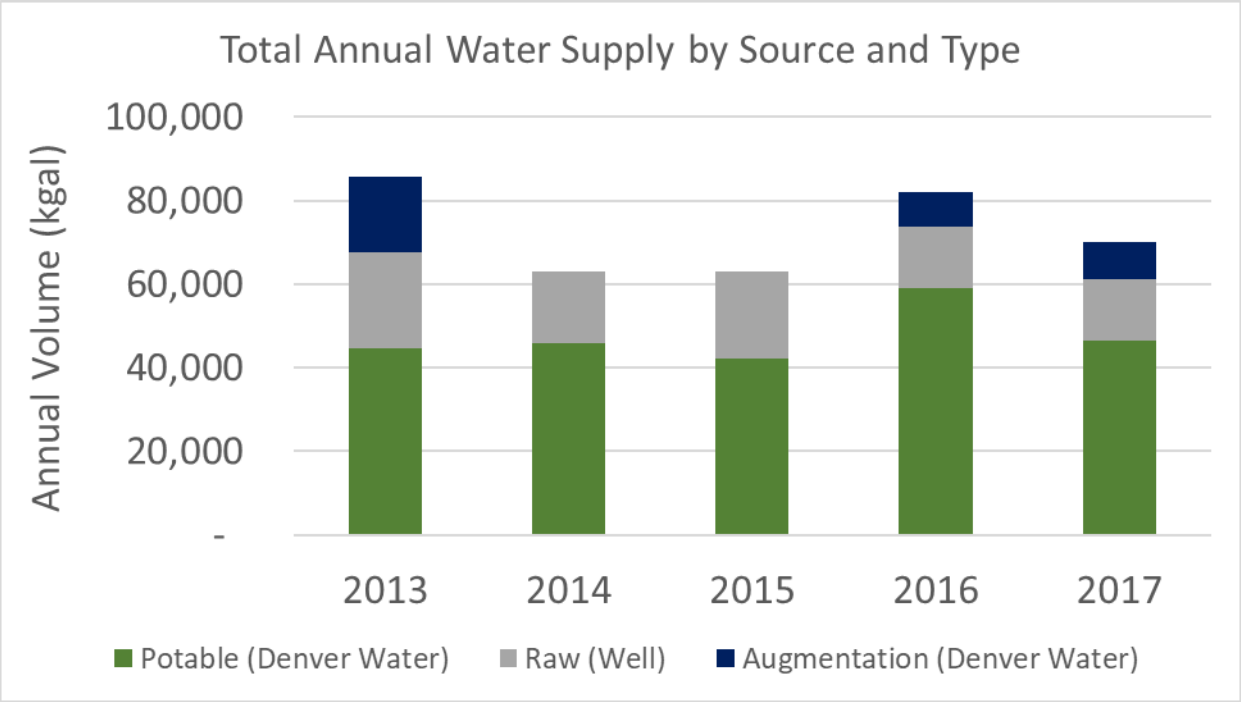

Figure 5. Total Annual Water Supply by Type and Source (2013-2017)

The interannual variability (or the variation in water supply between years) is larger than the five-year trends. This variability is attributed primarily to weather. Hotter temperatures lead to more water use on campus due to higher irrigation and cooling demands.

BUILDING SUPPLY

Water supply was analyzed by building type (where a meter measured combined building use) or by end use (where a meter was dedicated to serving a single use such as irrigation). On a volumetric basis, the top uses of water on campus include irrigation-only meters, combined water use by buildings designated as serving primarily academic functions, augmentation water, and combined water use at the Student Union and Food Court (Figure 6).

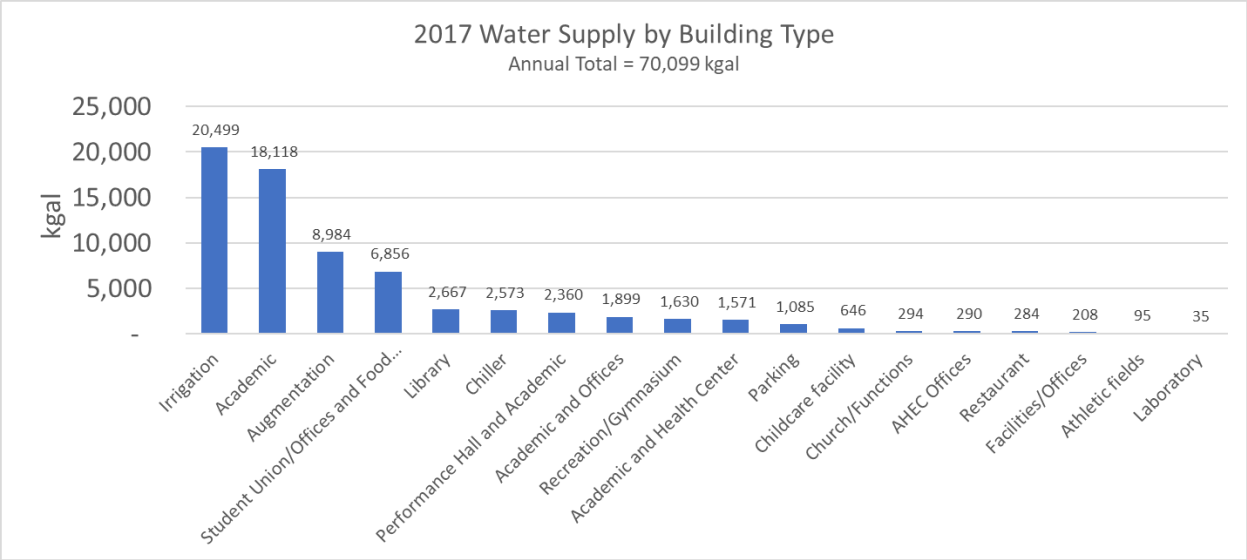

Figure 6. Water Supply by Building Type (2017)

SEASONAL SUPPLY

Across the campus, total monthly water supply demonstrates a seasonal pattern typical for Colorado – low water use in the winter months of November through April when water is used primarily indoors; high water use in the summer months of June through September when outdoor irrigation use and water used for cooling supplement indoor uses; and the months of May and October representing transition months between the seasons (Figure 7). Characteristics of Auraria Campus as a higher education campus influence that seasonal pattern, however. Many students, faculty, and staff leave campus during the month of December for the holiday season, March for spring break, and during the summer months.

