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GUNNISON

Basin Implementation Plan

Basin Implementation Plan at a Glance

The Gunnison Basin Roundtable strives to protect existing water through balancing municipal, agricultural, environmental and recreational water needs.

KEY ACHIEVEMENTS

A wide variety of projects in the Gunnison BIP provided numerous benefits to agricultural, E&R, and municipal water uses.

Lower Gunnison Project

Reservoir Rehabilitation on the Grand Mesa

Upper Gunnison River Water Conservancy District Stream Management Plan project

Selenium Compliance in the Lower Gunnison

CHALLENGES

Gunnison Basin's unwavering goal and main challenge is protecting existing water uses.

Water users and water managers in the basin must address water demand from agriculture and growing communities while also maintaining sufficient flows for endangered species, water-based recreation, and hydropower generation for a range of climate-impacted scenarios.

OUTREACH STRATEGIES

The Education Action Plan supports Colorado Water Plan and Gunnison BIP goals and objectives to provide water education for current and future Coloradoans with a focus on Gunnison Basin topics.

GOALS + OBJECTIVES

The basin has 9 GOALS centered around:

- ✓ **Protecting existing water uses for agricultural land, environmental, and recreational uses**
- ✓ **Addressing agricultural and municipal and industrial water shortages**
- ✓ **Improving water quality while maintaining and modernizing critical water infrastructure**
- ✓ **Encouraging relationships among agricultural and environmental recreational water uses**
- ✓ **Continuing public education, outreach, and stewardship**

DEMAND, SUPPLY, POTENTIAL WATER NEEDS

Municipal and Industrial:
Population growth (by approximately 100,000 people) is the primary driver for the increased M&I demands across planning scenarios as per capita water use is projected to decrease for every scenario except Hot Growth.

Agriculture:
A warmer and drier future climate is projected to result in increased gaps. Diversion demands are expected to decrease in three of the five planning scenarios due to reduction in irrigated land from urbanization and the adoption of water-saving agricultural technologies.

Environment and Recreation:
Future E&R risks include riparian/wetland plants and fish habitat ecological impacts due to climate change. Identifying these risks helps facilitate discussions about projects or strategies that can be implemented to reduce the risks.

Water Supply and Storage:
While climate-impacted scenarios show lower amounts of water in storage during dry periods than non-climate-impacted scenarios, storage levels generally recover back to baseline levels after dry periods.

STRATEGIC VISION

Key strategies provide a roadmap for meeting basin goals.

These strategies include:

- **Implementing projects**
- **Leverage funding opportunities**
- **Expanding weather modification programs**
- **Improving infrastructure**
- **Protecting environmental and recreational values**
- **Preparing for climate change**

FUTURE PROJECTS

$1.3 billion
total estimated costs for project implementation*

453 **Total Projects**

133 **Tier 1 Projects**

168 **Multi-purpose Projects**

322 **Projects meet agricultural needs**

199 **Projects meet environmental and recreational needs**

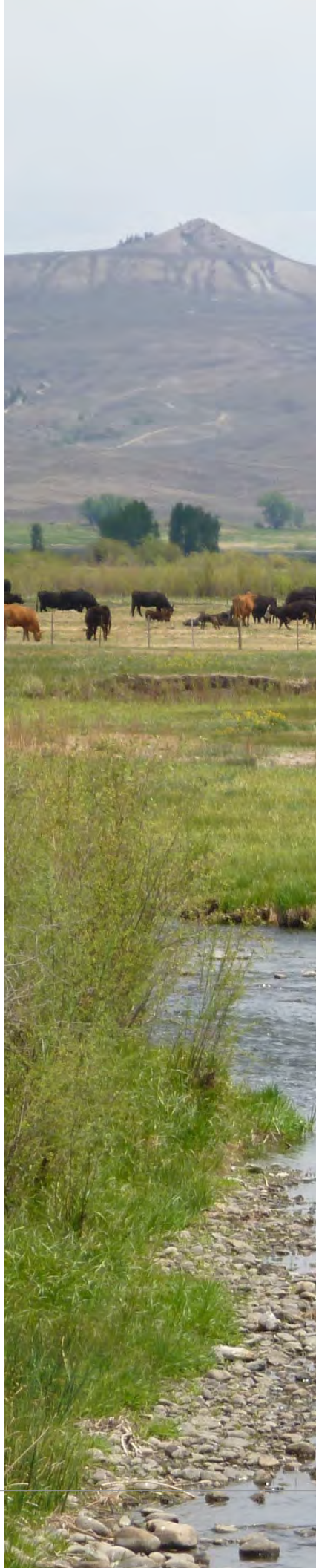
103 **Projects meet municipal and industrial needs**

** Total cost based on projects that provided cost information. Future basin projects include both consumptive and nonconsumptive projects that span all sectors of water use in the basin and are at various levels of development from conceptual to implementing.*

List of Roundtable Members

The Gunnison Basin Implementation Plan reflects the hard work, collaboration, and advice provided by the Gunnison Basin Roundtable members listed below. With much gratitude, a special thank you is extended to the Gunnison Basin Roundtable members who participated in the Gunnison Basin Implementation Plan Subcommittee, denoted with an asterisk:

- **Thomas Alvey* –** *North Fork Water Conservancy District*
- **Steve Anderson* –** *Agricultural Representative (Colorado Water Conservation Liaison)*
- **Bruce Bair –** *At-large Representative*
- **Mike Berry –** *Tri-County Water Conservation District (Recorder)*
- **Katie Birch –** *Colorado Parks and Wildlife (Liaison)*
- **Perry E Cabot –** *Colorado State University Extension (Liaison)*
- **Sonja Chavez* –** *At-large Representative*
- **Mike Cleary –** *Crawford Water Conservation District*
- **Kathleen Curry* –** *Saguache County Representative, Chair*
- **Cary Denison* –** *At-large Representative (Environmental)*
- **Allen Distel –** *Bostwick Park Water Conservation District*
- **Sharon Dunning –** *Assistant Recorder*
- **Joanne Fagan* –** *Ouray Municipalities and Interbasin Compact Committee Representative*
- **Steve Fletcher* –** *At-large Representative*
- **Ashley Hom –** *U.S. Forest Service (Liaison)*
- **Jonathan Houck* –** *Gunnison County*
- **Bob Hurford –** *Division of Water Resources (Liaison)*
- **John Justman* –** *Mesa County*
- **Jay Jutten –** *Montrose County*
- **Dave Kanzer* –** *Colorado River Water District*
- **Austin Keiser –** *Grand Mesa Water Conservation District, Vice-Chair*
- **Wendell Koontz –** *At-large Representative*
- **John McClow* –** *Legislative Appointment*
- **Chuck Mitisek –** *Ute Water Conservancy District*
- **Dan Murphy –** *Hinsdale Municipalities Representative*
- **Michael Murphy –** *Hinsdale County Representative*
- **Scott Murphy –** *Montrose Municipalities Representative*
- **Julie Nania* –** *Upper Gunnison River Water Conservation*
- **Bill Nesbitt* –** *Gunnison Municipalities Representative*
- **Jim Plumoff –** *Industrial Representative*
- **Bob Randall –** *Department of Natural Resources*
- **Mark Ritterbush –** *Mesa Municipalities Representative*
- **Mark Roeber –** *Delta County*
- **Neal Schwieterman –** *Recreation Representative*
- **Jedd Sondergard –** *Bureau of Land Management*
- **Sam Stein –** *CWCB Liaison*
- **Adam Turner –** *Local Domestic Water Provider*
- **Richard Udd –** *Delta Municipalities Representative*
- **Ryan Unterreiner –** *Colorado Parks and Wildlife (Liaison)*
- **Ed Warner –** *Bureau of Reclamation*
- **Marti Whitmore* –** *Ouray County Representative*



