Colorado Water Plan Agency Action 1.7 - Support Transformative Landscape Change

Outdoor Water Use and Savings Potential

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Introduction

This memorandum (aka “white paper”) was prepared for and in cooperation with the Colorado Water Conservation Board (CWCB). It explores two components of Colorado Water Plan Agency Action 1.7 to Support Transformative Landscape Change.

First, the white paper explores opportunities, options, and potential for reducing excessive outdoor water use across Colorado, particularly in the residential sector.

Second, the white paper explores the long-term goals of landscape transformation and what is needed to retain and sustain urban landscapes' benefits, such as shade and habitat. It also considers ideas for reasonable future water use requirements to ensure these benefits are maintained.

Research Approach

This white paper focuses on urban landscape transformation. The research was conducted through a series of strategic interviews with water providers across Colorado. These providers included:

1. City of Durango
2. City of Grand Junction
3. Ute Water District
4. Eagle River Water and Sanitation District
5. Aurora Water
6. Denver Water
7. City of Greeley
8. City of Colorado Springs
9. City of Boulder

The research team (Peter Mayer and Jenna Battson) developed specific questions to generate discussion with these water providers. The conversation with each provider usually included a review of the provider’s water supply sources and availability and then moved to the demand management topics. The research team took careful notes during each call and prepared summaries.

The primary research questions used to start the discussion were:

1. Have you measured non-functional turf (NFT) in your service area? If yes, how much is there (approx. square foot)?

2. Have you looked at or quantified excessive outdoor use?

3. Have you considered the highest water users, whether they could be made more efficient, and what water savings might result?

4. How much water will future landscapes in your service area use? What level of irrigation (inches or gallons per square foot) are you planning to supply water for future landscapes?

For this white paper, many water providers are not referred to by name unless the information provided comes from a published report. The researchers also examined policies enacted in other Western states to manage water demand.

Findings

Non-Functional Turf

In August 2022, a consortium of Western water providers, including Denver Water and Aurora Water, signed the 2022 Memorandum of Understanding by and among Colorado River Basin Municipal and Public Water Providers (MOU), committing to "introducing a program to reduce the quantity of non-functional turf (NFT) grass by 30% through replacement with drought- and climate-resilient landscaping while maintaining vital urban landscapes and tree canopies that benefit our communities, wildlife, and the environment."[1] At the time of signing, most Colorado water providers had not measured the quantity of NFT in their service areas, nor had they considered the costs associated with replacing it.

Recent research on NFT completed for the CWCB estimates reducing NFT by 30% across Colorado could achieve between 10,000 AF and 20,000 AF of water a year over the course of 10 years.[2,3] Based on the interviews conducted for this study, the actual water savings may be on the lower side of this estimate (~10,000 AF/year over ten years). The water savings will depend not on the turf removal itself but on three key factors: 1) how much the removed vegetation (e.g., turf) was previously irrigated, 2) the water demand of the landscape that replaces the turf, and 3) the application and permanence of ongoing efficient irrigation.

To better understand the potential local and statewide water savings from turf replacement efforts, it is necessary to realize the amount of irrigated turf and how much of it is considered non-functional.

[1] https://www.denverwater.org/sites/default/files/water-efficiency-mou.pdf
[2] https://engagecwcb.org/turf-analysis
[3] Resource Central. 2022 All Cities Report.

Since 2022, Denver and Aurora have measured NFT and are actively planning to achieve the 30% NFT replacement goal outlined in the MOU.[4] Denver Water plans to remove 2,000 acres of NFT over the next 15 years or so, which is 30% of the approximately 6,000 acres of NFT they have identified in the service area. Aurora is doing preliminary mapping using its own definition to understand the scope of the effort described in the MOU. Both Denver and Aurora acknowledged the challenge and expense associated with the NFT replacement effort. The high costs and high effort are supported by the numbers coming out of the State's first Turf Replacement Program. Colorado has already invested the first round of funding from HB22-1151 with matching funds from 50 water providers, municipalities, and 501(c)(3) nonprofits working in landscape transformation who expect to replace just under 57 acres of NFT.

Most water providers have yet to measure the NFT in their service areas, and some expressed hope that CWCB would fund and conduct this effort. All providers we spoke with, both East and West Slope, are actively engaged in replacing NFT, but usually on a relatively small scale. Few have developed a strategy for replacing large areas over the coming years, and funding and capacity for the NFT effort are a genuine concern for all.

There are also enforcement issues. A West Slope provider explained that they do not have any land use planning authority and thus could not prohibit NFT or encourage any form of landscaping.

One East Slope provider said that replacing NFT starts to make financial sense if water savings can be generated for $30,000 - $40,000 per AF saved or less. However, some NFT replacement programs cost much more than this, which raises the question of cost-effectiveness. If a water provider has limited staff and budget, is turf replacement the first best option? For some providers, limited resources may be better spent on a different type of program, such as effective pricing mechanisms, water budgets, and/or irrigation management.

However, some efforts seem to show a greater return on investment. Boulder-based nonprofit Resource Central conducted research on their popular Front Range program "Garden In A Box" with grant funding from CWCB.[5] Garden In A Box provides professionally designed, low-water garden kits tailor-made for Colorado yards between 100 - 300 square feet in size. The analysis conducted across the Front Range found water savings averaged 5,000 gallons per Garden In A Box installed per year.[6] On average, one AF of savings is achieved for every 65 Garden In A Box products installed. The customer cost for a garden averaged about $150, which means the water savings are delivered for $9,750 per AF + the Resource Central implementation costs.