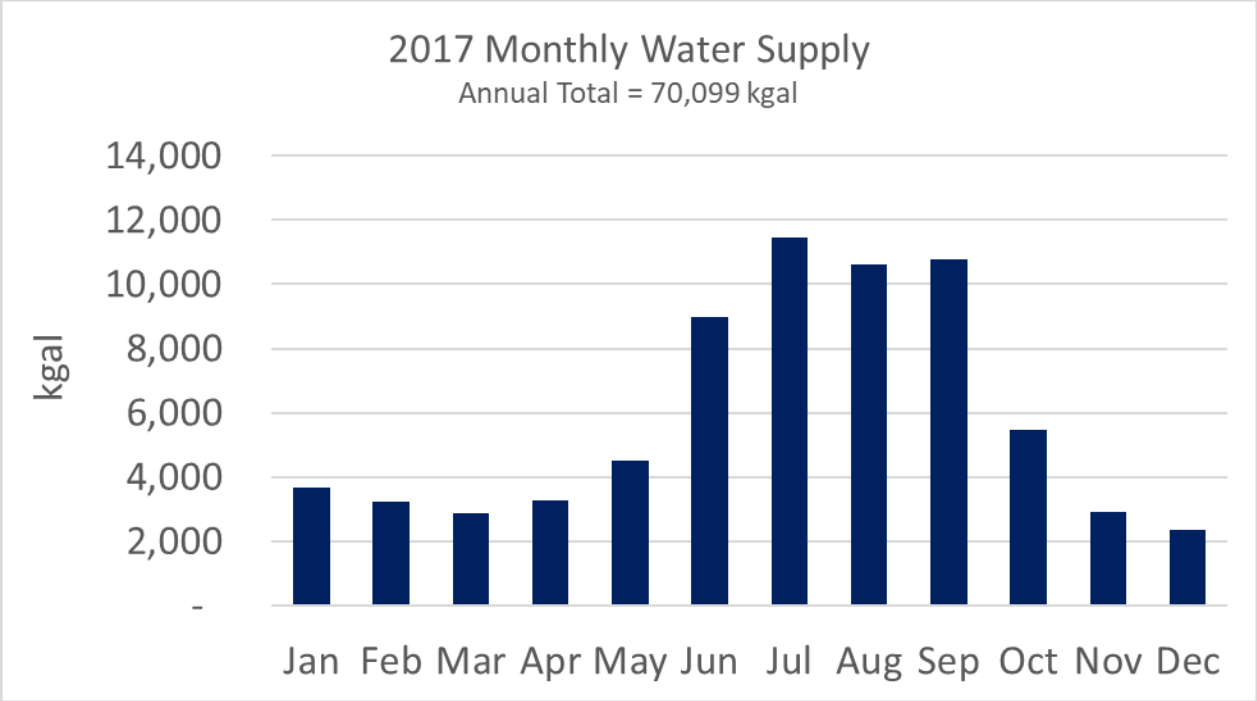

Figure 7. Monthly Water Supply (2017)

END USES

In the absence of historical water use data by major end use, a seasonal use analysis was conducted on the combined metered use to estimate the amount of water used indoors, outdoors for irrigation, and for cooling. In addition to the seasonal use pattern, characteristics of the individual buildings (i.e., building type, knowledge of building cooling systems, and a map of irrigated areas on campus) were used to inform the estimated breakdown of water use.

INDOOR USE

Indoor use includes fixtures and appliances such as toilets, urinals, sinks, faucets, showers, washing machines and other large process equipment (e.g., walk-in refrigerators, ice machines, commercial kitchen equipment).

Indoor use was estimated by analyzing the monthly use data during the winter season of November to March to determine a monthly average indoor use value. For the purposes of this analysis, indoor use is assumed to be constant throughout the year, so annual indoor use was calculated by multiplying the monthly average indoor use value by 12 months in the year.

OUTDOOR IRRIGATION AND COOLING USES

Outdoor irrigation use is measured through dedicated meters as well as combined building meters on campus. Similarly, water use for cooling is measured through dedicated meters on the two centralized chiller plants as well as combined building meters for individual cooling towers and evaporative cooling units. It is assumed that no water is used for irrigation or cooling during the winter months.

The difference between total water use and indoor water use was attributed to irrigation and cooling uses. Building and vegetation characteristics were used to estimate the proportion of water used for

irrigation versus cooling at a particular location. This estimation method is inherently uncertain but was the best information available at the time of analysis.

AUGMENTATION USE

Because augmentation water is contracted with Denver Water, monthly data are available. As previously mentioned, the Auraria campus does not actually consume this water on campus, but it is a part of the overall water budget.

SUMMARY

Outdoor irrigation use is estimated to be the largest end use on campus, though indoor use and outdoor use are estimated to be essentially equivalent in volume on an annual basis (Figure 8). No trend was discerned in indoor or outdoor uses over the period 2013-2017 (Figure 9).

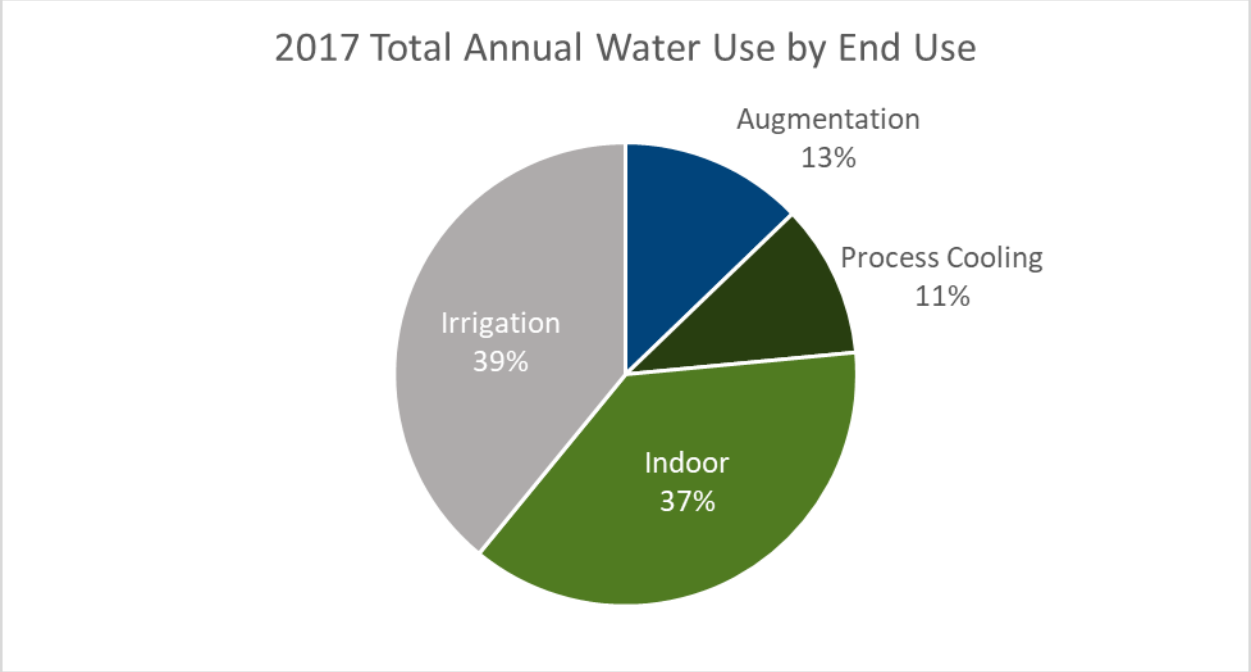

Figure 8. Total Annual Water Use by End Use (2017)

