Water Demands

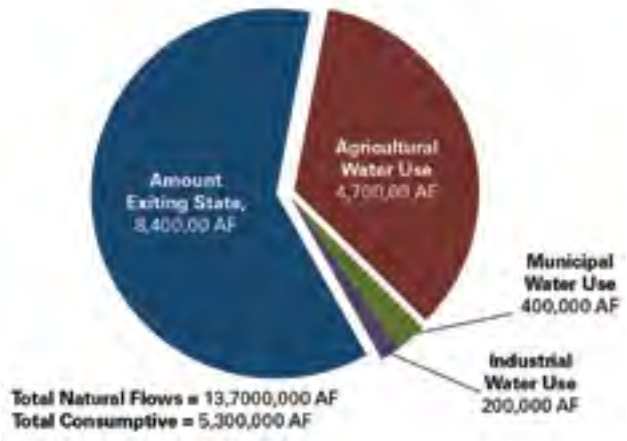
Chapter 5 provides an overview of Colorado's current and projected municipal, industrial, agricultural, environmental, and recreational uses of water. To assess the road ahead, it is essential to understand the many ways in which Coloradans use water throughout the state and how these uses are connected. As M&I needs expand, pressure on agriculture, the environment, and water-based recreation rises. And as the state grows, associated municipal-supply needs will likely increase, more people will seek the outdoor opportunities Colorado offers, and Coloradans will continue to increase their consumption of a variety of locally grown agricultural products that ranches and farms across the state provide.

A father leads his daughter through an agricultural field. Agriculture uses the most water of any industry in Colorado.

Overview

Water use is calculated in acre-feet, which is the amount of water required to cover one acre to a depth of one foot. An acre is about the size of a football field, including both end zones.

FIGURE 5-1 STATEWIDE CONSUMPTIVE WATER USE[1]



Colorado often uses water multiple times, as the following sequence demonstrates: 1) Water is diverted for a given use; 2) the plant, person, or process consumes a portion of the water; 3) the unconsumed portion of water makes its way back to the river (known as "return-flows"); and 4) other water users downstream subsequently use the return-flows, and the cycle repeats. On average, Colorado consumes 5.3 million acre-feet of water per year, but the state may use the water multiple times, as described above, with total diversions of 15.3 million acre-feet per year.

The total amount of water that originates within Colorado averages 13.7 million acre-feet per year. More than 60 percent of this water exits the state to downstream users. Less than 40 percent, or 5.3 million acre-feet, is consumed on average per year in Colorado.[2] Agricultural interests use 89 percent of consumed water, followed by municipalities, which use 7 percent, and large industries, which use 4 percent (Figure 5-1).[3] In addition to meeting the requirements of communities and food production, water is necessary to support aquatic- and riparian-dependent species, as well as boating, fishing, camping, and other water-based recreational activities.

Overview of M&I Water Needs

Summary of Municipal Water Needs

The State refers to water Coloradans need in their homes, yards, businesses, and small industry as "municipal water needs." One critical factor the State uses to quantify future water needs is population, and population projections rely on a multitude of economic trends. A vibrant economy, for instance, leads to the creation of more jobs and to an increase in the number of people staying in and moving to Colorado.[4] The CWCB determines water needs for municipalities by multiplying per-person water use by the number of additional people expected to live in Colorado, subtracting water conservation demand reductions, and adding any expected increases due to higher temperatures or commercial activities.[a]

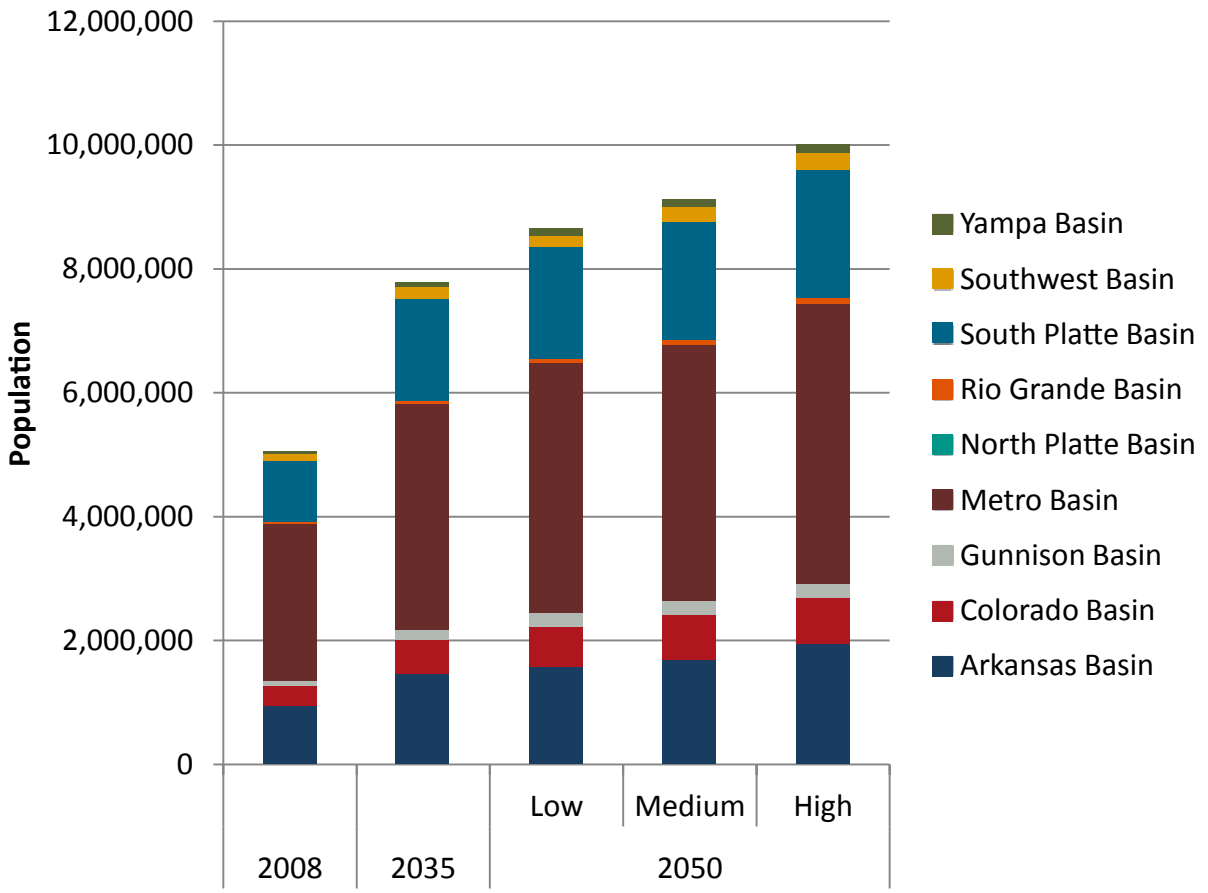
Looking ahead to 2050, the future population within Colorado is difficult to accurately predict. For that reason, the State developed low, medium, and high population estimates (Figure 5-2). However, even under slow economic growth conditions, the State projects that most communities throughout the state will grow.[5] Current indications show that Colorado has one of the fastest-growing state economies nationwide,

orado received the top-growth ranking in some analyses.[6] Under the high-growth scenario, the state's population could nearly double by 2050; some communities may grow moderately while others are expected to triple in size.[7] Such growth will increase water demands.

Playing soccer on a grassy field. Parks and sports fields require a small percentage of Colorado's total water usage.