*Members of the Gunnison Basin Implementation Plan Subcommittee

Table of Contents

DISCLAIMER

The Analysis and Technical Update to the Colorado Water Plan and the Basin Implementation Plan (BIP) provide technical data and information regarding Colorado's and the basin's water resources. The technical data and information generated are intended to help inform decision making and planning regarding water resources at a statewide or basinwide planning level. The information made available is not intended to replace projections or analyses prepared by local entities for specific project or planning purposes.

The Colorado Water Conservation Board (CWCB) and basin roundtables intend for the Technical Update and the BIP to help promote and facilitate a better understanding of water supply and demand considerations; however, the datasets provided are from a snapshot in time and cannot reflect actual or exact conditions in any given basin or the State at any given time. While the Technical Update and BIP strive to reflect the CWCB's best estimates of future water supply and demands under various scenarios, the reliability of these estimates is affected by the availability and reliability of data and the current capabilities of data evaluation. Moreover, the Technical Update and BIP cannot incorporate the varied and complex legal and policy considerations that may be relevant and applicable to any particular basin or project; therefore, nothing in the Technical Update, BIP, or the associated Flow Tool or Costing Tool is intended for use in any administrative, judicial or other proceeding to evince or otherwise reflect the State of Colorado's or the CWCB's legal interpretations of state or federal law.

Furthermore, nothing in the Technical Update, BIP, Flow Tool, Costing Tool, or any subsequent reports generated from these datasets is intended to, nor should be construed so as to, interpret, diminish, or modify the rights, authorities, or obligations of the State of Colorado or the CWCB under state law, federal law, administrative rule, regulation, guideline or other administrative provision.

What is the Basin Implementation Plan?

The Basin Implementation Plan (BIP), developed in a collaborative process by basin stakeholders, focuses on the current and future water needs in the Gunnison Basin, the vision for how individuals and organizations can meet future needs, and the strategies and projects that provide a pathway to success. The initial Gunnison Basin Implementation Plan was completed in 2015, and this is the first update of that plan.

THE GUNNISON BASIN IMPLEMENTATION PLAN CONSISTS OF TWO VOLUMES:	
VOLUME 1:	A summary of the Gunnison Basin's current and future water resources, focusing on goals, projects, and a strategic vision to meet future water needs.
VOLUME 2:	A comprehensive analysis of four specific sectors of interest: climate change, watershed health, weather modification, and project implementation.

Section 1. Basin Overview

The Gunnison Basin encompasses 8,000 square miles in western Colorado extending from the continental divide to the confluence of the Gunnison and Colorado Rivers near Grand Junction. The Gunnison River is a major tributary of the Colorado River and contributes an average of one-fifth to one-sixth of the Colorado River Basin's total annual flow that leaves the state. Approximately 50 percent of the total Gunnison Basin is forest, and more than 80 percent is public lands. About 5.5 percent of the land is classified as planted or cultivated, and these lands are concentrated in the Uncompahgre River Valley between Montrose and Delta, with additional pockets of irrigated lands throughout the many tributary valleys. A map of the basin is shown on Figure 1.

Gunnison Basin stakeholders include a broad range of water users that support a diverse economic base. Along with several growing communities, the Gunnison Basin includes a strong agricultural heritage, rugged landscapes, and Gold Medal fisheries that attract large numbers of recreational tourists. Key future water management issues, as described in the Colorado Water Plan, include water shortages across sectors due to climate change, significant and increasing shortages in agricultural supplies, and increased impacts on environmental and recreational uses.

AGRICULTURE

- Agriculture is the principal consumptive use and accounts for 97 percent of water diversions.
- More than 250,000 acres are irrigated, which waters pastures, orchards, wine grapes, commodity grains, forage crops, and vegetables. Livestock production is an important economic driver, with numerous cow/calf operations using irrigated lands as an important base of operations. In fact, beef production accounts for more than $110 million in yearly economic output (2016 number).[1]

WATERSHED

- More than 70 percent of the land is federally managed and attracts large numbers of outdoor enthusiasts to the many national forests, parks, recreation areas, and conservation areas.
- The Gunnison Basin is home to the Black Canyon of the Gunnison National Park and Curecanti National Recreation Area, which are some of the top tourist destinations in the state.
- The Gunnison Gorge is a designated Gold Medal fishery, and many of the rivers and streams in the Basin meet or exceed Gold Medal fishery standards and are renowned as some of the State's most popular fishing destinations.
- Four federally endangered fish species have been documented in the lower Gunnison River, including the Humpback Chub, Bonytail, Colorado Pikeminnow, and Razorback Sucker. The basin is also home to the Colorado River Cutthroat Trout and Roundtail Chub, which are native fish considered to be of special concern due to declining habitat and populations.
- A recent study determined total economic contributions of water-related recreation activities were $461 million in 2019.[2]

[1] BBC Research and Consulting, ERO Resources, and Headwater Corporation. 2020. Upper Basin Demand Management Economic Study in Western Colorado. Available: https://www.coloradoriverdistrict.org/wp-content/uploads/2020/09/upper-basin-demand-management-economic-study-in-western-colorado_corrected-09272020.pdf

[2] Southwick Associates. 2020. Business for Water Stewardship: The Economic Contributions of Water-related Outdoor Recreation in Colorado. Available: https://businessforwater.org/wp-content/uploads/2020/06/Southwick-Technical-report-2020.pdf

MUNICIPAL AND INDUSTRIAL

- The largest cities are Montrose (pop. 14,153), Delta (pop. 7,827), and Gunnison (pop. 5,271).
- Hydroelectric power plants are located at the dams of the Blue Mesa, Morrow Point, and Crystal reservoirs. The three power plants have the capability to generate up to 208 megawatts of power. Additional hydropower capacity has been added within the Uncompahgre Valley Water Users Associations (UVWUA) and Ridgway Reservoir system in recent years.