[4] https://www.denverwater.org/sites/default/files/water-efficiency-mou.pdf
[5] Peter Mayer, P.E. serves as a technical advisor to Resource Central for the landscape conservation programs.
[6] https://storymaps.arcgis.com/stories/1040b8ab35804034a50e7c1d517bce8f

Some utilities choose to provide incentives to reduce the cost of participation in Garden In A Box. This program offers an inexpensive way for water providers to implement landscape transformation without adding staff and capacity.

Definition of NFT

The definition of NFT is also complicated in that it varies from place to place. For example, Aurora considers and counts some residential front yards as NFT, but other providers do not. This makes definition-based turf mapping efforts outside of regional analysis complicated and more difficult to achieve.

Colorado SB24-005 (e.g., the nonfunctional turf ban) is the legislation that prohibits NFT installation in specific locations for new non-residential installations. In this legislation, **functional turf** is defined as "turf that is located in a recreational use area or other space that is regularly used for civic, community or recreational purposes, which may include playgrounds; sports fields; picnic grounds; amphitheaters; portions of parks; and playing areas of golf courses, such as driving ranges, chipping and putting greens, tee boxes, greens, fairways, and roughs."[7]

Turf considered **non-functional turf** is"located in a street right-of-way, parking lot, median or transportation corridor." To comply with SB24-005, municipalities will need to adopt new code updates for non-residential landscapes across the state that must be implemented by January 1, 2026.

It should be noted that even with these definitions, some providers in Colorado prefer the term, **non-essential turf**, arguing that all turf serves some environmental function. Developing standardized landscape terminology and nomenclature remains a challenge. For example, the term "xeriscape" (coined by Denver Water in the early 1980s)[8] and efforts to replace it, even as it is also defined in state legislation, provide a parallel example.

The definition of "water-wise landscape" or "water-wise landscaping" was further codified under HB22-1151 to mean "a water- and plant-management practice that Is intended to be functional and attractive…and emphasizes the use of plants that require lower supplemental water, such as native and drought-tolerant plants." The legislation goes on to identify and define the seven specific landscaping principles that comprise the concept (Colo. Rev. Stat. § 37-60-135).

[7] https://leg.colorado.gov/sites/default/files/2024a_005_signed.pdf
[8] https://www.merriam-webster.com/dictionary/xeriscape

Reducing Excessive Outdoor Use

If turf replacement programs are more time-intensive and costly to manage, might there be other cheaper options that truly target the biggest water use and potential water waste? Research over the years has shown that a small percentage of high water users often demand disproportionate volume, usually for their landscape and swimming pools or as a result of unaddressed leaks.[9,10] Indeed, a data analysis provided to the research team by an East Slope utility shows that the top 100 water users in this community of more than 100,000 (just 1% of the water users) use 17% of the total water volume served. A July 2024 news report noted that in Cortez, "eleven percent (11%) of single-family residences used almost one-third (⅓) of the city's water consumption."[11]

For most water providers interviewed, high water use analysis is focused on total annual use, not just outdoor use. For providers on both the East and West Slopes, the highest water user is often a university, a hospital, or a large laboratory. Public swimming pools and large city parks frequently make the top water users list. The diversity and necessity of these uses make it very difficult for water providers to consider demand management programs for these customers. However, there are larger water users beneath the highest users that may warrant more attention.

The City of Greeley has developed a practical approach to addressing high water use in the non-residential sector. Each customer receives an annual water allocation (water budget) based on the type of business and size of the building, among other considerations. At the end of each year, staff run a database report that compares actual metered use for the year against the allocation volume. Each year, 100 – 150 customers are identified for "over-using" water and exceeding the allocated volume. The staff then generates and sends "Surcharge Letters" to each over-using customer, assessing hefty financial penalties. Sometimes, leaks or another known and fixable problem cause excess water use. In these cases, the surcharge is credited back to the customer upon successful repair. In some cases, customers opt to purchase an additional allocation volume for their annual water budget. Depending on where they purchase their raw water credits, they can be purchased in 1/8 acre-foot increments or 1 full acre-foot increments. This approach helps the provider address high water use in the non-residential sector efficiently and effectively.

In addition to its water budget-based rate structure for the residential sector, Greeley utilizes its AMI and the WaterSmart company to notify residential customers of leak alerts. This is an

[9] Mayer, P., W. DeOreo, et. al. 1999. Residential End Uses of Water. Water Research Foundation. Denver, CO.
[10] DeOreo, W., P. Mayer, et. al. 2016. Residential End Uses of Water, Version 2. Water Research Foundation. Denver, CO.
[11] https://www.ksjd.org/podcast/ksjd-local-newscasts/2024-07-12/ksjd-local-newscast-july-12-2024

important trend in the water industry that is helping to reduce customer-side leakage through prompt notification.

High Outdoor Water Use

All participating providers had yet to calculate the volume of water that might be saved by reducing excessive outdoor water use. One East Slope provider has assessed that 15 – 20% of its customers are over-irrigating in the residential sector and likely 20% or more in the commercial sector. A West Slope provider noted that the top 10% of customers consistently use about 50% of the water. It is important to note that these users are not necessarily the highest due to NFT irrigation needs. The highest water user accounts typically include schools, hospitals, breweries, food product manufacturers, and hotels.