[a] For the purposes of the CWCB's technical work, conservation savings were divided into two categories. The first is passive conservation, which the CWCB used to reduce demand projections. Passive conservation results from the replacement of old indoor fixtures and appliances with newer, more efficient ones. Active conservation takes a concerted effort on the part of water providers and their customers. The CWCB treats this as a method to address the water supply gap. Section 6.3 examines ways to reduce demands through active conservation.

FIGURE 5-2 LOW, MEDIUM, AND HIGH 2050 POPULATION PROJECTIONS BY BASIN[8]



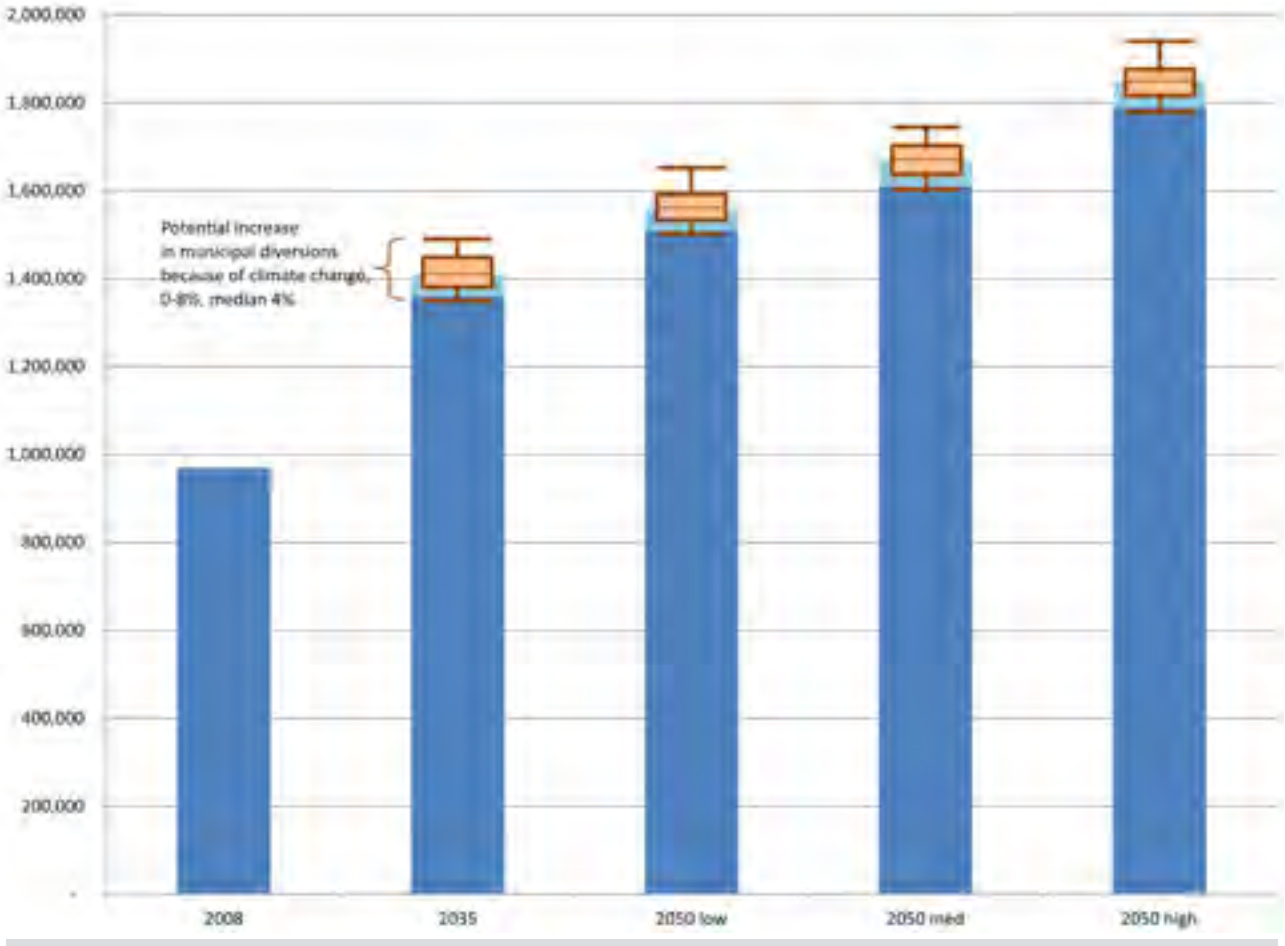
Colorado's growing economy leads to population growth in two primary ways. First, Coloradans have children who remain in the state as working adults and start their own families. With the birth rate exceeding the death rate, roughly half of the state's growth comes from residents born in Colorado.[9] Second, Colorado is a desirable place to live. A diverse and healthy economy, combined with vibrant communities, natural beauty, and a high quality of life, draw people and businesses to the state—and keep them here.[10]

As people migrate to Colorado to fill jobs, the population grows and changes, often driving further growth. For instance, with a growing elderly population, more people will require medical care. To serve this population, the state will need additional health workers, some of whom must come from out of the state.[11]

Looking forward, Colorado requires additional technical work in order to better inform the statewide discussion. The CWCB will update the SWSI 2010 technical analysis to take into account the length and severity of the recent economic recession and rebound.

Population projections from the DOLA indicate that even with the recent economic recession, the population may reach between 8.3 and 9.2 million people by the year 2050, compared to the current population of 5.2 million.[12] The CWCB is in the process of applying new water-use data to future population projections for low, medium, and high population scenarios. These data will result in updated water demand projections.

FIGURE 5-3 PROJECTED MUNICIPAL AND INDUSTRIAL WATER DEMANDS (ACRE-FEET) WITH RANGE OF POTENTIAL CLIMATE CHANGE INCREASES



Colorado's current municipal diversions total approximately 970,000 acre-feet annually (Figure 5-3).[13] Municipal use is split among indoor use, outdoor use, and water loss in distribution systems. Statewide, Colorado municipalities on average use 53 percent of their diversions indoors and 39 percent outdoors. The remaining 8 percent is not metered, and goes to fire protection and maintenance or is lost due to leaks in distribution systems (Figure 5-4).[b] One may further divide these numbers among residential, park, and commercial uses.

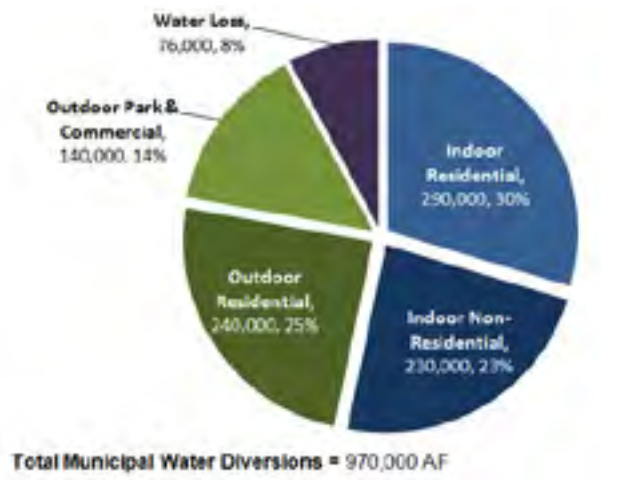
Population growth in Colorado is inevitable, but state and local governments can influence how and where the population grows, and how much water is needed to support such growth. Section 6.3 further discusses strategies for making that happen. Climate change could also increase municipal needs as outdoor landscapes adapt to longer growing seasons, higher temperatures, and higher rates of evapotranspiration. The State expects the effects of climate change on total annual municipal diversions to range from no-effect to up to an 8 percent increase (Figure 5-3).[14] If Colorado experiences a future in which the population rises while the climate becomes hotter and drier (a scenario known as "hot growth"),[c] the state could need nearly 1 million acre-feet of water per year by 2050, well beyond the 2008 demand levels.[16] However, if Colorado experiences weak population growth matched with historical temperature conditions, the additional annual demand for water beyond 2008 levels is approximately 600,000 acre-feet.[17]

[b] Water loss is defined as the difference between system-input volume and metered consumption, and consist of apparent losses plus real losses.