COMPACTS AND ADMINISTRATION

- Three reservoirs in the basin–Blue Mesa, Morrow Point, and Crystal–comprise the Aspinall Unit of the Colorado River Storage Project Act (CRSPA). CRSPA reservoirs were constructed to regulate the flow of the Colorado River, store water for beneficial use, enable the Upper Colorado River Basin states to develop their Colorado River Compact apportionments, and generate hydroelectric power as an incident to those purposes.
- There are several environmental flow requirements, including a minimum instream flow on the Gunnison River through the Black Canyon of the Gunnison of 300 cubic feet per second together with an annual peak flow, as well as a reoperation of the Aspinall Unit to provide reservoir releases to meet peak flow targets to improve critical habitat for four endangered fish species in the Colorado and Gunnison Rivers.
- On average, the Gunnison Basin contributes 1.84 million acre-feet at the confluence with the Colorado River, which is approximately one-sixth of the flow of the Colorado River Basin.[3]

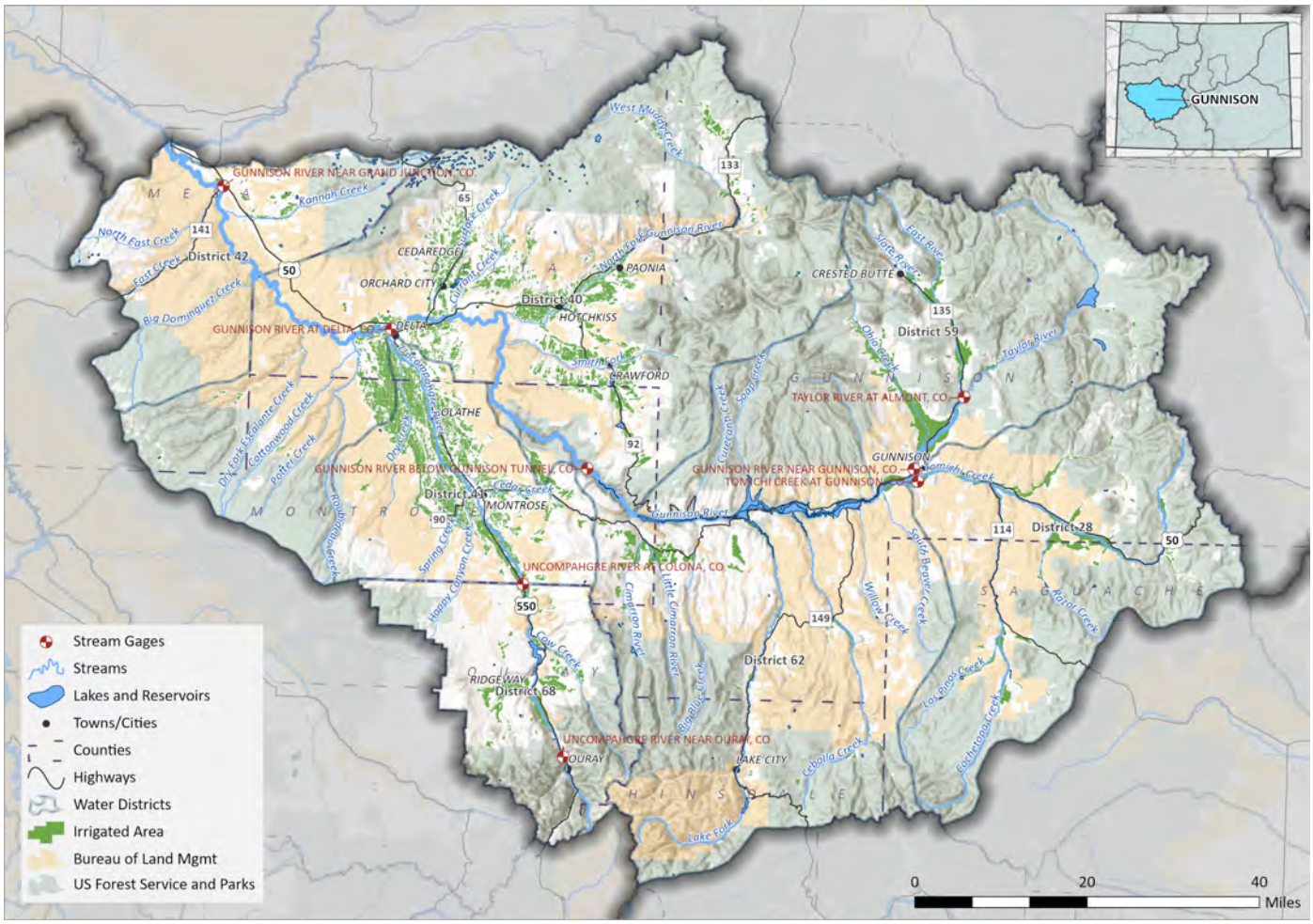


Figure 1. Map of the Basin

[3] The Gunnison Basin Roundtable. 2013. The Gunnison River Basin: A Handbook for Inhabitants. Available: https://www.coloradomesa.edu/water-center/documents/Gunnison_Basin_Special_2013.pdf

Section 2. Basin Challenges

Protecting existing water uses is the unwavering goal and main challenge in the Gunnison Basin. Water users and managers must address how to use the limited water resources to maintain agriculture while providing water for growing municipalities and meeting nonconsumptive needs like environmental, recreation, and hydropower. Stretching water supplies to meet multiple needs will be made more difficult by climate change.

KEY CHALLENGE

In the Gunnison Basin, water users and managers will need to address water demand from agriculture and growing communities while also maintaining sufficient flows for endangered species, water-based recreation, and hydropower generation for a range of climate-impacted scenarios.

Table 1. Key Future Water Management Issues and Challenges

AGRICULTURE	WATERSHED	MUNICIPAL AND INDUSTRIAL	COMPACTS AND ADMINISTRATION
• Addressing agricultural water shortages across the basin is a significant challenge. • Lack of financial resources for new infrastructure projects and rehabilitation of aging infrastructure is a major barrier to improved water management. • Loss of productive agricultural land to other uses remains a concern in many areas. • Increases in agricultural water demand will occur in a warmer and drier climate. • Hydrologic variability and drought continue to impact agricultural producers. • Climate-driven change adds risk to agricultural development. • Tourism is important in the headwaters, but agriculture is dominant in the Uncompahgre Valley. A rapid influx of retirees and growth in the Uncompahgre Valley may dramatically change land uses in the area.	• Regulatory drivers associated with the Endangered Species Act and the Clean Water Act create a complex set of environmental issues related to water quality, water quantity, and associated impacts to fish and wildlife habitat. • There is a need for better watershed health-management tools to mitigate wildfire risk and sedimentation in streams. • Environmental and recreational flows may be met less often in climate-impacted scenarios, especially in reaches with increased consumptive needs. • Protecting existing supply infrastructure after wildfire is a concern that has not been adequately addressed. • A need for higher-elevation storage may increase with climate change and require more natural solutions.	• Population growth in the headwater regions will require additional water management strategies. • Development of irrigated lands around urban areas will continue in all planning scenarios. There are legal and administrative challenges to using water from the converted agricultural lands to fill municipal gaps. • Climate-driven changes to hydrology may impact the reliability or resiliency of historical municipal supplies.	• Successfully resolving endangered species issues on the Colorado River and meeting environmental needs in a manner that does not adversely impact existing uses remains a challenge. • The outcome of Colorado River Compact negotiations will have an impact on the Gunnison Basin. Protecting post-compact uses is a major concern.