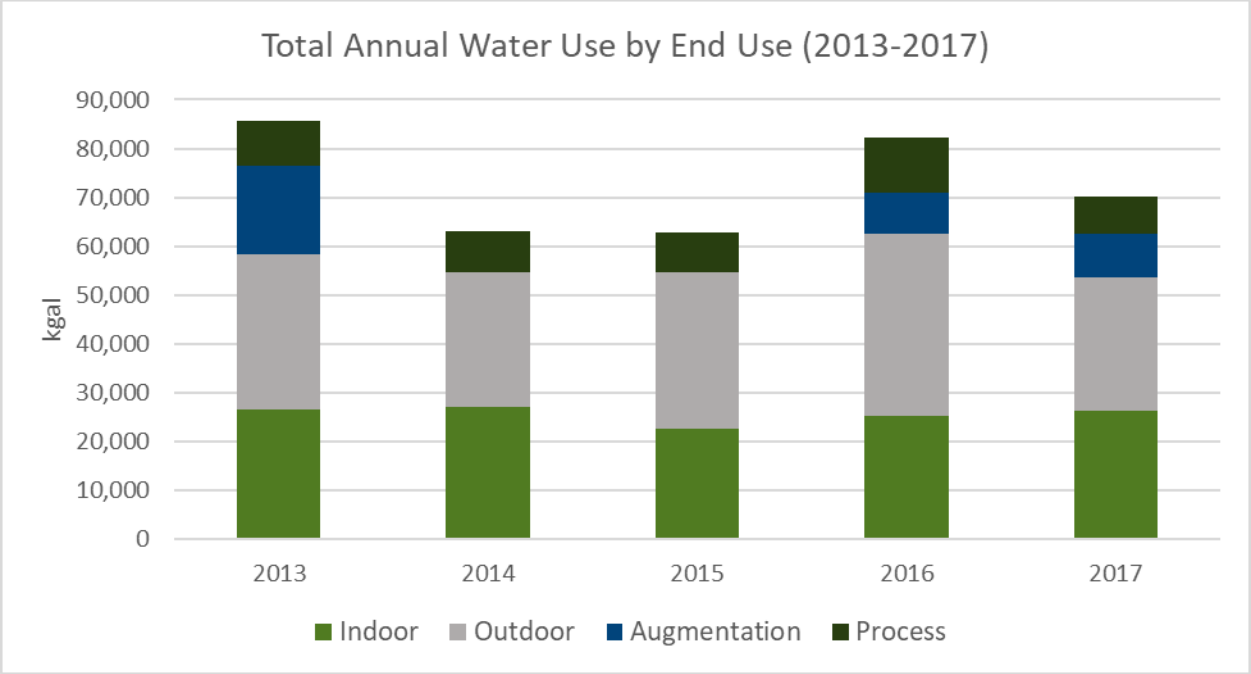

Figure 9. Total Annual Water Use by End Use (2013-2017)

Each of these end uses comes with a different environmental impact (Table 3). Augmentation water is not used consumptively. By definition, it has a beneficial environmental impact. For the most part, water used indoors returns to the river through wastewater collection and treatment systems, with only 5% of water on average being lost to leaks and evaporation. A significant portion of irrigation water (55-100%) is used consumptively through evapotranspiration depending on the vegetation and irrigation practices. Similarly, a high proportion of cooling water use is used consumptively (up to 100%). From this perspective, irrigation and cooling uses are much more impactful to the watershed than indoor use.

Table 3. End Uses, Watershed Impacts, and Minimum Water Quality Requirements

End Use	Watershed Impact (Estimated Consumptive Use %)	Minimum Water Quality Needed
Augmentation	Low (0%)	Non-potable
Indoor Use	Low (5%)	Mostly potable, small non-potable
Irrigation	Medium-High (55-100%)	Non-potable
Cooling	Medium-High (up to 100%)	Non-potable

WATER COSTS

Potable water delivered to campus by Denver Water costs on average about $240,000 per year. Well water is free, except for the operation and maintenance costs. The augmentation water provided by Denver Water is charged at approximately one-tenth of the cost of potable water. In summary, potable water makes up the majority of water costs for campus.

Although $240,000 is a lot of money, the Auraria campus spends far more on energy ($4.1 million during the 2017-2018 school year). Given the limited financial savings that can be achieved through water

efficiency, implementation efforts need to be strategic and promote co-benefits such as energy efficiency, education, research, and campus aesthetics.

However, water costs should not be ignored. According to the U.S. Department of Labor, water rates are rising significantly faster than inflation from the costs to fix or replace aging infrastructure and overflowing sewer mains (Harrison, 2018). Additionally, water stress is increasing in many parts of the U.S. due to supply shortages, population growth, and water quality degradation (Fedak, et al., 2018). Water efficiency efforts that save some money now may prove to be even more valuable in the future.

PAST PROJECTS AND WATER SAVINGS

Water conservation is one of the ASCP's seven pillars of sustainability. To date, the ASCP and AHEC have invested over $187,000 across four key projects to reduce water consumption on campus (Table 4). The four projects together have reduced water consumption on campus by more than 5.1 million gallons/yr (MG/yr), with a cumulative water savings of nearly 70 MG over the lifespan of the projects. These water savings translate to a cumulative cost savings of almost $390,000 over the lifespan of the projects and a 7% reduction from AHEC's average annual water budget (between 2013-2017) of 73,000 kgal/yr.