[c] This scenario is also known as the "hot growth" scenario in the IBCC scenario-planning work, which has hot and dry climate matched with high population growth.

The degree to which climate change could affect municipal demands varies considerably across the state due to differences in the amount of outdoor irrigation, potential temperature increases, and potential changes in precipitation patterns.[18] Increases in demand due to climate change do not take into account potential hydrological changes, which could further decrease municipal supply, thus exacerbating future municipal needs, as Chapter 4 discusses.

FIGURE 5-4 STATEWIDE MUNICIPAL-USE PATTERNS[15]



While climate change has the potential to intensify municipal needs, water conservation, reuse, and land-use planning have the potential to attenuate them. As Section 6.1 describes, no matter the future that Colorado faces, the state will need a substantial amount of conserved water to ensure that there is enough water to meet Colorado's needs.

State of Knowledge on Water Conservation

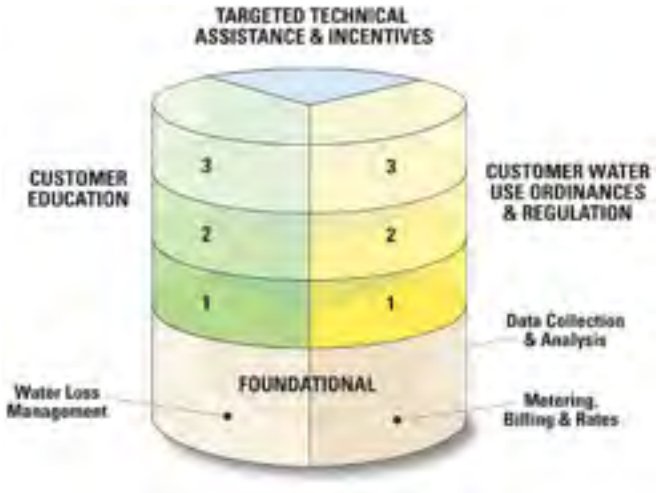
Colorado communities plan to build upon the success of existing conservation and efficiency programs to further reduce per-person water needs. Since the year 2000, Colorado as a whole reduced per-capita demands by 20 percent—even by as much as 30 percent in some communities.[19] To continue this trend, Colorado must implement additional best practices.

In 2010, the CWCB funded the first *Best Practices Guidebook for Municipal Water Conservation in Colorado.* Colorado WaterWise created the guidebook with a large technical and stakeholder group, and established 14 best practices that outline the potential benefits and costs for active water conservation measures, and for indoor, outdoor, residential, and non-residential practices. The guidebook provides a menu of options that water providers can select and add to their water conservation programs. The best practices require financial and human resources to accomplish, and implementation varies greatly among water providers.[20]

The CWCB created the levels-analysis framework, and prioritized the best practices a local water provider can use to achieve its goals. The levels analysis focuses on foundational practices first, and then outlines practices with varying degrees of difficulty. These practices are organized into three categories: technical assistance and incentives, local ordinances, and education (Figure 5-5). This analysis will help water providers focus their human and financial resources on the most cost-efficient activities first (those that save the most acre-feet or reduce resource expenditures), and later expand to pursue the more difficult and costly activities.[21]

Using the best practices as a basis, the SWSI 2010 estimated low, medium, and high strategies for active water conservation savings. Active water conservation is water conservation that occurs due to the enactment of programs at the local level, where financial and human resources commit to carrying out water

FIGURE 5-5 STATEWIDE WATER SUPPLY INITIATIVE LEVELS ANALYSIS FRAMEWORK



efficiency programming. Depending on the level of projected savings, varying amounts of effort are required to achieve penetration rates consistent with the savings estimates. The SWSI 2010 M&I Water Conservation Strategies report states:

"If water conservation is to be part of Colorado's future water supply portfolio, it must be supported and funded like other supply initiatives. To obtain the savings forecast in this report, the strategies described must be rigorously implemented at the state, regional, local, and customer level. Water is saved by municipal customers, but customers can be aided in the effort. State polices that promote conservation-oriented rates, water loss control measures, water efficient landscape and building standards, improved plumbing codes, and education and outreach set the stage for regional and local conservation program measures that target high demand customers and ensure new customers join the water system at a high level of efficiency."

The total potential savings in SWSI 2010 range from 160,000 to 461,000 acre-feet statewide in 2050 (Figure 5-6).[22]

Even at the highest level of conservation savings, individual water utilities still maintain considerable flexibility. For instance, under high-conservation savings, 50 to 80 percent of utilities statewide will need to implement targeted audits for customers that use high amounts of water on their landscapes (Table 5-1). This practice makes the most sense for water providers whose customers and commercial properties have large lots and outdoor space. By following best practices, water providers can get favorable results while implementing audits in ways that make sense for the utility. Furthermore, high conservation levels still allow for attractive landscapes that include grass, parks, and trees that maintain property values and continue to mitigate increased urban temperatures. Efforts to address outdoor water conservation must balance the vital importance of urban landscape with the benefits of conservation, including improved air, surface water and groundwater quality; increased property values; improved aesthetics; and an enhanced general quality of life.

The IBCC and CWCB identified a minimum of low to medium levels of active water conservation practices as a "no-and-low regret." Section 6.1 further describes this. In addition, the CWCB adopted an aspirational goal of 400,000 acre-feet in water conservation savings identified by the IBCC. This is equivalent to medium to high levels of savings. Section 6.3 describes this further.

Not all conservation savings can or should be applied to meet future growth. Not every municipality that conserves water will need all of that water to meet future growth, and legal barriers restrict water providers from sharing conserved water. Furthermore, most entities do not have the infrastructure to either share water or re-time conserved water in order to make it available for use. Additionally, some entities may choose to use conserved water as part of their strategic drought reserve. The roundtables' initial estimates indicate that Colorado water providers could use between 50 and 60 percent of conserved water to meet future growth.[23]

In addition to active conservation savings, an additional 150,000 acre-feet of savings will likely accrue by 2050 due to natural replacement of fixtures and appliances.[24] These passive water conservation savings occur when home and property owners replace their indoor water fixtures and appliances. Their choices save water as a result of large-scale regulatory or legislative initiatives, such as the Energy Policy Act of 1992 (1992 EPACT). Passive water conservation