Section 3. Achievements

The Gunnison Basin Roundtable (BRT), one of nine roundtables within the state, has been engaged in a wide variety of projects and activities since the Gunnison BIP was issued in 2015. The ongoing and completed projects have achieved results that further the goals of the Gunnison BRT and provided numerous benefits to agricultural, environmental, recreational, and municipal water users. Several of these achievements are summarized in this section (listed alphabetically).

Lower Gunnison Project: Water Quality Improvements and Water Conservation

A series of projects are underway in the Lower Gunnison Basin to improve water quality and advance water conservation. The Lower Gunnison Project, led by the Colorado River District, achieved a significant milestone in 2021 with the completion of a 4-year contract to support construction of eight large-scale irrigation water conveyance projects and installation of on-farm high-efficiency irrigation water management systems on approximately 400 acres, along with water monitoring and control technology.

The contract includes $8 million in funds from the U.S. Department of Agriculture's National Resources Conservation Service (NRCS) and an additional $10 million of U.S. Bureau of Reclamation funding. Accomplishments thus far include the installation of approximately 52,000 feet of pipelines, an in-line regulation facility, and the upgrading of environmentally sensitive diversion headwork structures across four focus areas of the Lower Gunnison Basin (Bostwick Park, Crawford Country, North Fork Basin, and Uncompahgre). Together, these project components keep an estimated 15,000 tons of salt and 700 pounds of selenium out of the Colorado River system on an annual basis and conserve approximately 3,500 acre-feet (AF) of water per year.

PROJECT PROPONENTS: While this project is supported by more than 20 proponents, the Colorado River District is the lead agency. Formed in 1937, the Colorado River District strives to be a leader in the protection, conservation, use, and development of the water resources of the Colorado River Basin for the welfare of the District.

TIMELINE: Multi-year project that began in 2017

COST: $40 million (in progress)

Selenium Water Quality Compliance in the Lower Gunnison

The Lower Gunnison River is now in compliance with the Clean Water Act. Twenty-two years after it was first listed as an impaired water body by the State of Colorado's Water Quality Control Commission and after decades of concerted, cooperative efforts by a diverse consortium of dedicated stakeholders, 66 miles of the mainstem Gunnison River was removed in May of 2021 from the list of impaired waters by dissolved selenium under the aquatic use chronic standard.

A long-term United States Geological Survey water quality dataset and associated trend analyses clearly indicates that the best management practices implemented by irrigators, farmers, ranchers, municipalities, and other water users have significantly reduced selenium loading to the Gunnison and Colorado Rivers. A recently published study estimates that more than 6,600 pounds per year of selenium has been controlled since 1995.[4] With continued management and best management practices implementation, this declining trend is projected to continue.

After the State of Colorado's public action, the Gunnison River is now in full compliance with the Clean Water Act, which helps ensure that future water development can continue and discharge permits may once again be issued.

PROJECT PROPONENTS: Selenium Management Program participants

TIMELINE: Multi-year project that began in 1998

COST: $200,000 per year on average

[4] USGS. 2020. Assessment of dissolved selenium concentrations and loads in the Lower Gunnison River Basin, Colorado, as part of the Selenium Management Program. Open File Report 2020-1078 Available: https://pubs.er.usgs.gov/publication/ofr20201078

Upper Gunnison River Watershed and Stream Management Planning Project

A watershed and stream management planning effort will help improve water security in the Upper Gunnison Basin. In 2017, the Upper Gunnison River Water Conservancy District began a multi-year watershed and stream management planning effort. The intent is to improve water security by first identifying current and future needs in the Upper Gunnison Basin in the face of increasing water demand and climate uncertainty. To date, extensive stakeholder outreach and planning has been completed in the Ohio Creek, Lake Fork, and East River subwatersheds (Phase 1). Phase 2 assessments are underway in the Cebolla and Tomichi Creeks, Taylor River, and Gunnison River mainstem subwatershed. This effort has resulted in the ability to target projects at a landscape, delivery system, or reach level to maximize natural resource benefits. The Gunnison River Improvement Project exemplifies this strategy: the project seeks to eliminate gravel channel push-up dams and incorporate improvements to irrigation diversion infrastructure to restore the channel and fishery, improve irrigation water management, and protect critical wet meadow mesic habitat for Gunnison sage-grouse.[5]

PROJECT PROPONENTS: Established in 1959, the Upper Gunnison River Water Conservancy District strives to be an active leader in issues affecting the water resources of the Upper Gunnison Basin.

TIMELINE: Multi-year project that began in 2017

[5] More information can be found at the Upper Gunnison River Conservancy District website: https://ugrwcd.org/about/

Water Infrastructure Rehabilitation on the Grand Mesa

Several water infrastructure improvements will allow small reservoirs to remain in compliance with Colorado Dam Safety Engineers standards.
The Grand Mesa is the only water source for Surface Creek Valley in Delta County. The Mesa reaches an elevation of more than 10,000 feet and is home to more than 100 reservoirs of various sizes. All but five of these reservoirs are privately held by the Grand Mesa Water Conservancy District. Since these reservoirs are small and cover a wide area, management and administration is the responsibility of the Grand Mesa Water Users Association, which is a private company that is supported by all the owners of the structures and water. The availability of grants through the Colorado Water Conservation Board (CWCB) is critical for the owners to maintain these small reservoirs to the standards of the Colorado Dam Safety Engineers. Over the past years, there have been many projects that received funding from CWCB, such as the Blanch Park Reservoir rehabilitation and Granby 5-11 Reservoir outlet pipe repairs. State funding has played a significant role in assisting the broad spectrum of owners with grants that enable these projects to move forward.

PROJECT PROPONENTS:
Grand Mesa Water Users Association is a private company with the goal of administering, preserving, protecting, and defending the water rights of its members.

TIMELINE: Multiple projects are included in this summary with varying timelines and costs. All projects have been funded in part through the CWCB grant program.

Section 4. Updated Goals and Objectives

Each of the nine BRTs across Colorado developed goals and strategies or actions to achieve their goals during the development of their 2015 BIPs. The structure and naming convention of goals, objectives, strategies, and actions slightly vary across roundtables, but they all include a discrete set of high-level targets (described as goals and/or themes) with supporting objectives, actions, strategies, or processes that will help the stakeholders achieve their basin targets.

The Gunnison BRT developed goals that are consistent with the goals of the Colorado Water Plan and seek to promote a healthy and diverse economy into the future. Nine basin goals were identified. Of the nine, one goal–protect and maintain existing water uses in the Gunnison Basin–is primary. The other eight goals support this primary goal.

The Gunnison BRT's overarching goal is to protect and maintain existing water uses in the Basin in a larger effort to ensure a healthy and diverse economy into the future.