Several East Slope providers, such as Greeley, Castle Rock, Centennial, Boulder, and Colorado Springs, use landscape water budgets to address excessive outdoor water use. The top-tier rates associated with these types of structures impact excessive outdoor users and are a proven approach for addressing high water use.

Under one provider's 5-tier increasing block rate water budget, block 3 starts at 100%, and block 4 begins at 150% of the monthly water budget. In 2023, with a notably wet start to the irrigation season, just 5.1% of all water use across all customer categories was in blocks 4 and 5 combined, and only 11% of use was "over budget" in blocks 3, 4, and 5. This indicates that water users stay within or close to their monthly water budget. In 2023, the single-family sector had just 7.1% of its water use "over budget" in blocks 3, 4, or 5. This provider plans to comprehensively review its water budget-based rate structure in the coming years; changes are anticipated.[12]

A West Slope provider in a resort area addresses high water use through rates, enforcement, and, eventually, fines. New landscapes receive a water budget of 24" per year, ample for irrigating high alpine turf. This provider plans to save 400 AF by reducing excess use without removing turf. In this region, landscape codes are "largely unenforced," and there are significant differences in landscape choices from property to property, based on proximity to the resorts.

This same West Slope provider is developing water budgets, starting with new properties. Purchasers can adapt the proposed landscape to reduce connection fees. The program is location-specific in the service area, as some places are more expensive to serve.

Another West Slope provider has a program to identify and contact high water users. They then set meetings to work with them to reduce their water use.

[12] Seasonal water rates implemented in Phoenix, AZ (discussed below) help reduce water use and stimulate landscape transformation.

A large East Slope provider uses informational water budgets to inform customers about their utility bills and whether their water use is reasonable. They described the program as "effective and low-cost". The provider sees "luxury" water use as a tiny fraction of their total.[13] Overall, this provider's customers' consumption in 2023 (a notably wet year) was the same as it was in 1969. "Focus on high water users? We have gotten that done," they said.

Aurora, Denver, and several other Front Range communities forbid spray irrigation on medians and strips less than a designated width, usually 8 or 9 feet. Some Front Range communities have also prohibited turf on tree lawns of right-of-ways.

One Front Range provider is looking toward proscriptive landscape requirements, where a maximum of 25% of the irrigable area is allowed for high-water-use vegetation. They hope to implement landscape irrigation system design, installation, and post-installation inspection to ensure everything is done correctly and efficiently. Water use will be tracked and managed with a landscape water budget. Over the coming five years, this provider expects to implement system-wide water budget-based rates as a cornerstone program to manage excess water use.

Many Colorado municipalities have a Water Waste Ordinance on the books. These ordinances may be a part of a more comprehensive conservation ordinance or stand alone as separate regulations. Typically, water waste ordinances apply to all properties (not just new developments) and address standards and practices related to outdoor irrigation, including prohibited activities (e.g., allowing irrigation to pool or run off) and maintenance expectations (e.g., leak repair). Water waste ordinances are an important regulatory tool to have in place in the event a water provider has to enact water restrictions due to drought or other conditions.

Water waste ordinances should align with other community and water provider policies and procedures for property/system maintenance and nuisance violations, or the water waste ordinances should provide details about how they will be monitored and enforced. Water provider water restrictions should also align with water waste ordinance provisions and processes. Water providers may be asked to provide water data to inform whether a violation is occurring; water providers may also have the technology to alert customers about potential water waste issues (e.g., leaks, broken sprinkler heads, water running down the street) before a formal violation occurs.

Communities enforce conservation and water waste ordinances in different ways. For example, the City of Aurora describes water waste as "excessive runoff, pooling water in landscape or hard surfaces and spraying onto hard surfaces (sidewalks, driveways, gutters, streets or alleys)."

[13] "Luxury" water use usually occurs in ultra-wealthy resort communities with large irrigated properties, and owners who may never see the water bill and will pay any amount. In one Colorado resort community, two single-family residences were the seventh- and eighth-biggest water users on the system, using 6.5 million gallons (nearly 20 acre-feet) and 5.8 million gallons (nearly 18 acre-feet) of water per year, respectively.

The city prohibits watering between 10 am and 6 pm from May 1 to September 30. New sod, seed, and irrigation systems require a permit.[14] The city provides residents with a phone number and online form to report water-wasting concerns. Persons out of compliance are issued a warning on their first violation. If they are out of compliance again within the same 12-month period, they will receive a fine between $125 - $2,000, outlined in Sec. 138 – 190 of Aurora's Municipal Code.

Other approaches to addressing high outdoor water use are being implemented across the Western United States and are discussed later in this white paper.

Savings Potential – Excessive Outdoor Use

The 2023 Colorado Water Plan presented annual municipal indoor and outdoor demand. Municipal outdoor use was 144,400 AF. As noted above, research for the CWCB estimates the water savings that might be achieved from reducing NFT by 30% across Colorado at between 10,000 AF and 20,000 AF annually over ten years of investment in removing and replacing NFT.

This range of savings seems reasonable. One East Slope provider estimated the achievable water savings in its service area alone to be approximately 7,000 AF from both indoor and outdoor efforts. Another East Slope provider has calculated 900 AF of water savings from replacing 30% of NFT. Of course, the cost and capacity needed to run these programs is high.