FIGURE 5-6 POTENTIAL WATER SAVINGS FOR 2030 AND 2050 IN THE STATEWIDE WATER SUPPLY INITIATIVE 2010

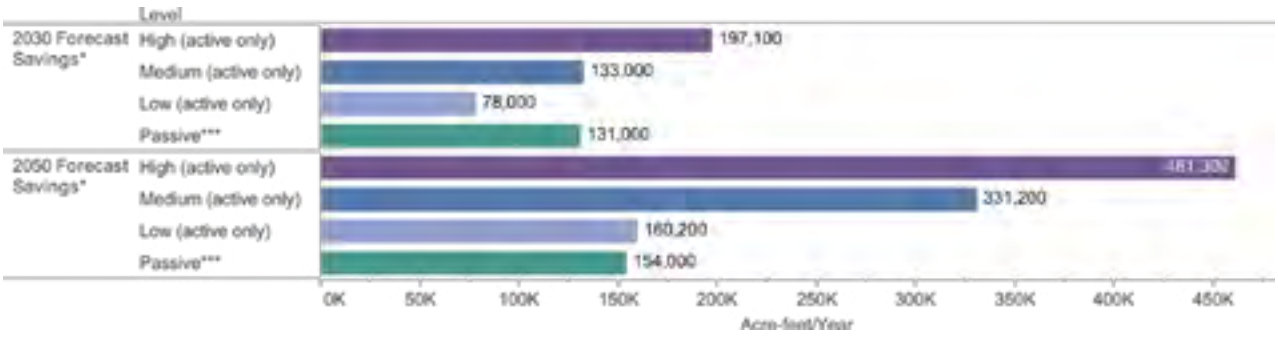


TABLE 5-1 COMPARISON OF 2050 IMPLEMENTATION AND PENETRATION LEVELS FOR THREE CONSERVATION STRATEGIES AND DEMAND REDUCTION USED IN FORECASTS

MEASURE	Implementation or Penetration Level by 2050		
	LOW STRATEGY	MEDIUM STRATEGY	HIGH STRATEGY
System-wide Conservation Measures with Potential to Affect All Customers			
Public information and education	~100%	~100%	~100%
Integrated resources planning	~100%	~100%	~100%
Conservation-oriented water rates	~100%	~100%	~100%
Water budget-based water rates	<=10% of utilities implement	<=30% of utilities implement	<=50% of utilities implement
Conservation-oriented tap fees	0 - 5% of utilities implement	5 - 10% of utilities implement	<= 50% of utilities implement
Smart-metering with leak-detection	<=10% of pop.	<=50% of pop.	50 - 100% of pop.
Residential Indoor Savings and Measures			
Reduction in residential per capita indoor use	Res. Indoor gpcd = 40	Res. Indoor gpcd = 35	Res. Indoor gpcd = 30
Conservation-oriented plumbing and building codes, green-building, rules for new residential construction	30-50% of state affected	50-70% of state affected	70-100% of state affected
High-efficiency toilets, clothes washers, faucets, and CII equipment	Passive ~100%	Passive ~100%	Passive ~100%
Submetering of new multifamily housing	0%	~50%	~100%
Reduction in customer side leakage	33% savings: passive from toilet replacement	37% savings: passive from toilet replacement and active repairs	43% savings: passive from toilet replacement and active repairs
Non-residential Indoor Savings and Measures			
Reduction in nonresidential per capita indoor use	15% reduction	25% reduction	30% reduction
High-efficiency toilets, urinals, clothes washers, faucets, and showers	Passive ~100%	Passive ~100%	Passive ~100%
Conservation-oriented plumbing and building codes, green-building, rules for new nonresidential construction	30-50% of state affected	50-70% of state affected	70-100% of state affected
Specialized nonresidential surveys, audits, and equipment efficiency improvements	0-10% of utilities implement	10-50% of utilities implement	50-80% of utilities implement
*Landscape Conservation Savings and Measures			
Landscape water-use reductions (residential and nonresidential)	15% reduction	22-25% reduction	27-35% reduction
Targeted audits for high-demand landscape customers	0-30% of utilities implement	30-50% of utilities implement	50-80% of utilities implement
Landscape transformation of some high-water requirement turf to low-water requirement plantings	<=20% of landscapes	20-40% of landscapes	>50% of landscapes
Irrigation efficiency improvements	<=10% of landscapes	<=50% of landscapes	50 - 100% of landscapes
Utility Water Loss Control			
Improved utility water-loss control measures	<=7% real losses	<=6% real losses	<=6% real losses

*Landscape water demand reductions include the expected effects of urban densification.

can be considered a baseline of water savings that will occur naturally, and thus, Colorado includes this in demand projections. As customers replace their toilets, dishwashers, clothes washers, showers, and other water-using appliances, many will choose WaterSense- or EnergyStar-labeled fixtures and appliances, which use less water. Colorado may experience these savings sooner than expected because of recent legislation, such as Senate Bill 14-103. Section 6.3 describes this further.

Municipal Reuse

According to the SWSI 2010, the CWCB projects reuse of existing supplies to provide 43,000 to 61,000 acre-feet of water per year, which accounts for about 10 percent of the total projected yield from the IPPs.[25] The full use of reusable water supplies and efficient reuse of water will play an integral role in closing the supply gap.

Colorado water law defines which water supplies Colorado can reuse, and the extent to which the State can reuse each source. With limited exceptions, Colorado can legally reuse the following sources:

- **Non-native water:** In most cases, Colorado can reuse to extinction water imported into a basin through a transbasin diversion or a TMD. Such diversions account for a substantial quantity of the total reusable supply in Colorado.
- **Agricultural-municipal water transfers:** Agricultural transfers are generally available for reuse; however, the State limits reuse to the historic consumptive use of the original agricultural water-right decree. This includes water from a traditional purchase of agricultural water rights and from alternative transfer methods.
- **Nontributary groundwater:** The State allows reuse of nontributary groundwater.
- **Other diverted water:** Users may reuse any water right with a decreed reuse-right to the extent the decree describes.

Users may reuse these sources directly or indirectly. Directly, they may pipe the recycled water from the water reclamation facility to beneficial uses, such as non-potable irrigation sites or industrial uses. Indirectly, they may augment a surface water or groundwater body with reusable return flows and divert an equal amount of flow from a different point of diversion.[26]

The Colorado Department of Public Health and Environment (CDPHE) Water Quality Control Commission (WQCC) developed Regulation 84, which guides the use of reclaimed domestic wastewater. This regulation currently authorizes the use of reclaimed water for landscape-related beneficial uses, such as non-potable irrigation (including single-family residential irrigation), and various commercial and industrial uses, such as cooling-tower use, dust control, soil compaction, mechanized street cleaning, fire protection, and zoo operations.[27]

Municipal Land Use

Land-use patterns affect how much water a community uses. Land-use tools, such as higher-density developments or tap-fee incentives for water-efficient developments, save water by increasing the efficiency of water distribution systems, limiting lawn size, and installing efficient indoor fixtures and appliances. The 2009 California Water Plan Update showed that a 20 percent increase in housing density could yield a 10 percent water savings,[28] and initial data from Colorado confirm these results in a technical memorandum.[29] Denser development can also enhance other elements that help define a community, such as transportation, open space, neighborhood design, and walkability. Best practices in landscape and irrigation may yield more benefits within a denser land-use environment than within a traditional, less dense environment. Because healthy urban landscapes enhance the livability of a city or town and are a crucial asset in urban populations, urban parks and landscapes will not disappear with denser urban development.

Large Industry

Colorado's large industries include beer brewing, snowmaking, energy and mining extraction, power generation, food processing, and a multitude of others. Collectively, these industries require approximately 200,000 acre-feet of water annually. Projections indicate that future large-industry needs could increase by 50,000 to 130,000 acre-feet per year by 2050. [30]

Future water planning efforts will incorporate additional analyses of industrial needs regarding water use associated with energy and extraction. Through statewide and basin-wide planning efforts, the CWCB will confirm existing data and update future uses. For instance, the Colorado and Yampa/White/Green Basin Roundtables conducted an Energy Development Water Needs Assessment Update, and have asked the CWCB to incorporate this work into future statewide planning efforts.[31]

Summary

Demand management strategies such as water conservation, water reuse, and land use will play a central role in reducing future municipal water demands. As this section has outlined, Colorado water providers have accomplished much work in the areas of demand management and alternative supplies. Additionally, innovative work is occurring across the United States and points to trends that Colorado may wish to follow. Section 6.3 describes next steps and future actions.