BASIN GOALS

- **Protect existing water uses in the Gunnison Basin**
- **Discourage the conversion of productive agricultural land to all other uses within the context of private property rights**
- **Improve agricultural water supplies to reduce shortages**
- **Identify and address municipal and industrial water shortages**
- **Quantify and protect environmental and recreational uses**
- **Maintain or, where necessary, improve water quality throughout the Gunnison Basin**
- **Describe and encourage relationships among agricultural and environmental recreational water uses**
- **Restore, maintain, and modernize critical water infrastructure**
- **Create and maintain active, relevant, and comprehensive public education, outreach, and stewardship processes involving water resources in the six sectors of the Gunnison Basin**

Protect existing water uses in the Gunnison Basin

This goal reflects the agreement among Gunnison Basin inhabitants that the existing water uses for agricultural, municipal, industrial, environmental, and recreational purposes throughout the basin should be protected. This mix of existing uses includes both decreed and non-decreed water use. Fundamental to this goal is the preservation of the agricultural base, as aspects of agricultural water use impact environmental and recreational uses as well as municipal and industrial uses. It is important to note that existing uses are not constant from year to year and may be even more variable with a changing climate. As such, achievement of this goal includes a process for assessing water supply impacts under different scenarios.

KEY COMPONENTS

- Continue to emphasize maintaining the highest possible baseline of irrigation as certain areas urbanize. Some irrigated land will be lost to urbanization. As much as possible, that urbanization should take place while acknowledging the value of the underlying water rights and transferring those rights to other uses within the Gunnison Basin. Where possible, urban development should be encouraged on less-productive soils.
- Continue to emphasize maintaining and improving existing infrastructure to avoid the loss of water rights to involuntary abandonment or loss of water availability in response to infrastructure deterioration.
- Continue to maintain water supply for environmental and recreational uses.
- The Gunnison Basin is increasingly a water-short basin. Consumptive uses may impact instream environmental and recreational uses; diversions may reduce water availability and alter stream temperatures, while return flows may enhance flows during certain times of the year. The Gunnison BRT must increasingly endeavor to understand the relationships among water use sectors.

Discourage the conversion of productive agricultural land to all other uses within the context of private property rights

The Gunnison BRT strongly opposes the dry-up of agricultural land in Gunnison Basin; however, the Gunnison BRT also recognizes the importance of private property rights in the successful operation of Colorado's long-standing water rights system. Therefore, the Gunnison BRT is committed to encouraging the preservation of agriculture through effective voluntary means. This includes conservation easements and other efforts through heritage-protection organizations. Future education efforts of the Gunnison BRT (Goal 9) may also focus on encouraging the preservation of agricultural land.

KEY COMPONENTS

- Maintain productive and profitable agriculture as an important component of discouraging conversion of agricultural land to other uses. Address irrigation water supply issues, including infrastructure improvement, as a means of keeping production costs competitive with other regions. Create the water supply certainty necessary for continued agricultural investment through work on storage and Colorado River Compact issues.
- Periodically invite qualified experts and decision makers to the Gunnison BRT to discuss their work on issues like land conservation, high-value crop production, and other topics that have a nexus between water use and the agricultural economy.

3 Improve agricultural water supplies to reduce shortages

While it is common for many agricultural areas in Colorado to be seasonally or periodically water-short, these shortages represent an opportunity for improvement. This goal focuses on identifying chronic shortages and the potential projects that would increase or improve agricultural supplies, and on identifying agricultural water shortages. Successfully achieving this goal will result in increased agricultural efficiency, repairs to aging infrastructure, and improved delivery of agricultural water supplies within the basin.

KEY COMPONENTS

- Reduce basinwide agricultural shortages by developing projects that increase agricultural efficiency, repair aging infrastructure, and/or improve supplies.
- Continue inventory of irrigation infrastructure projects similar to what has been completed in the North Fork of the Gunnison and in the Upper Gunnison.

4 Identify and address municipal and industrial water shortages

As the Gunnison Basin continues to grow, its municipal and industrial water needs must be identified and addressed. Though the Gunnison Basin has a relatively small population, it is projected to grow from approximately 100,000 to between 120,000 and 200,000 people in the low- and high-growth growth projections, respectively, which is an increase in population of 19 percent to 99 percent (see Section 5). This goal focuses on identifying specific locations where municipal and industrial water shortages currently exist or will exist in the future, and identifying ways to address those water shortages. The identification or development of projects and water conservation plans are important components of meeting municipal and industrial demand.

KEY COMPONENTS

- Reliably meet 100 percent of essential municipal and industrial water provider system demands through the year 2050 and beyond.
- Support projects to update water conservation, landscaping, and building codes to require increased water conservation and efficiency for municipal development.
- Support flexible water use mechanisms to help meet growing municipal and industrial (M&I) demand while protecting other uses.

5 Quantify and protect environmental and recreational uses

Environmental and recreational water uses are critical to the economy and way of life in the Gunnison Basin. Work related to this goal will continue to identify specific locations where environmental and recreational needs are unmet and recommend site-specific solutions in collaboration with local water users. Segments that are identified as having unmet need will be prioritized using multiple metrics, such as analyses of instream flow water rights and/or analyses of economic impacts of environmental and recreational focus segments. Solutions that meet multiple objectives (e.g., consumptive, environmental, and recreational) will be encouraged. The Gunnison BRT will also continue to support existing environmental and recreational efforts, such as the work of local watershed groups.

KEY COMPONENTS

- Continue to meet identified environmental and recreational needs basinwide by developing 10 projects from the list of projects in the Gunnison BIP by the year 2030.
- Implement the Environmental and Recreational Project Identification and Inventory projects from the list of projects in the Gunnison BIP by 2030.
- Improve the current baseline of native trout and endangered fish populations in the Gunnison Basin through the year 2050.
- Continue to identify and quantify environmental/recreational needs throughout the Gunnison Basin.

6 Maintain or, where necessary, improve water quality throughout the Gunnison Basin

The Gunnison Basin has a wide range of water quality and corresponding issues. Most tributaries in the headwaters have excellent water quality with the exception of mining impacts in some locations. Lower in the basin, the Mancos Shale soils of the Uncompahgre Valley have resulted in selenium water quality impacts that exceed state standards. To minimize the leaching of selenium from soils, impacts are being addressed by various projects sponsored by the Uncompahgre Valley Water Users Association, U. S. Bureau of Reclamation, and the Colorado River Water Conservation District. Salinity (aka dissolved solids) is also an issue in lower reaches of the Gunnison Basin as addressed by the Colorado River Basin Salinity Control Act of 1974 that authorized the planning and construction of salinity-control projects.

KEY COMPONENTS

- Compliance with all applicable state and federal water quality standards.
- As determined by ongoing water quality data collection, maintain outstanding water quality in headwaters streams and improve site-specific water quality related to mining, hydraulic fracturing, selenium, and salinity.
- Safe Drinking Water: 100 percent of existing direct use and conveyance use reservoirs attain the applicable standards that protect the water supply use classification.