In addition to the ASCP-funded projects, AHEC has also put resources toward identifying water conservation opportunities as follows:

- Denver Water irrigation audit report (2012)
- Indoor fixture retrofits project (2013)
- Auraria Campus water management plan (2014)
- HVAC and indoor fixtures audit (2016)
- Water use and cost tracking via EnergyCAP (ongoing)

Table 4. Key Projects to Reduce Water Consumption on Campus

Project Name	Summary	Projected Years of Benefit	Projected Annual Water Savings (Gallons)	Projected Cumulative Water Savings (Gallons) Over Lifespan	% of Water Budget Reduced (Gallons)	Projected Annual Monetary Benefit	Projected Total Monetary Benefit
PE/Events Center Shower Retrofit *August/December 2010*	Replaced 18 shower columns in the PE building with fixtures that are 65% more efficient.	10	1,450,000	14,500,000	2.07%	$8,000	$80,000
Low Flow Fixture Installation Part I (Toilets, Urinals, Sinks) *Fall 2010*	Replaced over 413 toilets, 145 urinals and 210 sink faucets with low-flow devices in partnership with Denver Water. Estimated savings: 1.61 million gallons for toilets and 1.34 millioni for faucets for a total of 2.954 million gallons annually or 44.25 million gallons over 15 years. Confirmed buildings include 9th Street Park houses (15 units), Plaza Building, Arts Building. Most of the following were eventually upgraded, as well: Library, Central, West, South (Cherry Creek), Technology (Boulder Creek, St. Francis, PE/Events Center, Tivoli, 7th Street Classroom, Facilities Management, Facilities Annex, St. Cajetan's, Rectory Building.	15	2,950,000	44,250,000	4.21%	$16,078	$241,163
ELC Flush Valve Conversion *2011*	Replaced 28 3.5 gpf toilets to 1.6 gpm toilets. Funded by SCP per conversation with Tom Johnson in May 2019.	15	107,692	1,615,380	0.15%	$587	$8,804
Water Fixtures Phase II *5/5/14*	Follow up to an audit/Phase I, but this time including KC, NC, Admis, Tivoli, St. Caj, Facilities Annex and Facilities Services.	15	600,000	9,000,000	0.86%	$4,000	$60,000
	Totals	**14**	**5,107,692**	**69,365,380**	**7.3%**	**$28,664**	**$389,966**

FUTURE PROJECTS AND SAVINGS

WATER EFFICIENCY GOAL AND FORECAST

The ASCP has established a goal to reduce campus water use by 10% by 2022 as compared to the 2017 baseline year. If this goal is achieved, campus water use in the year 2022 will be approximately 63,000 kgal (Figure 10).

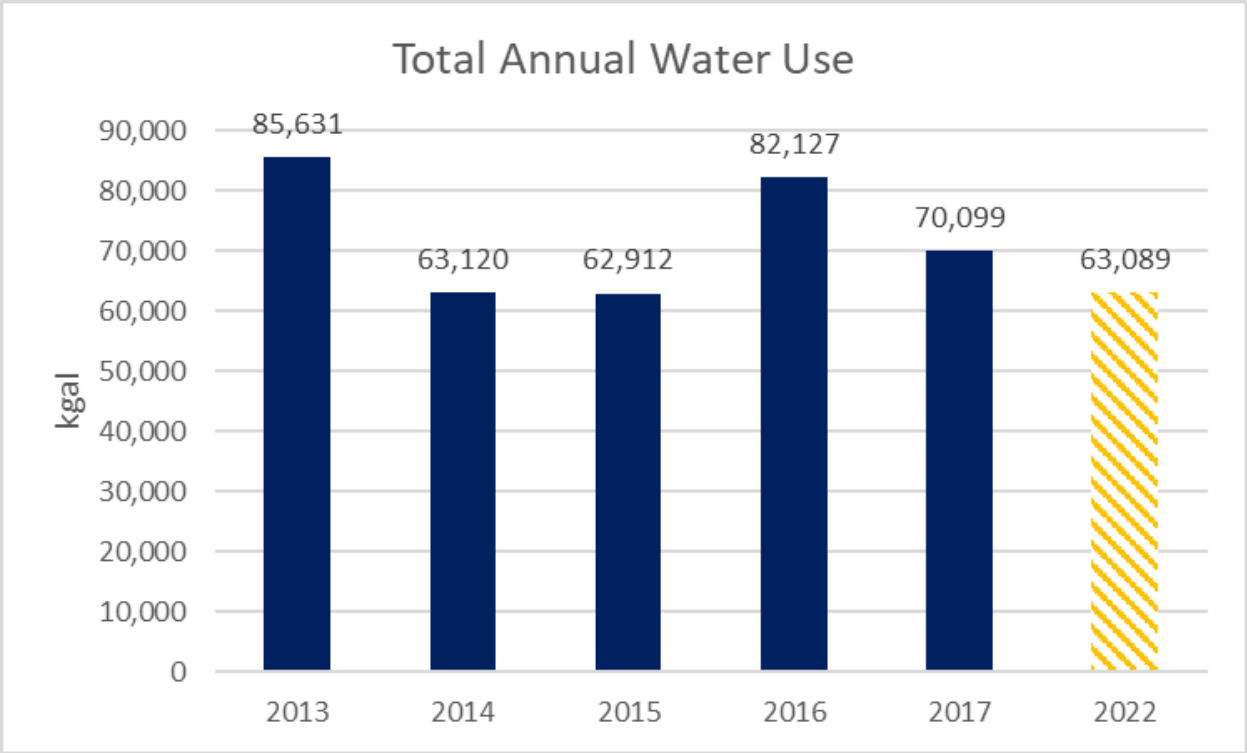

Figure 10. Total Annual Water Use – 2022 Forecast

ONE WATER GOAL

A "One Water" approach considers the urban water cycle (i.e., water supply, stormwater, and wastewater) as an integrated and interconnected system in which all flows are potential resources (Figure 11). For Auraria Campus, using a One Water approach means promoting alternative water supplies where allowable, feasible, and cost-effective. Table 3 summarizes the minimum quality of water that is needed to satisfy each major end use on campus. Only indoor use requires potable water for the most part. Augmentation, cooling, irrigation, and even indoor toilet flushing can be served with non-potable water supplies, potentially saving energy, money, and chemical use.

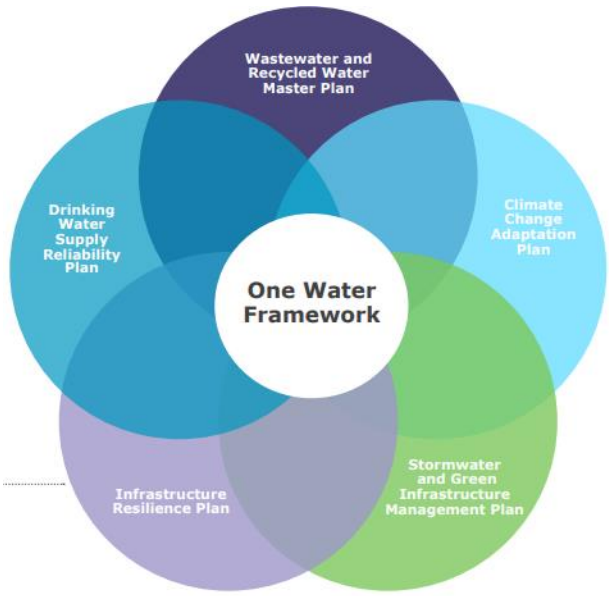

Figure 11. One Water Framework (Paulson, Stephens, & Broley, 2017))

ACTIVITY IDENTIFICATION

Potential water efficiency activities were identified from multiple sources including the baseline water use analysis, a stakeholder engagement process focused on identifying goals and priorities, a campus water competition, and a review of past activities and related plans.