Compare that to an outdoor-focused conservation effort implemented statewide, such as urban landscape water budgets. An achievable target from such an effort would be to reduce outdoor use by 10% or 14,000 AF. An aggressive target would be a 15% reduction or 21,000 AF. Research on the impact of water budgets has found demand reductions from 10 – 30% at the utility scale, but results vary.[15] **This suggests that conceptually, a concerted state-wide focus on reducing excessive outdoor water use through water budgets could produce similar water savings to what has been estimated from replacing 30% of NFT, likely for much less cost.**

Future Landscape Water Demand in Colorado

Landscape Water Requirements

Landscape water requirements vary across Colorado based on climate and plant variety. Without some level of supplemental irrigation, a limited number of plants and trees will grow and thrive in Colorado. In other words, most urban landscapes in Colorado require supplemental irrigation.

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[14] https://www.auroragov.org/residents/water/watering_times

[15] https://budgetbasedrates.com/
Mayer, P.W., et. al. 2008. Water Budgets and Rate Structures: Innovative Management Tools. American Water Works Association Research Foundation. Denver, CO.

Generally, the highest-water-using urban landscapes require 24 to 26 inches per year of supplemental irrigation, which equates to 15 - 16 gallons per square foot of landscape. Some landscapes require more water than this, but they are rare in Colorado. Native grass and Denver's aspirational Green Code require 9 - 12 inches of water per year (5.6 – 7.4 gpsf).[16] The water requirements of the typical range of Colorado urban landscapes are shown in Figure 1.

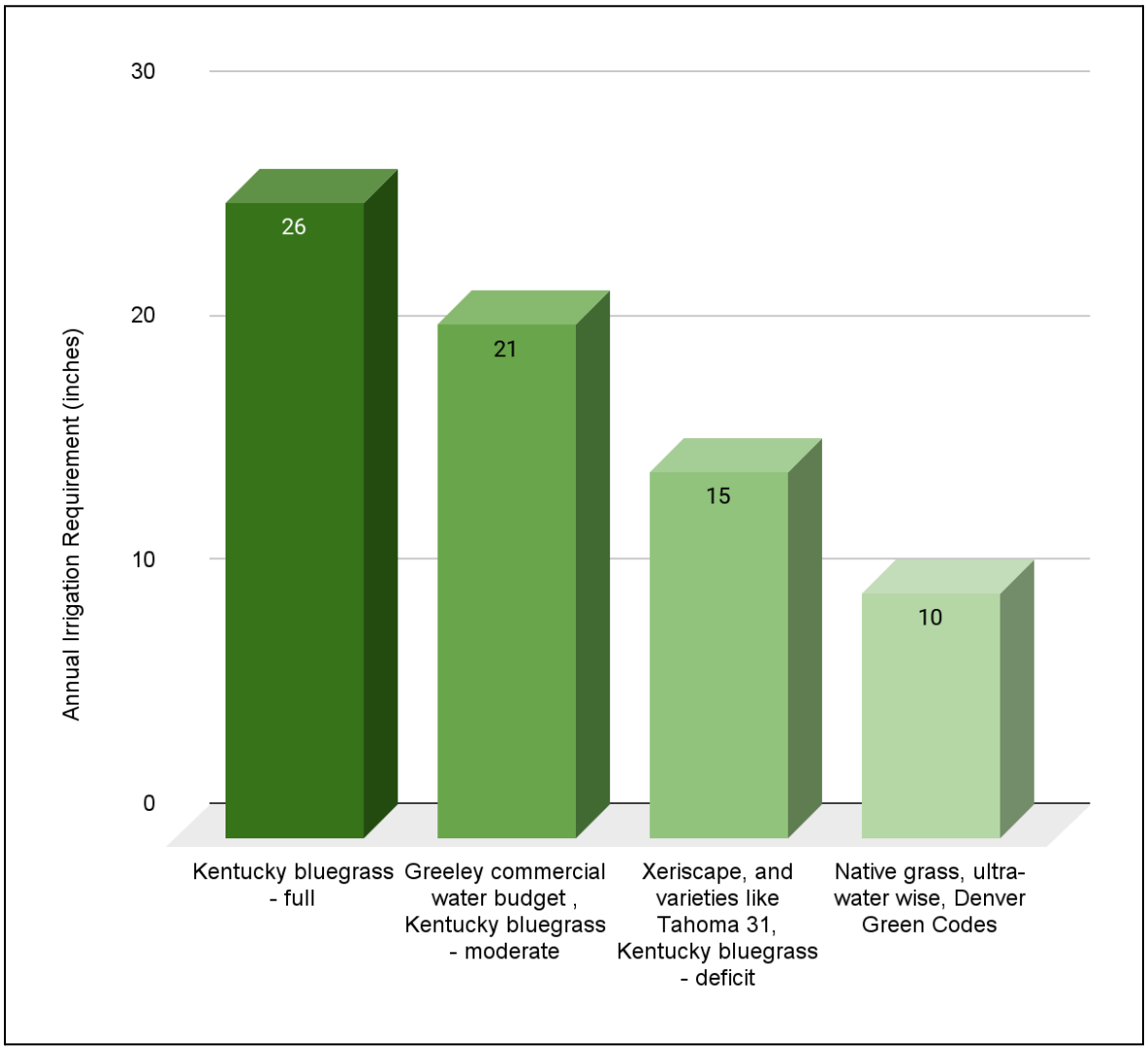


Figure 1: Landscape irrigation requirements (inches) in Colorado[17]

[16] https://www.denvergov.org/Government/Agencies-Departments-Offices/Agencies-Departments-Offices-Directory/Community-Planning-and-Development/Building-Codes-Policies-and-Guides/Denver-Green-Code

[17] https://sod-growers.com/wp-content/uploads/2012/02/the_truth_about_bluegrass_web.pdf, https://cmg.extension.colostate.edu/Gardennotes/412.pdf

New research from Resource Central on the impact of the Garden in a Box program found similar irrigation levels, expressed in gallons per square foot.[18] This is shown in Figure 2.