7 Describe and encourage relationships among agricultural and environmental recreational water uses

The relationship among agricultural water use and environmental and recreational water uses is complex. Previous discussions between the Gunnison BRT and Interbasin Compact Committee have noted the beneficial effects that the extensive agricultural water uses in the Gunnison Basin have on recreational uses and the environment. Reservoir releases may provide additional flows for recreation and the environment and can help mitigate stream temperature issues in distinct locations. Delayed irrigation return flows and the irrigation water stored in the soil provide a benefit to streamflows, particularly in the fall during the latter part of the water year. At the same time, diversions may impact environmental and recreational uses. Diversions may reduce the volume of water in streams, and thus reduce habitat for fish and other wildlife. Lower flows and warmer return flows can contribute to elevated stream temperatures and impact water quality. Instream flows can help maintain stream ecosystems while providing riparian habitat for a range of species and help minimize potential Endangered Species Act concerns. Environmental and recreational flows support river-based recreation and translate into substantial economic value. Work related to this goal will continue to identify locations in the Gunnison Basin where agricultural and recreational and environmental water use are mutually beneficial or can be improved to address quality and quantity issues. Multi-purpose water projects, including watershed restoration projects, will be encouraged to meet this goal.

KEY COMPONENTS

- Complete multi-purpose water projects where possible, including two storage projects and two watershed restoration projects, in the Gunnison Basin by 2030 that demonstrate the beneficial relationship among agricultural, environmental, and recreational uses.
- Explore where watershed restoration techniques, such as wet meadow and flood plain restoration, can be used to address water quality and quantity issues that support both agriculture and environmental and recreational uses.

8 Restore, maintain, and modernize critical water infrastructure

To preserve critical existing water rights and use, current infrastructure in the Gunnison Basin must be restored, maintained, and modernized. It is particularly important to preserve infrastructure that enables the use of water rights that predate the Colorado River Compact. Infrastructure maintenance is an efficient and prudent option to preserve existing uses. Furthermore, in many cases, restoration or modernization efforts serve to address multiple purposes, such as improved diversion reliability and accuracy, the addition of hydropower generation, and improved fish and boat passage. The Gunnison BRT and Colorado Water Plan encourage multi-purpose projects where feasible. These projects include not only those benefiting agricultural and environmental or recreational uses, but municipal uses as well.

KEY COMPONENTS

- Implement at least one project every year in the Gunnison Basin that focuses on the restoration, maintenance, and modernization of existing water infrastructure.

9 Create and maintain active, relevant, and comprehensive public education, outreach, and stewardship processes involving water resources in the six sectors of the Gunnison Basin

The Gunnison BRT seeks to further educate and involve the people of the Gunnison Basin in their role in their water future. The Gunnison BRT has formed a Gunnison Basin Education and Outreach Committee (GBEOC) made up of representatives from the six sectors, incorporating where possible representation from existing organizations with education missions (e.g., watershed groups, conservancies, and public schools, among others). To the greatest extent possible, the GBEOC education, outreach, and stewardship programs will involve active engagement with the water resources rather than passive education to help promote increasing public understanding and participation in important water issues in the basin, state, and region.

KEY COMPONENTS

- By 2030, representatives from the Gunnison BRT will work with local water organizations to provide educational materials and serve as a resource for county commissioner boards, city councils, and related planning staff regarding local water supply and land development issues.
- By 2030, all public schools in the Gunnison Basin (approximately 30) will have water education programs in place with some degree of coordination and oversight by the Gunnison BRT Education Coordinator.

Section 5. Demand, Supply, and Potential Water Needs

Water in the Basin

The average annual flow of the Gunnison River near Grand Junction is approximately 1.84 million acre-feet. National forest lands comprise the headwaters for the entire Gunnison Basin. Snow accumulates in the Grand Mesa, Uncompahgre, and Gunnison National Forests and produces the runoff that provides much of the water for the Gunnison Basin. Approximately 90 percent of the precipitation over the Gunnison Basin comes in the form of snow "stored" in the winter snowpack above 8,000 feet, which melts and flows downstream during the months of May and June[6]. The remainder of precipitation comes in the form of rain throughout the rest of the year, most frequently through summer thunderstorms.

Planning Scenarios

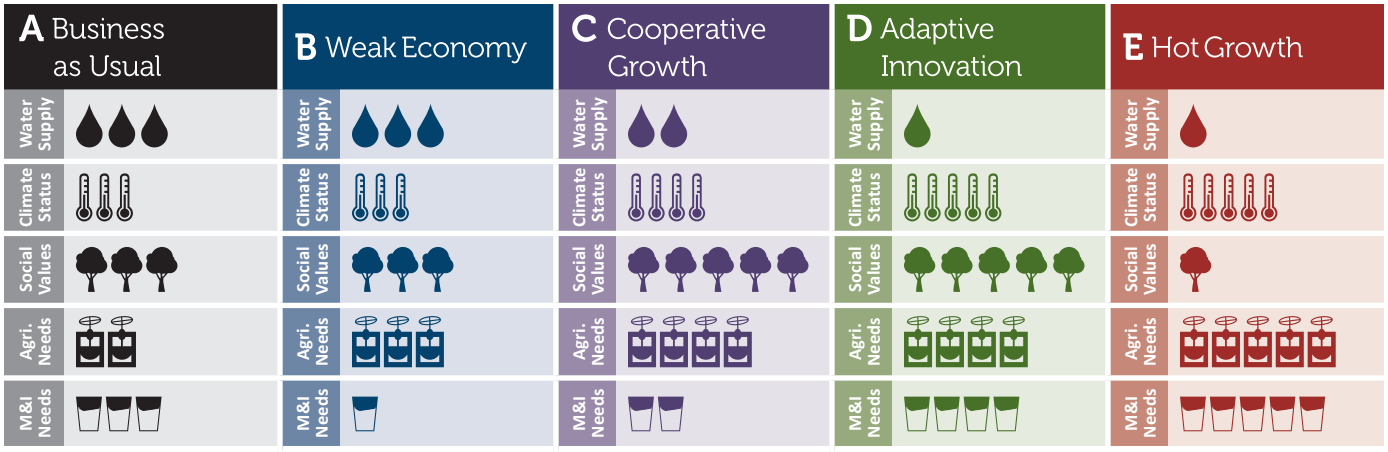
The Analysis and Technical Update to the Colorado Water Plan (Technical Update) published in 2019 quantified the current and potential future water demands, supplies, and additional water needs under five alternative future scenarios. A key enhancement to Colorado's water planning processes has been the incorporation of scenario planning. The Colorado Water Plan identified five different but plausible future conditions for the year 2050. The scenarios each consider several water resources drivers and how the drivers may change. The drivers included population, urban land use, climate change, industrial water needs, agricultural conditions, and adoption of municipal and agricultural water conservation measures.

Water demands, supplies, and potential future water needs were quantified in the Technical Update and are described in Section 4.5 of the Update. The analyses in the Technical Update were enhanced with new data during the BIP update. This section summarizes demands, supplies, and potential water needs based on the new input data.