Each identified activity was assigned an activity type based on CWCB's planning framework (AMEC Environment & Infrastructure, 2012):

- **Foundational Activities:** Foundational activities may not themselves result in water savings, but they lay the groundwork for successful efficiency programs. Foundational activities include metering, data collection, water loss control, planning, and staffing.
- **Targeted Technical Assistance and Incentives:** These activities rely on indoor water efficient technologies and water-wise outdoor practices. Activities include installation of water efficient fixtures and appliances, low water use landscapes, water efficient industrial and commercial processes, and incentives.
- **Ordinances and Regulations:** Ordinances and regulations should promote or enforce water efficiency. Activities include general water use regulations, landscape design and installation rules and regulations, and indoor and commercial regulations.
- **Educational Activities:** Educational activities include a variety of techniques and venues to convey water efficiency information to the public.

EFFICIENCY ACTIVITIES

Thirteen water efficiency activities were identified for Auraria Campus. Projects were identified from campus staff during the planning process; from students during a campus-wide water competition; and from an engineering analysis of campus water use. These activities are summarized in Table 5 along with their potential to save water and money. Water and cost savings were estimated from a cost-benefit analysis based on baseline water use, typical water savings from water efficiency activities, and water billing rates. The resulting water and cost savings cannot be summed across the activities, as some of the activities are overlapping. Promoting alternative water supplies will serve to reduce potable water use, but not overall campus water use.

Table 5. Efficiency Activity Summary

Efficiency Activity	Activity Type	Estimated Water Savings (kgal/yr)	Estimated Cost Savings ($/yr)
Campus Submetering and Leak Detection	Foundational Activities	2,000	$5,100
Annual Water Use Reporting	Foundational Activities	700	$2,600
Water Use Data Integration and Monitoring	Foundational Activities		
Water Use Benchmarking	Foundational Activities		
Irrigation Audit and Equipment Retrofits	Technical Assistance	4,000	$11,000
Steam to Natural Gas Conversion	Technical Assistance	5,000	$0
Evaporative Cooling Upgrades	Technical Assistance	n/q*	n/q*
Cooling Tower Operations	Technical Assistance	400	$1,400
Brewery Operations	Technical Assistance	22	$80**
Outdoor Watering Guidelines	Ordinance and Regulations	7,400	$15,000
One Water (Promoting Alternative Water Supplies)	Ordinance and Regulations	27,000	$100,000
Campus-Wide Water Efficiency and Conservation Program	Education	300	$1,400
Higher-Education Cross-Learnings	Education	700	$2,600

*n/q = not quantifiable with available information

**This cost savings represents water conservation only and does not reflect the total benefits from other types of savings.

The following four tables (Table 6, Table 7, Table 8, Table 9) provide additional detail about the identified activities and their estimated water and cost savings.

Table 6. Proposed Foundational Activities

Activity	Activity Summary	Savings Assumptions and Recommendations	Savings Estimates	Timeline	Activity Leads
Campus Submetering and Leak Detection	Install submeters for all irrigation use and tie to EnergyCAP data management system. Use data to support "Water Use Data Integration and Monitoring" Activity. Use irrigation controller software interface to monitor system pressure and identify leaks in real-time, or at least before they are visible based on ground conditions.	• 7% of total irrigation water could be saved, 5% from leak detection and 2% through monitoring efficiencies (Green & Maddaus, 2010) • Potable cost savings based on unit cost of water supplied from Denver Water • Non-potable cost savings based on unit cost of augmentation water assuming all well pumping would have necessitated augmentation	2,000 kgal/yr $5,100/yr	2019	Grounds
Annual Water Use Reporting	Update water use metrics annually and share with grounds, facilities, and campus planners.		700 kgal/yr $2,600/yr	2019-2020	ASCP, OWOW, Campus Engineer, student support
Water Use Data Integration and Monitoring	Integrate all water use data (metered, pumping records, irrigation submeters, augmentation records) and monitor regularly.	• 1% of total water use through improved understanding of water use (Green & Maddaus, 2010) • Potable cost savings based on unit cost of water supplied from Denver Water		2020-2023	ASCP, Energy Manager, Campus Engineer
Water Use Benchmarking	Benchmark water use against efficiency benchmarks and over time to inform future water efficiency projects and strategies.			2020-2023	ASCP, OWOW, Energy Manager, Campus Engineer

Table 7. Proposed Technical Assistance Activities

Activity	Activity Summary	Savings Assumptions and Recommendations	Savings Estimates	Timeline	Activity Leads
Irrigation Audit and Equipment Retrofits	The AHEC Grounds and Facilities teams are engaging with a third-party consultant to conduct an assessment of well water as a long-term irrigation supply; a field assessment of existing controllers, backflow devices, and mainline configuration; upgrades of irrigation controllers; and installation of flow monitoring and communication technology. **Error! Reference source not found.**contains the project scope. Retrofits are proposed to be phased as follows: • Phase I: Controller related equip retrofits. • Phase II: Replace and modernize irrigation heads/nozzles • Phase III = Isolation valves to better shut off portions of the system without having to shut off all of campus • Modify planting beds to receive point source irrigation instead of popup sprayers A pilot project is being initiated at the 9th Street Park to test the costs and benefits of upgrading to weather-based controllers for improved irrigation scheduling and other improvements to equipment and irrigation water management practices.	• 15% of irrigation use, to be replaced by audit estimates when available (Green & Maddaus, 2010). • Potable cost savings based on unit cost of water supplied from Denver Water • Non-potable cost savings based on unit cost of augmentation water assuming all well pumping would have necessitated augmentation	4,000 kgal/yr $11,000/yr	2019-2020	Grounds
Steam to Natural Gas Conversion	Nine buildings that use steam heating will be converted to natural gas heating. Xcel Energy pumps the steam to campus for heating.	• The steam was not captured in the baseline use analysis and therefore will not contribute towards this plan's goals.	5,000 kgal/yr (for Xcel Energy) $0/yr	2019-2020	HVAC