Overview of Agricultural Needs

Statewide, agriculture diverts 34 percent of the total amount of water originating within Colorado, which represents 89 percent of the total amount of water consumed. The CWCB estimates current agricultural consumptive use to be approximately 4.7 million acre-feet of water on an average annual basis.[32] However, taking into account crop irrigation requirements, current agricultural crops would use an additional 2 million acre-feet of water if a plentiful supply existed.[33] It is important to note, on the other hand, that some water shortages are due to management decisions in addition to physical or legal limitations on water supplies. The CWCB does not expect that every agricultural shortage can or should be met in the future.

CARL & CURRAN TRICK

NORTH PLATTE RIVER BASIN

Carl, a North Platte rancher and water leader, served on the Colorado Water Conservation Board. He is passing on the responsibility to help keep agriculture viable in Colorado to his daughter Curran, who is a water rights and natural resources attorney.

Carl Trick grew up in North Park, Colorado on the family's cattle ranch, and after leaving for a stretch to attend New Mexico University in Las Cruces, returned to manage the ranch where he raised his family and daughter, Curran. At the North Park Angus Ranch, Carl passed on to Curran an appreciation for the importance of water. Through ranching and working with multiple generations of the family, both Carl and Curran learned how important water is to agriculture's livelihood. Both have been involved in local, basin-wide and statewide issues and recognize how important our precious resource is in Colorado.

CONTINUED AT END OF CHAPTER

PROFILE

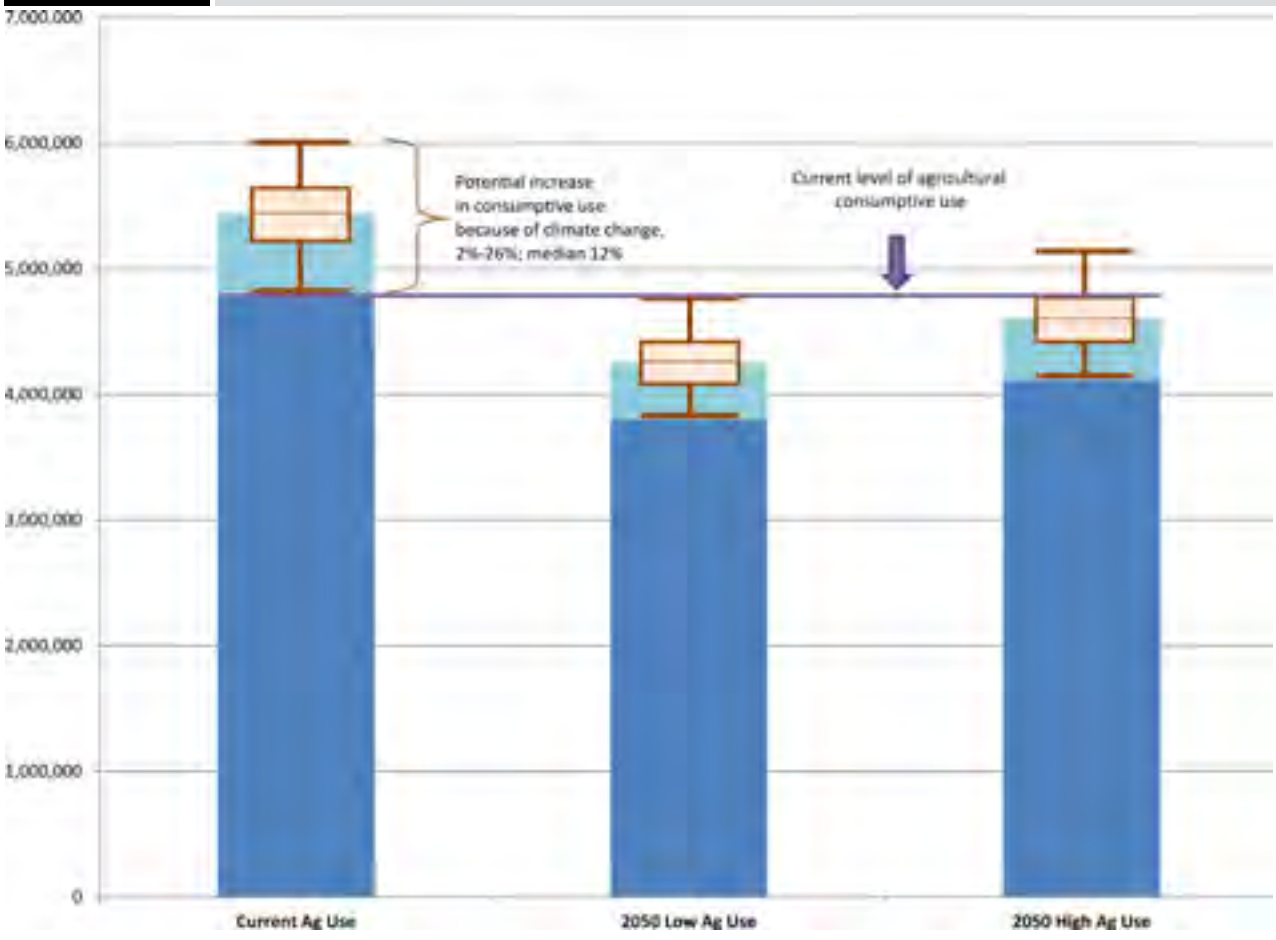
The CWCB expects statewide irrigated acreage to decline for a variety of reasons:

- Many municipalities turn to agricultural water rights as an affordable, reliable source of water, and purchase them from willing sellers.
- Developers purchase irrigated farmland to expand urban areas, thus urbanizing those agricultural lands.
- Due to aquifer sustainability and some compact-related issues, the South Platte, Republican, and Rio Grande Basins have reduced, or are in the process of reducing, irrigated acreage.[34]

TABLE 5-2 SUMMARY OF AGRICULTURAL GOALS INDICATED IN THE BASIN IMPLEMENTATION PLANS

BASIN	IDENTIFIED AGRICULTURAL GOALS
Arkansas	Increase amount of agricultural augmentation water by 30,000-50,000 acre-feet
Colorado	Reduce agricultural shortages
Gunnison	Reduce agricultural shortages by approximately 17,000 acre-feet
Metro/South Platte	Reduce agricultural shortages
North Platte	Add 28,000 acres of irrigated farmland; continue to restore, maintain, and modernize critical water infrastructure to preserve current uses and increase efficiencies
Rio Grande	Manage water use to sustain optimal agricultural economy throughout the basin's communities
Southwest	Increase agricultural efficiencies by implementing at least 10 projects
Yampa/White/Green	Add 14,000 acres of irrigated farmland; reduce agricultural shortages