[6] The Gunnison Basin Roundtable. 2013. The Gunnison River Basin: A Handbook for Inhabitants. Available: https://www.coloradomesa.edu/water-center/documents/Gunnison_Basin_Special_2013.pdf

Potential future water needs, aka gaps, were estimated for each planning scenario. Gaps are a characterization of the potential risk that water supplies will not be adequate to meet future demand.

The graphic below provides a brief overview of the drivers and the scenarios. Refer to the Technical Update, Sections 2.1.3 and 2.1.4, for more details on the scenarios and drivers (**https://cwcb.colorado.gov/colorado-water-plan/technical-update-to-the-plan**).



A Business as Usual

- Population growth increases at trends predicted by the State Demography Office (SDO).
- Future hydrology, per capita water demands and adoption of conservation measures are similar to what has recently occurred.

B Weak Economy

- The world's economy slows, and the state's population growth is less than predicted.
- Hydrology is similar to recent patterns.
- This scenario puts the least amount of stress on future water supplies and is a bookend for scenarios.

C Cooperative Growth

- Statewide population is similar to SDO predictions but is distributed differently across the state.
- Climate is moderately warmer, and irrigation demands increase.
- People seek to mitigate increased demands by more aggressively adopting water conservation.

D Adaptive Innovation / **E Hot Growth**

- Both scenarios assume that population growth is higher than projected and both assume a much warmer and drier future climate.
- The scenarios' primary differences revolve around conservation. In the Adaptive Innovation scenario, the state aggressively adopts conservation measures in both municipal and agricultural sectors. In the Hot Growth scenario, conservation is not a focus.

THE FUTURE WATER CONDITIONS DESCRIBED FOR THE GUNNISON BASIN WILL BE IN THE CONTEXT OF THE FIVE PLANNING SCENARIOS.

Refinements to Technical Update Modeling

During the BIP update process, some basins identified enhancements to the Technical Update data, modeling, and analyses. Enhancements included incorporating better municipal water use data, updating operating protocols for basin storage facilities, and revising potential future industrial water demands.

For the Gunnison BRT, the revisions were primarily associated with Taylor Park Reservoir operations and demands at Redlands Canal. An amended decree for Taylor Park Reservoir was signed on November 2, 2020, that altered how the reservoir operates under drought conditions. This information was used to develop more representative storage targets and release targets for each scenario. Additionally, based on conversations with the Division of Water Resources Division 4 office, the model was revised to better represent the interaction between UVWUA's water in Taylor Park and Blue Mesa Reservoir. These two revisions to Taylor Park Reservoir operations had the effect of increasing the stored water in Taylor Park.

The Redlands Canal diverts water for both irrigation and power generation. Based on local input, the total Redlands Canal demand and the split between the power demand (approximately 96 percent) and the irrigation demand (approximately 4 percent) were revised in both the Gunnison and Colorado Basins.

Lastly, during review of the Gunnison water allocation model, it was noted that the Gunnison Whitewater Course recreational in-channel diversion (RICD) was at the wrong location in the model. The RICD model location was moved upstream to the correct location during the revision effort.

Note that the Gunnison Basin benefits from the delivery of a small amount of imported transbasin supplies from the Colorado River and Southwest Basins. Revisions to these source basins did not impact the transbasin imports associated with these deliveries; the information presented in the Technical Update for this aspect remains unchanged.

Additional information on the refinements to the Technical Update modeling is provided in Appendix A to Volume 2 of the Gunnison BIP.

Municipal and Industrial Demands

POPULATION PROJECTIONS

Approximately 100,000 people currently reside in the Gunnison Basin, or 2 percent of the statewide population. By the year 2050, the population is projected to grow to between 120,000 and 200,000 in the low- and high-growth projections, respectively, which is an increase of 19 percent to 99 percent. Table 2 shows how population is projected to vary across the planning scenarios. Population estimates are based on State Demography Office (SDO) projections, with upward or downward adjustments based on the scenario description.

DEMANDS

Current and future diversion demands for M&I water users are driven by population and water usage rates. Model refinements did not impact the M&I demand in the basin. The following are observations on M&I demand (also see Table 2):

- Systemwide per capita use rates are projected to decrease relative to the baseline in all scenarios except Hot Growth.
- Municipal demands are expected to grow from approximately 16,200 acre-feet per year (AFY) in 2015 to between 17,900 AFY and 31,900 AFY in 2050.
- Industrial demand is expected to grow from 900 AFY in 2015 to between 1,200 AFY and 2,220 AFY in 2050. Figure 2 shows the projected M&I demands plotted against projected population under the five planning scenarios.
- Population increases are the primary driver for the increased M&I demands across planning scenarios, as per capital water use is projected to decrease for every scenario except Hot Growt.

GAPS

Current and projected M&I water demands were evaluated against available water supplies in the various planning scenarios using the Colorado Decision Support System (CDSS) modeling tools. Gaps are defined as periods when demand exceeds physically and legally available water supplies. Table 2 shows both the average annual gap and the maximum annual gap. Figure 3 shows the maximum annual gap and the M&I demand, and Figure 4 shows projected annual M&I gaps expressed as a percent of demand for each planning scenario. The following are observations on the M&I gaps:

- While the model refinements did not impact the M&I demands in the Gunnison Basin, they did result in a slight reduction to the M&I gap. The revised reservoir operations led to an increase in water availability to municipal entities, which led to a reduction in the overall M&I gap in the basin across the planning scenarios.
- The maximum M&I gap for the five planning scenarios is projected to range from 800 AFY to 8,700 AFY in 2050.
- M&I gaps vary by scenario but are higher in climate-change scenarios as shown in Table 2 and Figure 3.
- While M&I gaps are projected to be relatively steady, they are estimated to increase during drought conditions especially during the Hot Growth scenario as shown on Figure 4.

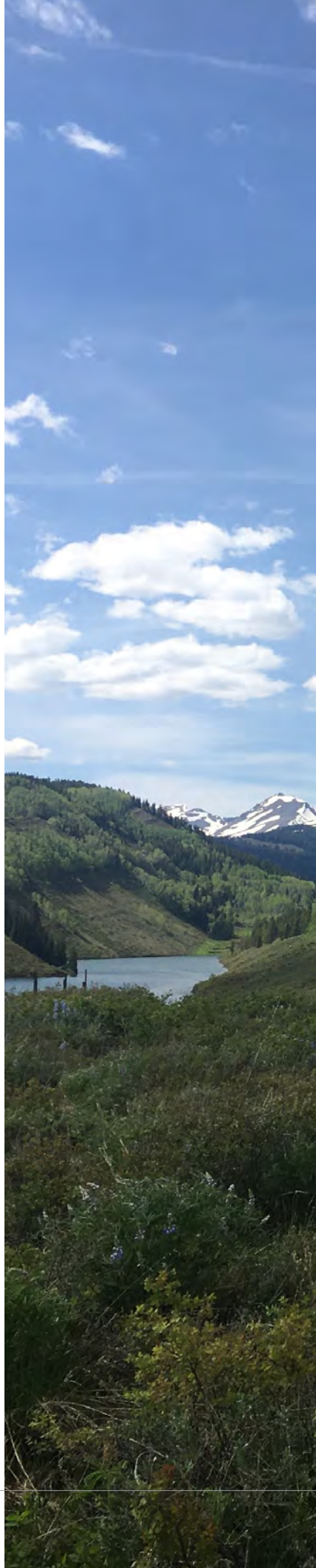


Table 2. Summary of Baseline and 2050 Projected Municipal and Industrial Water Demands and Gaps