Activity	Activity Summary	Savings Assumptions and Recommendations	Savings Estimates	Timeline	Activity Leads
Evaporative Cooling Upgrades	Campus staff are auditing evaporative coolers and rooftop units as well as current status of conductivity monitors and biocide use. 20 abandoned chillers are being replaced with a central chiller. Total dissolved solids (TDS) monitors are being installed in some units. Biocide application is being considered for some units for more efficient water management while also protecting human health and safety.	• Not quantifiable with the available information. Localized building water use is being transferred to centralized water use, which may not result in any water savings, depending on the efficiencies of the old and new equipment. However, the central plant should facilitate leak detection.	n/q	2020-2023	HVAC
Cooling Tower Operations	Optimize cooling tower operations for water efficiency	• 5% of cooling tower use through operational adjustments. • Potable cost savings based on unit cost of water supplied from Denver Water	400 kgal/yr $1,400 /yr	2019-2020	HVAC
Brewery Operations	Replace conventional settling tanks with a centrifuge (Table 10).	• 8-month return on investment estimated from reducing settling and cleaning time and increased beer yield. • Water savings come from improved tank washing efficiency (less cleaning time and fewer tanks to clean).	22 kgal/yr $80/yr (water savings only)	2020-2023	ASCP, Tivoli Brewing Company

Table 8. Proposed Ordinances & Regulations

Activity	Activity Summary	Savings Assumptions and Recommendations	Savings Estimates	Timeline	Activity Leads

Outdoor Watering Guidelines	• Increase watering efficiency on existing landscape areas.
	• Develop and implement a campus landscape master plan with watering guidelines that adhere to Denver Water's efficiency benchmarks for public spaces (Table 2).
	• An industrial design class developed recommendations for vegetation and grading practices to improve irrigation efficiency (Table 10).
	• Link watering guidelines to Denver Water's drought response plan and watering restrictions.
	
	A pilot project to replace turf with native grasses is being considered at the northwest entrance to the campus.
	
	Campus Planning will map irrigation zones to efficiency standards.
		• Existing irrigation: Achieve a sitewide application rate of 18 gal/sq ft/yr or less.
		  ○ Potable irrigation currently at 20 gal/sq ft/yr.
		  ○ Raw water irrigation currently at 27 gal/sq ft/yr.
		• New irrigation: Mitigate growth in irrigation use across campus.
			7,400 kgal/yr
			$15,000/yr
				2020-2023	AHEC, Campus Planning & Development, Grounds

One Water (Promote Alternative Supplies)	• Shift from potable use to non-potable use where allowable, feasible, cost-effective, and acceptable. Potential uses include irrigation, toilet flushing, and cooling use.
	• Reclaimed water is not feasible for Denver Water to bring to campus.
	• Well water pumping could be increased but suffers from water quality issues previously noted.
	• Rainwater harvesting is possible and not utilized. Campus detention basins could be repurposed for rainwater collection and storage and/or snow management (Table 10).
	• Graywater systems may be feasible for new buildings.
	• Alternative supplies should be used for demonstration and research purposes.
		• Approximately 60% of water use can be met with non-potable supplies:
		  ○ Irrigation (currently 53% non-potable, could be 100%)
		  ○ Toilet flushing (currently 0% non-potable, focus on new buildings)
		  ○ Cooling (currently 0% non-potable, could be 100%)
		• Toilet flushing is assumed to be 25% of indoor water use.
			27,000 kgal/yr
			$100,000/yr
				2023+	ASCP, OWOW, Campus Architects, Design/Build Teams, AHEC Plumbing, HVAC, Grounds

Table 9. Proposed Educational Activities

Activity	Activity Summary	Savings Assumptions and Recommendations	Savings Estimates	Timeline	Activity Leads
Campus-Wide Water Efficiency and Conservation Program	Raise awareness and encourage engagement of staff, students, faculty, and researchers to reduce water consumption as well as change perception of water efficiency activities by providing them with knowledge and motivation to reduce water usage.	• 1% of total water use through improved understanding of water use (Green & Maddaus, 2010) • Potable cost savings based on unit cost of water supplied from Denver Water	300 kgal/yr $1,400/yr	2019-2020	ASCP, OWOW
Higher-Education Cross-Learnings	• Conduct an annual classroom competition to raise awareness of the Colorado Water Plan. The first competition was held in Fall 2019. See Table 10 for project descriptions from the four classrooms that completed the competition. • Host a water symposium or other learning opportunities. • Link to ASCP Sustainability Plan efforts. • Conduct a social media campaign for the OWOW Center (Table 10).		700 kgal/yr $2,600/yr	2019-2020	ASCP, OWOW

The first-ever Auraria campus water competition – designed for students from all disciplines to propose innovative solutions to Colorado's water challenges – was held during the Fall 2019 semester. Six classrooms signed up to participate; four classrooms completed the competition. Table 10 summarizes the final four projects.

Table 10. Fall 2019 Auraria Campus Water Competition Projects

OWOW's Strategic Communications Plan by JMP 3740: Public Relations Research, Planning, and Management The Project Team developed a Strategic Communications Plan for the OWOW Center. The Project Team evaluated past social media activity to determine that Facebook was the most impactful outlet and that posts associated with the Denver Botanic Gardens were most popular. Water awareness campaigns such as #LikeItLikeYouLoveIt were successful. The Project Team suggested that the OWOW Center raise water awareness on campus by hosting open houses every two years, promoting water conservation projects with signage, and conducting events in partnership with the Denver Botanic Gardens.	**Tivoli Brewery Centrifuge by GEG 4720: Sustainability Mitigation Planning** The Project Team proposed to replace the conventional settling tanks with a centrifuge at the Tivoli Brewery to reduce wastewater, increase compostable outputs, and minimize evaporation. Traditional yeast settling methods take 2-3 days, resulting in evaporative losses, the need for multiple settling tanks to maintain a consistent beer supply, and a large amount of water to clean the tanks. With a centrifuge, the yeast is separated quickly and efficiently, while also providing a higher yield. The centrifuge requires much less cleaning. The Project Team investigated equipment costs and estimated a payback period of 8-months, primarily from the increased yield. Water savings were estimated to be 1,800 gal/mo from the reduced cleaning demands.
Landscape Design by IND 2450: Beginning Industrial Design Studio Outdoor water use on campus can be significantly reduced through low-water native vegetation and good drainage design. The Project Team developed a campus landscape design guide with suggested plants and site layouts scalable to any location on campus. Traditional sprinkler heads would be replaced with drip irrigation to minimize evaporative losses. Terraces and other grade variations would be used to promote water drainage. Large turf areas on campus should be evaluated for the proposed landscape design. Interactive art displays and signage would be used to educate the public about waterwise stewardship.	**Snow Management by CET 4100: Water Resources Senior Project 1** The Project Team proposed to repurpose detention basis for snow management to improve parking lot and sidewalk safety, reduce sublimation losses, and promote snowmelt infiltration. The Project Team designed a geothermal heating element and multi-layered filtration media to accelerate snowmelt and promote groundwater recharge. Educational signs would be installed to increase public awareness of water management and use on campus.