FIGURE 5-7 PROJECTED AGRICULTURAL WATER DEMANDS (ACRE-FEET) WITH RANGE OF POTENTIAL CLIMATE CHANGE INCREASES



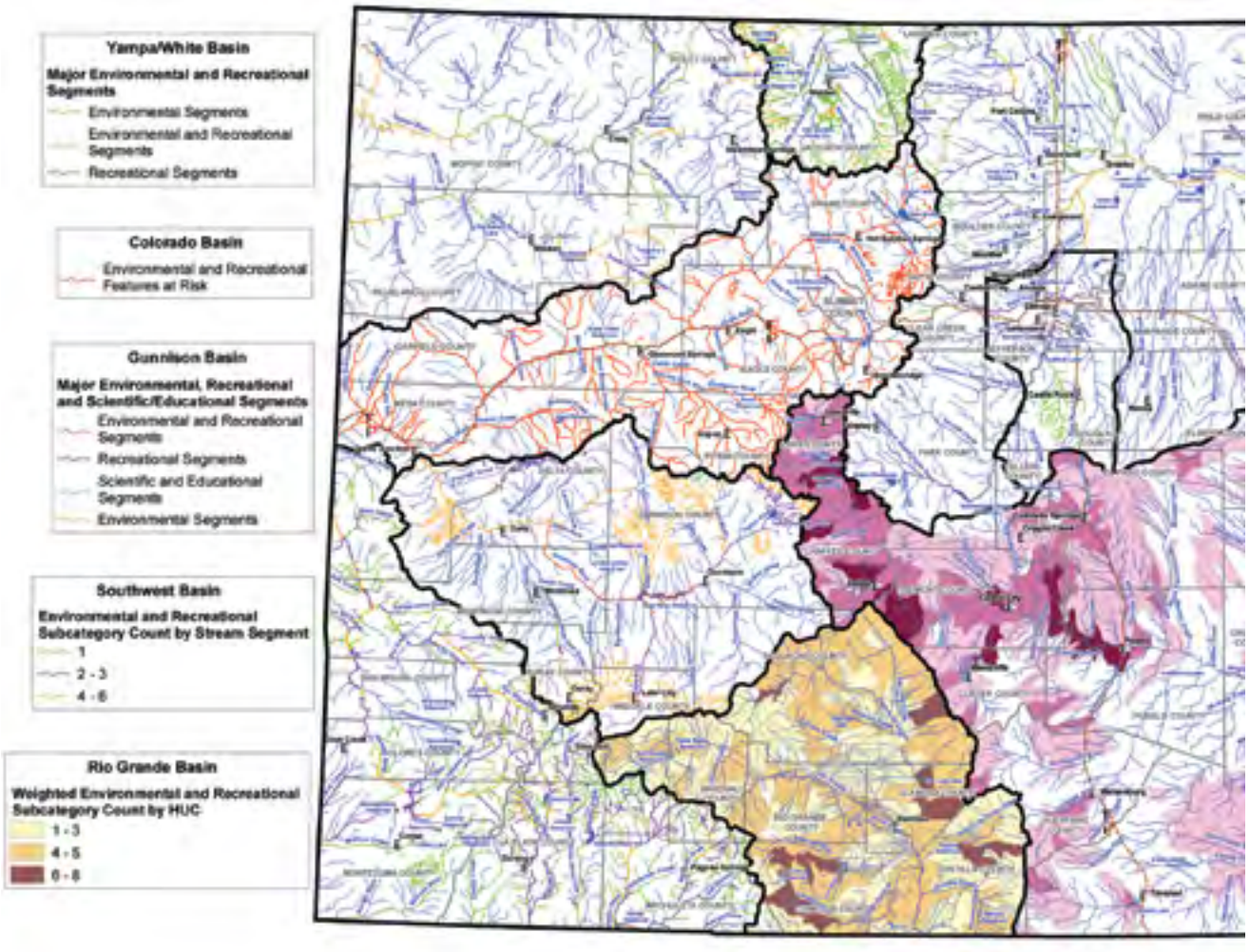
Watering vegetable seedlings with siphon tubes on Sakata farms in Brighton. Photo: M. Nager.

Irrigated acres could decrease from 3.5 million to 2.7 million acres statewide.[35] The potential effect is most pronounced in the South Platte Basin, where a decrease could remove as much as 35 percent of the irrigated acres from production.[36]

In addition to potential decreases in irrigated acres, climate change could further affect agricultural producers. Depending on the location, higher temperatures in the future could increase water consumption by 2 to 26 percent on lands that are still in production (Figure 5-7, as noted on page 5-11).[37] More frequent or severe droughts could also affect agricultural production and slow economic agricultural activity. During the 2012 drought, the State experienced a loss of agricultural revenues of $409 million, and an additional loss of $317 million in secondary spending in local communities.[38]

As part of the BIP process, basin roundtables examined future agricultural water needs. Six basins expect decreases in irrigated acres, while two expect increases. All of the basin roundtables aim to reduce expected shortages. The roundtables identified several agricultural goals (Table 5-11-2, on page 5-11. Section 6.5 further explores projects and methods to achieve these goals.

FIGURE 5-8 STATEWIDE ENVIRONMENTAL AND RECREATIONAL NEEDS[42]



Overview of Environmental and River-Based Recreational Needs

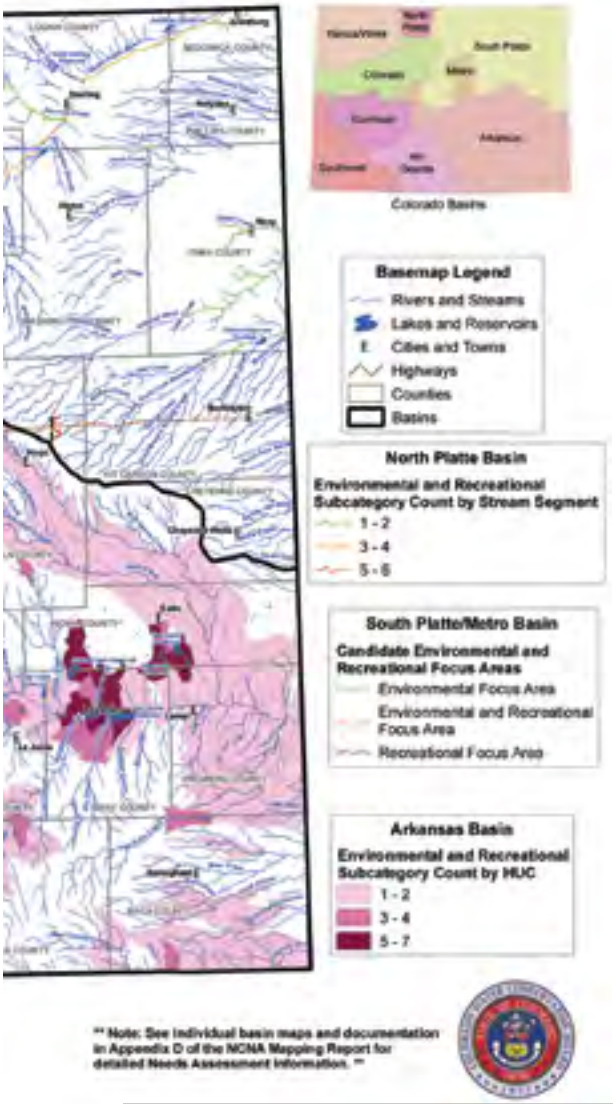
River flows, aquatic and riparian habitat, water quality, bank stability, stream access, water temperature, and habitat connectivity are all critical factors to consider when determining environmental and river-based recreational needs. Therefore, river-based environmental and recreational needs are often represented by the number of stream-miles or acres of wetland that have important attributes and need protection or restoration. As part of the SWSI 2010, a collaborative effort between the CWCB and the basin roundtables identified 13,500 perennial stream-miles in Colorado that have important attributes, and therefore selected these as "focus areas."[39] Examples of important attributes include imperiled fish species, outstanding examples of riparian habitat, and important boating and fishing areas.[d] Figure 5-8 illustrates these areas. The basin roundtables did not intend to include every stream with important attributes in every basin. The roundtables will continue to place importance on additional analysis to define what the focus areas need and to identify other streams with substantial values.