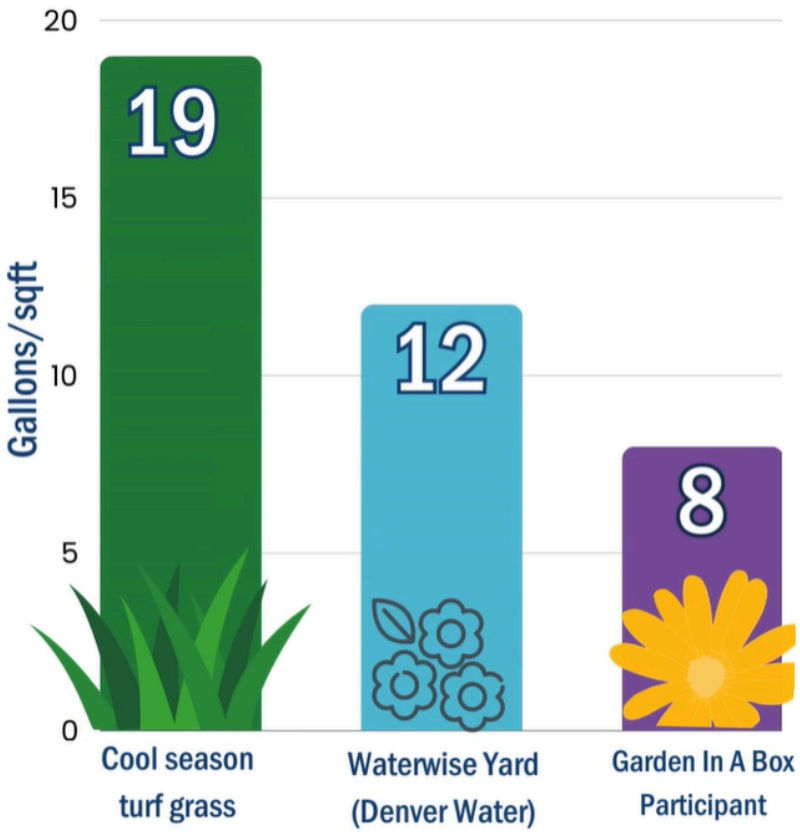


Figure 2: Landscape irrigation requirements (gallons/square foot) in Colorado from Garden In A Box impact analysis (2024)

The typical range of landscape water requirements in Colorado is shown in inches and gallons per square foot here:

- 24 - 26 inches (15 - 16 gpsf) - current Kentucky bluegrass full standard
- 21 inches (13 gpsf) - City of Greeley landscape water budget for new commercial development, Kentucky bluegrass - moderate
- 12 – 18 inches (7.5 – 11 gpsf) – typical water wise/xeriscape/ColoradoScape and grass varieties like Tahoma 31, Kentucky bluegrass - marginal/deficit
- 9 – 12 inches (5.6 – 7.5 gpsf) – native grass, ultra-water wise, Denver Green Codes

[18] Butler, K. and M. Stolp. 2024. Garden In A Box Impact Analysis. Assessing the impact of Resource Central's Garden In A Box Program. Resource Central. https://storymaps.arcgis.com/stories/1040b8ab35804034a50e7c1d517bce8f

Colorado has significant variability in how water providers are planning for the irrigation requirements of future landscapes. One West Slope provider is preparing for landscapes requiring 24 inches a year. Some East Slope providers are planning for 9 - 12 inches per year in the future with landscapes that require supplemental irrigation just once per week. Others worry that this is insufficient supplemental irrigation to maintain Colorado's quality of life standard. One provider noted that landscapes that require just 9 – 12 inches in Colorado "will have us looking like Tucson."

Future Colorado Landscapes

What will Colorado's future landscapes look like, and how much water will they use? The 2023 Colorado Water Plan suggests "identifying the optimal low-water replacement materials that could be sustained on as little as one day of efficient irrigation per week."

For several East Slope providers, the ultimate goal aligns with the Water Plan—to have landscapes that thrive on one day per week of watering. Others believe more water is needed to maintain the community's quality of life standard. One East Slope provider explained, "We want culture change" related to landscapes and water use, but "I'm not quite sure where we are going."

One East Slope provider explained that policies impacting urban landscapes have consequences for cities and municipalities. The same provider felt that a state water budget based on 60- 70% of local reference evapotranspiration (ET), which would be about 14 - 18 inches across much of Colorado, with minimum vegetation coverage requirements of 50 – 75%, could be policy goals to work towards. This would help ensure water efficiency and the quality and health of urban landscapes, including trees.

Trees that provide canopy and shade are essential to Colorado's urban landscapes today and in the future. The City of Denver found that neighborhoods without trees could be nine degrees hotter than canopied areas and is aggressively planting new trees in response.[19] Trees need water. Providing enough water to maintain the health and well-being of the urban tree canopy, even during drought years, should be a priority given the essential benefits the canopy provides. Decoupling grass or garden irrigation from tree canopies is one way to help ensure they can still receive water during times of drought and watering restrictions.