IMPLEMENTATION AND MONITORING PLANS

IMPLEMENTATION PLAN

Implementation of the water efficiency activities is dependent on the involvement of internal staff resources, potential partnerships, and funding resources.

INTERNAL STAFF RESOURCES

Staff members from the OWOW Center, AHEC, and ASCP will be responsible for implementing this Plan. Staff are committed to completing the water use benchmarking activity and one additional activity in the first year of implementation, and target to complete one additional activity each year thereafter.

PARTNERSHIPS

Auraria Campus will work with its water, stormwater, and wastewater service providers to implement this plan (Table 11).

Table 11. Existing and Potential Partners and Collaboration Opportunities

Organization	Partnership Opportunities
Denver Water	Water efficiency programs and rebates Water efficiency guidelines Drought response coordination Educational materials
Mile High Flood District	Stormwater management planning
Metro Wastewater	Wastewater planning

FUNDING

Internal funding for water efficiency activities will continue to originate through AHEC and ASCP annual operating funds. The OWOW Center will continue to pursue CWCB grant funds for plan implementation as well. Potential implementation resources are summarized in Table 12.

Table 12. Potential Implementation Resources

Organization	Implementation Resource	Resource Type
CWCB	Water Efficiency Implementation Grants	Grant funding
CWCB	Public Education and Outreach Grants	Grant funding
CWCB	Water Plan Grants	Grant funding
Colorado WaterWise	Live Like You Love It	Educational campaign
Denver Water	Water efficiency program	Rebates and other incentives
EPA	WaterSense	Audit tools
HDR Foundation	Equipment grants	Grant funding

PLAN REVIEW, MONITORING, AND UPDATES

Auraria Campus intends to monitor the success of the water efficiency programs annually using the metrics presented in this Plan. If any of the water efficiency activities are not effective in achieving the expected water savings or are not cost effective, they may be discontinued.

Auraria Campus will update this Plan every seven years. Plan updates will incorporate new data and may include revisions to campus water efficiency goals and planned activities, as appropriate.

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APPENDIX A: DENVER WATER'S WATER COLLECTION SYSTEM

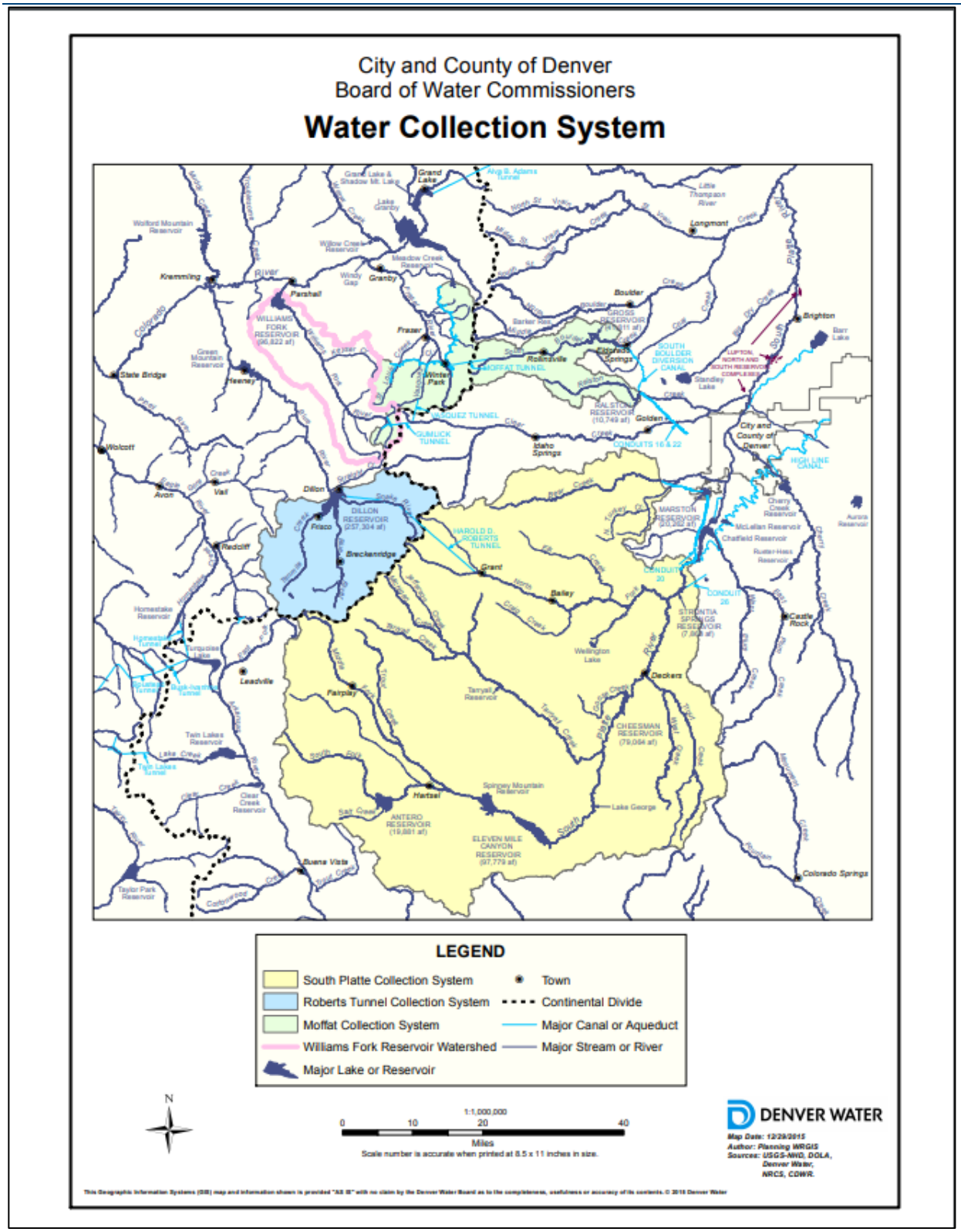

Figure 12. Denver Water Collection System (Denver Water, 2019)

APPENDIX B: STUDENT SURVEY RESULTS

In the spring semester of 2019, the One World One Water (OWOW) Center distributed a short survey to over 150 students on Auraria Campus at two different events – the annual Spring Fling and Auraria Campus Sustainable Program's (ASCP) Sustainability Fair. Any students that attended the events and approached the OWOW Center's table were asked to complete the survey in exchange for a reusable cloth bag or a stainless-steel straw. The following questions were asked in the survey…

1. How important do you think it is for Auraria Campus to be a leader and advocate for responsible water management?
2. On a scale of 1 to 5, how is Auraria Campus doing on water conservation?
3. Would you like to do more to support water conservation on campus?
    a. If yes, list one thing you'd like to see happen with water on campus.
4. Complete the sentence, "I'd like the Auraria Campus' water future to…" (e.g. be a leader for our community, engage our student body, etc.)