Analysis of the focus areas is a critical step in describing the needs of specific basin attributes, and the roundtables will ultimately develop strategies to address these environmental and recreational needs. Below are a few examples of this analysis:

- The roundtables identified 2,260 perennial stream-miles of Colorado River and greenback cutthroat trout habitat in focus areas across the state.
- The roundtables identified 3,164 perennial stream-miles of warm-water fish habitat in focus areas. These reaches include endangered, threatened, or imperiled fish species.
- The roundtables identified 7,642 perennial stream-miles of substantial riparian areas and wetlands. These include occurrences of exemplary-plant communities as well as rare-plant communities.

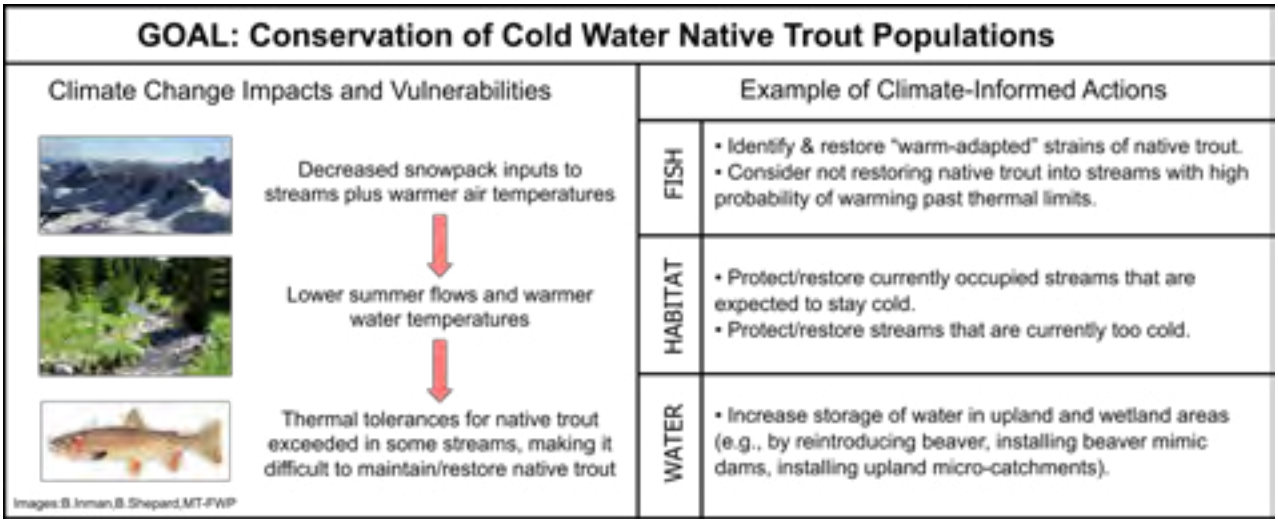
The number of water rights appropriated for instream flows, natural lake levels, and recreational in-channel diversions demonstrates some of the ongoing flow needs for the environment and recreation:

- Instream flows: 9,180 stream-miles for 1,595 decreed water rights
- Natural lake levels: 126,000 acre-feet for 476 decreed water rights
- Recreational in-channel diversions: 20 decreed water rights, ranging in size from 5 to 1,800 cubic feet per second



[d] Recreation in Colorado's Water Plan includes boating, fishing, camping, wildlife viewing, and waterfowl hunting. Many other recreational activities in Colorado require water in some form, but are counted as part of other uses. The irrigation of sports fields, golf courses, and parks are primarily served by municipal water providers and are included as a municipal use. Likewise, skiing depends on snowmaking, and the water rights associated with this use are typically owned by resort operators. Therefore snowmaking is classified as an industrial use.

FIGURE 5-9 ILLUSTRATIVE CLIMATE-INFORMED ACTIONS IN RESPONSE TO CLIMATE-CHANGE EFFECTS ON THE AVAILABILITY OF SUITABLE HABITAT FOR COLD-WATER NATIVE TROUT[43]

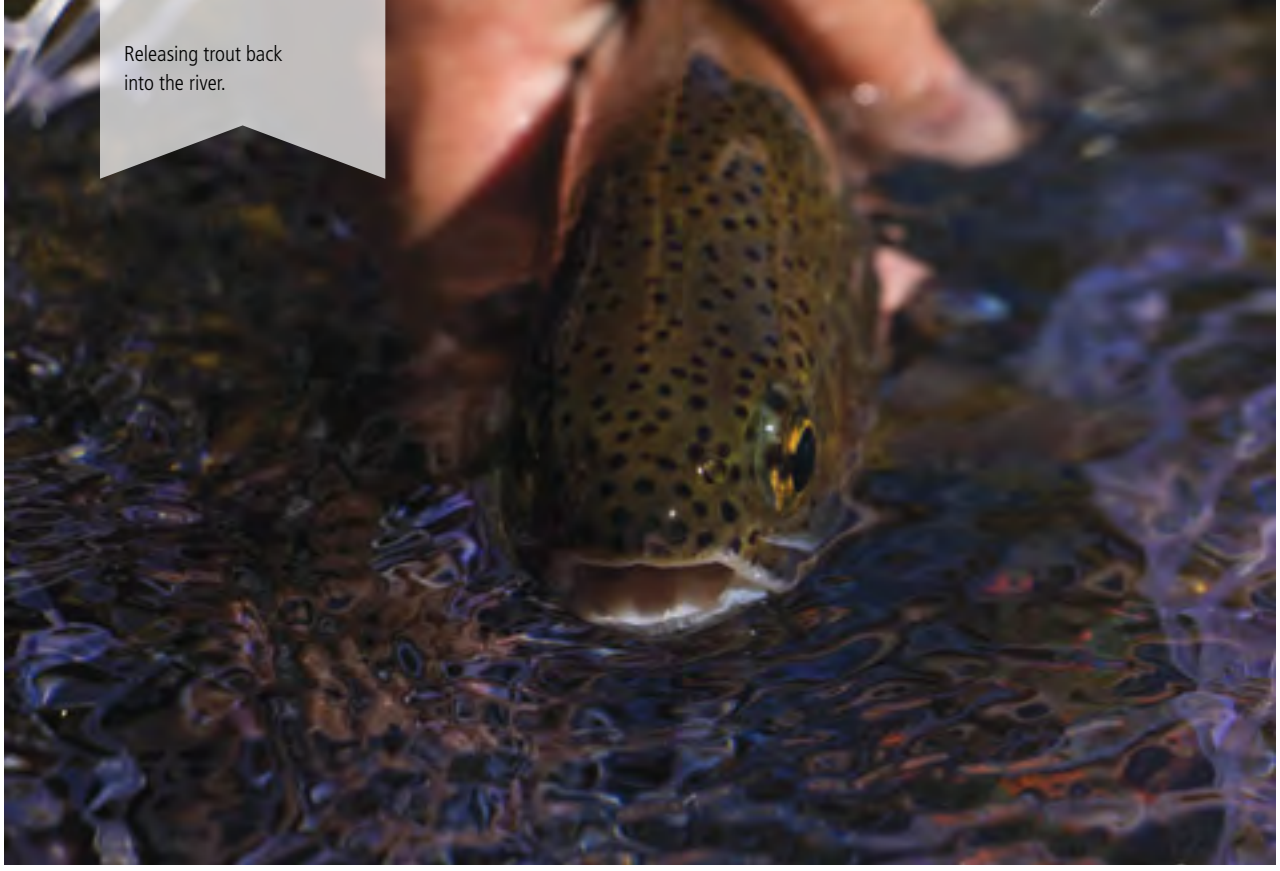


Environmental and recreational water needs often overlap. For example, the ability to keep a stream flowing can be beneficial for aquatic life as well as for anglers. Boulders and other structures that enhance boating experiences can also improve aquatic habitat for fish. In some cases, however, needs conflict—for example, conflicts arise when there are different optimal flow levels for rafting and fishing.