This point was illustrated recently in Sacramento when around 20 percent of the city's trees were either damaged or lost because of mandatory water restrictions. In response, Amy Talbot, the water efficiency program manager for the Sacramento Regional Water Authority, said, "There's going to need to be a wholesale change in the way we look at landscapes and what we

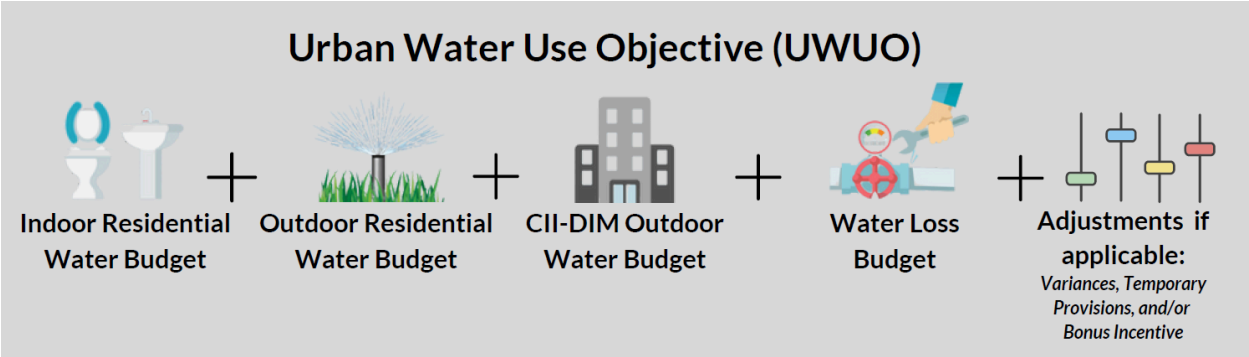
[19] https://coloradosun.com/2024/07/17/denver-heat-islands-climate-change-weather/

value in them. "But I don't see valuing trees changing. … That's something we're not willing to give up."[20]

Water Management Ideas from Other States

Make Water Conservation a California Way of Life

In California, SB 606 and AB 1668, signed in 2018, are intended to "Make Water Conservation a California Way of Life." Three water use standards (indoor residential, outdoor residential, and outdoor commercial, industrial, and institutional), one water loss standard, and various adjustments are used to calculate each urban water supplier's overall budget. The sum is called the *Urban Water Use Objective (UWUO)*.[21]



The California State Water Resources Control Board (State Water Board) approved the final Urban Water Use Objective rules in July 2024. State Water Board Chairman Joaquin Esquivel said, "This is not a perfect regulation. We can never have perfect regulation. But it is a significant one and moves us into a direction here into the future that we can all be proud of — and that is nation-leading."

The efficiency improvements required to achieve the Urban Water Use Objective vary from supplier to supplier, and some have already achieved future target components. A UWUO can be adjusted via variances, temporary provisions, and/or a bonus incentive for potable reuse, where applicable per supplier. A variance or temporary provision must receive prior approval by submitting a request to the State Water Board.

In addition to the UWUO, every urban supplier will need to comply with a set of Commercial, Industrial, and Institutional (CII) and dedicated irrigation meter (DIM) performance measures.

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20 https://www.politico.com/newsletters/california-climate/2024/07/03/trees-cast-shade-on-californias-climate-ambitions-00166560

21 https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Water-Use-And-Efficiency/2018-Water-Conservation-Legislation/Performance-Measures/CIIDIMWUS_STD_-WUES-DWR-2021-03_COMPLETE.pdf

These performance measures are intended to enable water-usage benchmarking per CII classification category and establish Best Management Practices for indoor and outdoor CII water use regardless of CII-DIM status. Even if an agency meets its UWUO, it must still follow the CII Performance Measures.

The indoor residential target is set at 47 gallons per capita per day (GPCD) and will decrease to 42 GPCD in 2030 and beyond. Recent end-use analysis conducted by Flume and WaterDM shows that many residences in the US can use less than 40 gallons per person per day indoors without behavioral changes.[22] A similar approach could work in Colorado with appropriately set GPCD targets.

The water loss standard is derived from separate but related legislation, Senate Bill 55 (2015), which also requires urban water retail suppliers to submit annual validated water audits. Suppliers' annual validated water audits can be found on the California Department of Water Resources website.

The California water loss standard focuses on actual losses expressed in gallons per connection per day or gallons per mile (of pipe) per day, depending on system size. The vast majority of suppliers are expected to be able to report water loss in terms of gallons per connection per day.

Supplier-specific 2028 water loss targets (maximum loss) are calculated from the State Water Board-created economic model that incorporates both water loss and economic metrics. A supplier can customize the majority of the economic model's inputs if documentation is submitted.[23]

Colorado has started collecting water audits and moving toward audit validation. In 2023, the Colorado Water Conservation Board voted to start requiring covered entities to submit an annual water loss audit. The next step in Colorado will be to expand auditing and audit validation and analyze the reported data to understand levels of loss across the state. Once water loss is better understood, recommendations for a Colorado water loss standard could be set.

Nevada – Water Use Limits

Nevada has taken several innovative steps to curtail high water use in communities reliant on Colorado River water. Starting with NFT legislation in 2021, Nevada has effectively prohibited using Colorado River water to irrigate large areas of turf. According to a 2005 analysis of the potential water savings from turf replacement, turf grass requires 73.0 gallons per square foot

[22] https://flumewater.com/water-index/
[23] https://calwep.org/water-loss-standard/

(117.2 inches), while xeric landscaped areas only need 17.2 gallons per square foot (27.6 inches).[24] Recent Nevada legislation has targeted high water users who rely on Colorado River water.