It was intentional to not collect demographic information from survey takers. In order to maximize the number of survey responses collected, it was decided to keep the survey short and composing of multiple choice, Likert scale, and brief open-ended questions.

Over the course of three days, 155 surveys were completed. The survey responses were then analyzed by ASCP and the OWOW Center.

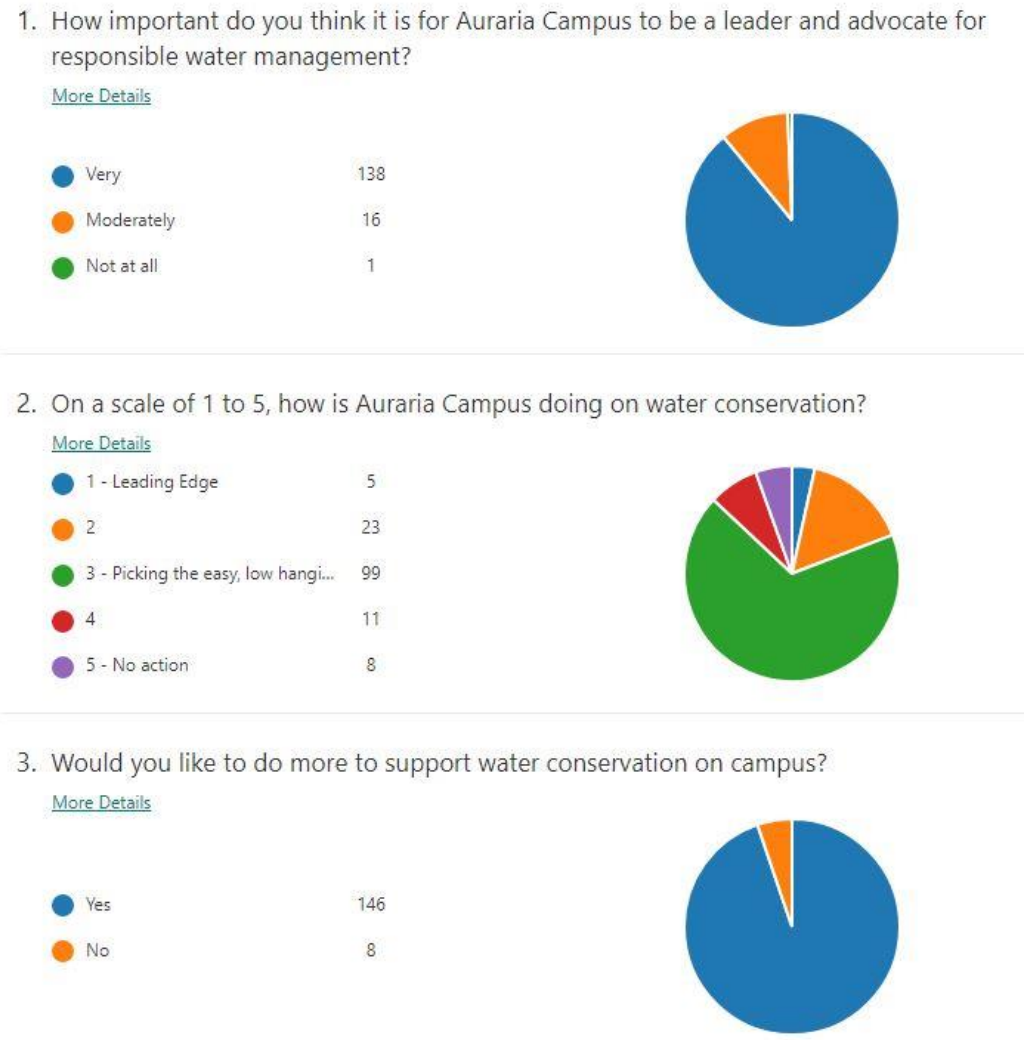

Figure 13. Survey questions and responses

An overwhelming majority of students feel that it is important for Auraria Campus to be a leader and advocate for responsible water management. Yet, 99% of the people surveyed feel that Auraria Campus is picking the "easy, low hanging fruit" when it comes to water projects and another 19 survey takers feel Auraria is doing even less. Regardless, 95% of survey takers reported wanting to do more to support water conservation on campus. Although many of the survey takers don't feel Auraria Campus is doing enough in regard to water conservation projects (whether that be an accurate opinion or a result of a lack of understanding and knowledge on past and current campus water projects), a similar majority expressed wanting to be more engaged. Considering that a council of students vote on how ACSP should spend funding on various sustainability projects every year, the survey results could be a good indicator that they would be willing to prioritize water conservation projects.

When asked, "list one thing you'd like to see happen with water on campus," survey takers responded most frequently with:

- More water bottle refill stations and/or banning single-use plastic water bottles on campus (19%)

- More water conservation and water re-use (13%)
- Greater access to reusable bottles, plates, and utensils/less single-use plastic on campus (12%)
- More education and awareness brought to campus efforts and sustainability plans (10%)
- Updating and improving irrigation systems and location of sprinklers/diversifying campus land use – xeriscaping, native plants, etc. (9%)
- Replacing appliances – sinks, toilets (6%)
- No answer/ ”I don’t know” (25%)

Most of the top answers to this question reflect a student’s lack of access to their choice of water conservation techniques and education. 25% of those who answered, “yes” to the question “Would you like to do more to support water conservation on campus?” either did not respond or responded with “I don’t know.” Perhaps those responses relate more strongly to the 10% that asked for more education and awareness than a lack of understanding?

The final question in the short survey asked students to, “Complete the sentence, ‘I’d like the Auraria Campus’ water future to…’ (e.g. be a leader for our community, engage our student body, etc.)” The most popular responses were:

  - … be a community leader (27%)
  - … engage with and educate students (21%)
  - … to be more sustainable and conservation-oriented (11%)
  - No answer/ ”I don’t know” (12%)