While identifying environmental and recreational attributes of importance is a necessary step to evaluating nonconsumptive needs, gaps, and potential projects and methods, a quantification of the amount of water required to support these attributes may be needed in some cases. Section 6.6 explores tools, projects, and methods to meet Colorado's environmental and recreational needs.

This document and the BIPs refer to the term "nonconsumptive," and use it to refer to environmental and recreational uses. However, environmental and recreational uses often consume water through evaporation or evapotranspiration. Both environmental and recreational uses involve keeping water in streams and designating water for those specific uses. Agricultural, municipal, and industrial water users downstream often reuse this water multiple times.

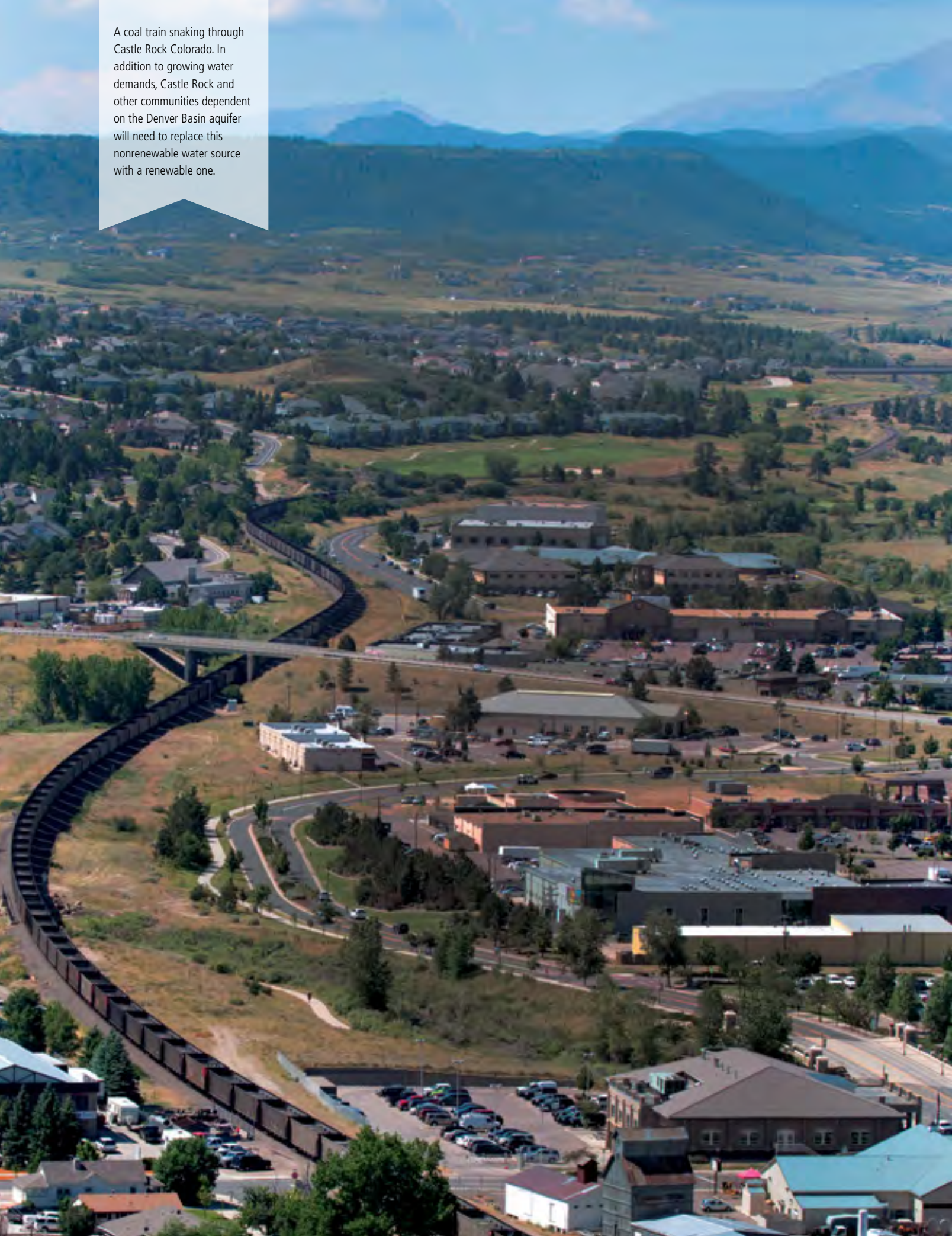
Climate change could affect environmental and recreational needs as well. Scientists expect that if temperatures continue to increase, the range of suitable habitat for cold-water fish species will diminish (Figure 5-9). Rising temperatures could also adversely affect plant communities.[40] Reduced water supplies due to increased evapotranspiration could also be a factor in maintaining the same range of cold-water species due to the lower capacity of reduced flows to dissipate heat.[41]



Releasing trout back into the river.

In addition to the tools mentioned above, various projects and methods—such as flow-maintenance agreements and habitat restoration—help meet environmental and recreational needs. As Figure 5-9 indicates, environmental, agricultural, and municipal partnerships, as well as mitigation measures, will be critical to maintaining existing cold-water fish reaches as functional habitats. Sections 6.6 and 9.2 list several examples of multipurpose projects. Below are a few multipurpose projects that meet multiple needs:

- Upper Arkansas Voluntary Flow Management Program,
- Alternative Wild and Scenic Processes (e.g., the Upper Colorado, Lower Colorado, and Dolores Rivers),
- Colorado River Cooperative Agreement,
- Elkhead Reservoir Enlargement,
- Rio Blanco River Restoration.



A coal train snaking through Castle Rock Colorado. In addition to growing water demands, Castle Rock and other communities dependent on the Denver Basin aquifer will need to replace this nonrenewable water source with a renewable one.

A LOOK AT HISTORY

Horsetooth Reservoir was completed in 1949 as a part of the Colorado-Big Thompson project to supply a growing Northern Colorado with water for municipal and irrigation uses.

CARL AND CURRAN TRICK, CONTINUED FROM PAGE 5-10

Carl's water resume is vast, in the past he was a CWCB member and the North Platte Representative for the IBCC. Currently he is a board member of the North Platte Basin Roundtable, Mountain Parks Electric, Tri State G&T, and the Jackson County Water Conservancy District. He also is the President of the Walden Reservoir Company.

Curran also ventured out from Colorado to attend Grinnell College in Iowa, where she was a member of the women's basketball team. After graduation Curran returned to the North Platte basin where she was also involved in the North Platte Basin Roundtable as their Recorder and Education Liaison. She then went on to Law School at University of Wyoming, where she received her J.D. in 2012.

Curran participated in the Colorado Foundation for Water Education's Water Leaders Program in 2008 and recently joined the firm of Lawrence Jones Custer Grasmick LLP to practice law in the area of Water Rights and Natural Resources Law. Here she is able to work on her goal of keeping agriculture viable in Colorado. Curran hopes to be involved in projects that give agriculture more flexible options than buy and dry, and will focus on representing conservancy districts and agricultural users to assist them with water issues.

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