Under specific tiered drought conditions, this legislation—AB220—directs the Southern Nevada Water Authority (SNWA) to limit residential property water consumption to 0.5 acre-feet (163,000 gallons) per year and provides for penalties. AB220 also establishes requirements for an irrigation water efficiency monitoring program to identify inefficient use beyond the residential sector.

Section 30 of AB220 requires specific parcels of property that use waters of the Colorado River to participate in an irrigation water efficiency monitoring program if the property: (1) is not used exclusively as a single-family residence and (2) consists of 20,000 square feet or more of turf. Section 30 also (1) requires the Board of Directors to develop and establish policies, guidelines, and deadlines for participation in such an irrigation water efficiency monitoring program and (2) authorizes a waiver, when necessary, from the irrigation water efficiency monitoring program.

This component of AB220 incentivizes properties to reduce their turf area or face annual audits. This is expected to be an effective change agent for high-water users, who must at least ensure their irrigation systems are efficient if they don't reduce their turf. AB220 goes further and also establishes minimum standards for certain landscaping irrigation fixtures in new construction and expansions and renovations in certain structures.

Mike Bernardo from SNWA spoke about Nevada's efforts to address high residential water use at the 2024 Next Generation Water Summit in Santa Fe, New Mexico."We have tiered water rates as an established excessive use charge," Bernardo said. "If you exceed the threshold of the top 10% of water users, there is a $9 surcharge per 1k gallons used."

In January 2023, the Las Vegas Valley Water District implemented an excessive use charge targeted at these high water users, which resulted in a 500% rate increase in excessive water use. The District finds this program is already working for about half of that top 10%.

Bronson Mack, the Las Vegas Valley Water District's public information officer, says, "About half of our highest water users are already proactively taking steps to reduce their water use so that they don't incur that fee."[25]

The District chose to target these high water users because of their disproportionate impact on the supply system. Mack explained, "The top 10 percent of residential water users consume

[24] https://www.snwa.com/assets/pdf/reports-xeriscape.pdf
[25] https://www.ktnv.com/13-investigates/excessive-use-charge-making-impact-on-top-residential-water-users

about 35 percent of all of the water that is delivered to residents. Many residential properties are using more water in a single month than the average household uses during an entire year."

"Absolutely, it is meant to be a punitive cost for those water users that use an outsized proportion of water," Mack said.

Nevada's and Greeley's approaches to addressing high water use through an annual consumption evaluation share some similarities. In both cases, customers exceeding their allotment are subject to financial penalties.

When asked about Nevada's approach to limiting water use, a Colorado Front Range provider noted that "luxury" water use was not really an issue in their service area. While the concepts used in Nevada to address high water usage could apply in Colorado, geographic differences would need to be considered, and flexibility to allow for customization might be worth considering. It should be noted that some Colorado providers have already taken measures to address excessive water use, as described in this white paper.

Utah – Improved Metering and Accountability

In Utah, many residential connections use secondary (raw) water for outside irrigation. When connections aren't metered, tracking and conserving secondary water is difficult. Meters have been proven to help reduce water demand by informing users of their consumption and increasing accountability.[26]

The state legislature passed HB 242 in 2022 and SB 251 in 2023. These two bills resulted in Utah Code 73-10-34, which requires all secondary pressurized connections to be metered by January 1, 2030.

In addition, Utah Code 73-10-34.5 appropriated $250 million in ARPA grants for the purchase and installation of secondary water meters. The Board of Water Resources was tasked with distributing these funds.

Colorado has many unmetered raw water connections, particularly on the West Slope. Working to improve measurement and accountability for all water use in the state is an important goal. This is an area where gradual improvement could be made, and there could be a legislative role in catalyzing the effort.

Phoenix, Arizona – Seasonal Water Rates

Phoenix, Arizona, has some of the hottest temperatures in the nation. The city averages around 300 days of sunshine annually, and the average annual rainfall is just over seven (7) inches.[27]

[26] Tanverakul, S. and J. Lee. 2015. Impacts of Metering on Residential Water Use in California. Journal of the American Water Works Association. February 2015, 107:2. http://dx.doi.org/10.5942/jawwa.2015.107.0005
[27] https://www.usclimatedata.com/climate/phoenix/arizona/united-states/usaz0166

While these conditions are better suited for water-wise and regionally appropriate vegetation, Phoenix developed similarly to the rest of the country with stretches of green grass.

Despite not implementing a turf replacement program, the city found a way to reduce the amount of high-water use vegetation on residential properties. Phoenix's adoption of seasonal water rates in the early 1990s, charging more for summer water than winter water, played a crucial role in promoting water conservation.

Seasonal rates can mean customers who consume more summer water during the peak season will more proportionally contribute to the infrastructure needed to meet the demands. The pricing mechanism can serve as an educational tool to convey information to customers about the higher water use necessary in the summer for maintaining water-intensive landscaping, thereby prompting conversion to more regionally appropriate landscaping. In the 1970s, roughly 80 percent of single-family homes were landscaped with a majority of turf grass, with the current number accounting for less than 10 percent.[28]

By implementing seasonal rates to encourage conservation, Phoenix maintained affordable water through low fixed charges and for basic indoor needs. While the city has voted to increase water rates over the past few years, a 2018 publication in the Journal of the American Water Works Association ranked the water in Phoenix as the most affordable of the 25 largest cities in the country.[29] In 2024, Phoenix launched a non-residential grass incentive program to continue the advancement of water-wise landscaping in the urban area.[30] Currently, residential grass removal incentives are not available but are expected to begin in early January 2025.[31] Instead, Phoenix provides information to help customers lower their water bills, including leak detection, usage monitoring, and efficient irrigation techniques.[32]

[28] https://www.greenbiz.com/article/lessons-phoenix-water-management-and-equity
[29] https://efcnetwork.org/wp-content/uploads/2019/05/Teodoro-JAWWA-2018-affordability-methology.pdf
[30] https://www.phoenix.gov/newsroom/water-services/3007
[31] https://www.phoenix.gov/waterservices/water-conservation-incentives
[32] https://www.phoenix.gov/waterservices/resourcesconservation/yourhome/high-water-bill

Conclusions

Key takeaways from this white paper:

Non-functional turf - Providers are in varying states of readiness for replacing NFT, but how much is a question. While only a handful of Colorado signatories (Aurora Water, Denver Water, Pueblo Water, and Castle Rock Water) are on the MOU that aims to replace 30% of the identified NFT, large providers on the Front Range are actively working on NFT removal initiatives that it will take years to complete at the current pace. Because full mapping of the total NFT has rarely been completed, the true goals and potential water savings are nascent. Still, replacing NFT is a topic of concern and priority for most providers that were contacted. Some providers are looking at CWCB to fund the effort.

Addressing high outdoor water use -

- All the participating providers had yet to calculate the volume of water that might be saved by reducing excessive outdoor water use. One East Slope provider has assessed that 15 – 20% of its customers are over-irrigating in the residential sector and likely 20% or more in the commercial sector. A West Slope provider noted that the top 10% of customers consistently use about 50% of the water. Tackling over-irrigation and removing NFT can be done simultaneously, but irrigation efficiency and outdoor waste can also be tackled whether NFT is removed or not.

- Several East Slope providers, such as Greeley, Castle Rock, Centennial, Boulder, and Colorado Springs, use landscape water budgets to address excessive outdoor water use. The top-tier rates associated with these types of structures impact excessive outdoor users and are a proven approach for addressing high water use. These can be a more cost-effective approach to managing high outdoor use than investment in NFT removal. Additionally, money generated from upper tiers can help pay for conservation programs like NFT replacement.

- One Front Range provider is looking toward proscriptive landscape requirements where a maximum of 25% of the irrigable area is allowed for high-water-use vegetation. They hope to implement landscape irrigation system design, installation, and post-installation inspection to ensure everything is done efficiently. Water use will be tracked and managed with a landscape water budget. Over the coming five years, this provider expects to implement a full system of water budget-based rates as a cornerstone program to manage excess water use.

Savings potential from addressing high outdoor use -

If an outdoor-focused conservation effort such as landscape water budgets were to be implemented statewide, an achievable target from such an effort would be to reduce outdoor use by 10% or 14,000 AF. An aggressive target would be a 15% reduction or 21,000 AF. Research on the impact of water budgets has found demand reductions from 10 – 30% at the utility scale, but results vary.[33] This suggests that conceptually, a concerted state-wide focus on reducing excessive outdoor water use through water budgets could produce similar water savings to what has been estimated from replacing 30% of NFT. This could potentially save more water than NFT removal at a cheaper cost. The two efforts do not also have to be mutually exclusive.

Future landscape water requirements -

Colorado has significant variability in how water providers are planning for the water requirements of future landscapes. One West Slope provider is planning for landscapes that require 24 inches per year. Some East Slope providers are planning for 9 - 12 inches per year in the future, with landscapes requiring supplemental irrigation just once weekly. Others worry that this is insufficient supplemental irrigation to maintain Colorado's quality of life standard and essential tree canopy. One provider noted that landscapes that require just 9 – 12 inches in Colorado "will have us looking like Tucson."

Future Colorado landscapes -

Colorado providers have different ideas about the future of Colorado's urban landscapes and how much water they require.

- One East Slope provider explained, "We want culture change" related to landscapes and water use, but "I'm not quite sure where we are going."
- For several East Slope providers, the ultimate goal is landscapes that thrive on one (1) day per week of watering. Others believe more water is needed to maintain the community's quality of life standard.
- An East Slope provider explained that policies impacting urban landscapes have consequences for cities and municipalities. The same provider felt that a state water budget based on 60- 70% of local reference evapotranspiration (ET), which would be about 14 - 18 inches across much of Colorado, with minimum vegetation coverage requirements of 50 – 75%, could be policy goals to work towards. This would help ensure water efficiency and the quality and health of urban landscapes, including trees.

Water management ideas from other states -

[33] https://budgetbasedrates.com/
Mayer, P.W., et. al. 2008. Water Budgets and Rate Structures: Innovative Management Tools. American Water Works Association Research Foundation. Denver, CO.

California created urban water use objectives for each provider based on measurable and accountable factors, including indoor residential, outdoor, CII, and water loss.

Nevada set strict limits on how much water a single-family residence can use in certain drought-impacted years.

Utah invested $250 million in federal funds to improve raw water metering and accountability.

Phoenix, Arizona, used a seasonal rate structure with substantially higher summer rates to incentivize outdoor water use reductions.