	Baseline[1]	Business as Usual	Weak Economy	Cooperative Growth	Adaptive Innovation	Hot Growth
Population	103,100	162,600	123,100	158,600	196,000	204,900
Systemwide Per Capita Demands (gallons per capita per day) [1]	158	146	149	140	133	160
Municipal Diversion Demand (AFY) [2]	16,200	23,200	17,900	21,600	25,100	31,900
Industrial Diversion Demand (AFY) [2]	900	1,600	1,200	1,300	1,300	2,200
Total M&I Diversion Demand (AFY) [2]	17,000	24,800	19,100	22,900	26,400	34,100
Average Annual Gap (AFY)	0[3]	1,000	200	1,100	2,200	4,800
Maximum Annual Gap (AF)	0[3]	2,500	800	2,800	3,300	8,700

[1]*Baseline year is 2015.*

[2]*M&I demands may vary slightly from the M&I Demand section of the Technical Update (Section 4.5.4) due to differences in geographic distribution of demand for counties that lie in multiple basins.*

[3]*CDSS water allocation model in Gunnison Basin calculates small baseline M&I gaps, but they are either due to calibration issues or they are reflective of infrequent, dry-year shortages that are typically managed with temporary demand reductions, such as watering restrictions.*

Calculation methodologies and assumptions for M&I water demands are available in the Technical Update documentation.

https://cwcb.colorado.gov/colorado-water-plan/technical-update-to-the-plan

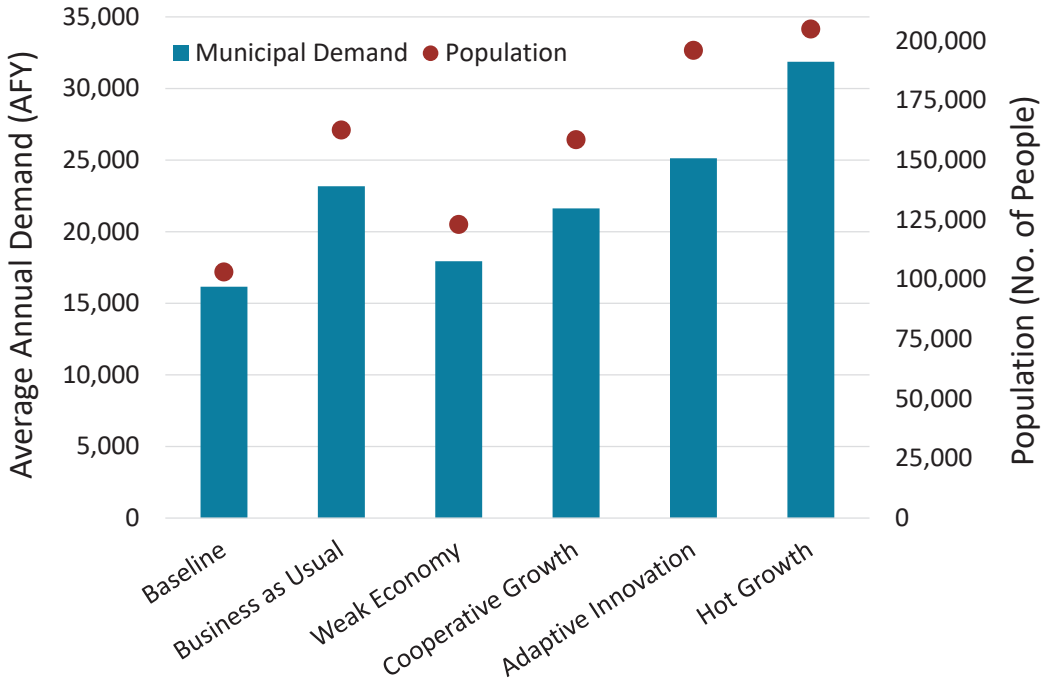


Figure 2. Baseline and 2050 Projected Population and Municipal Demand

Figure 3. Baseline and 2050 Projected Maximum Annual M&I Demand Met and Gaps

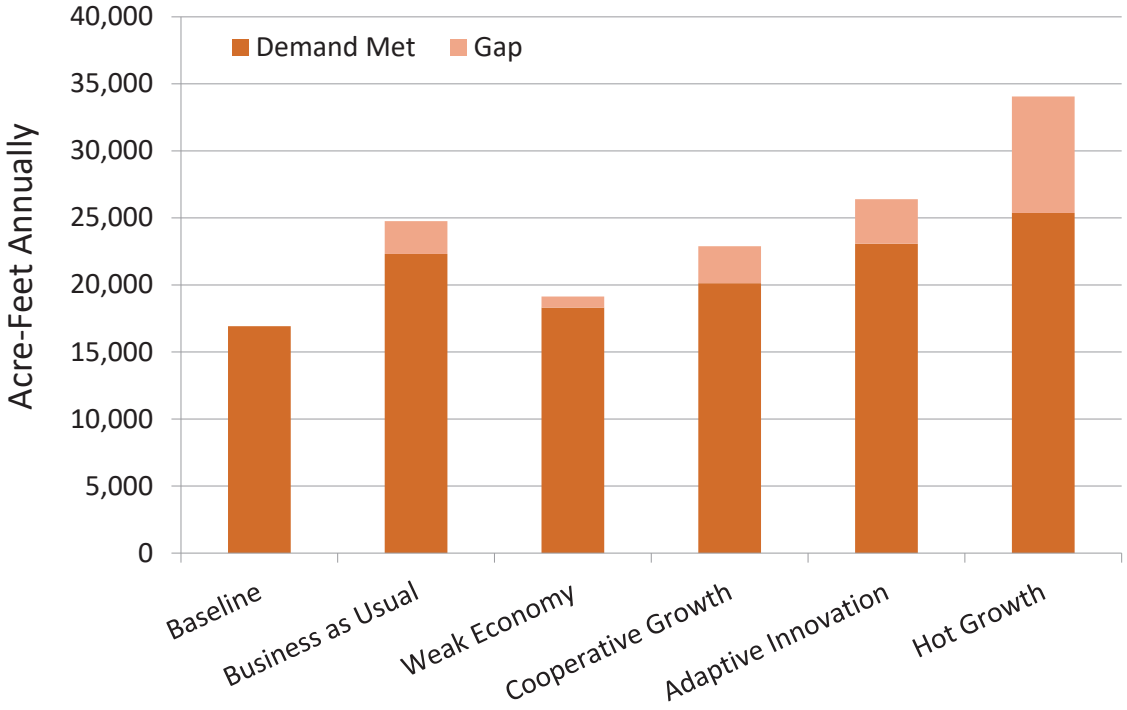
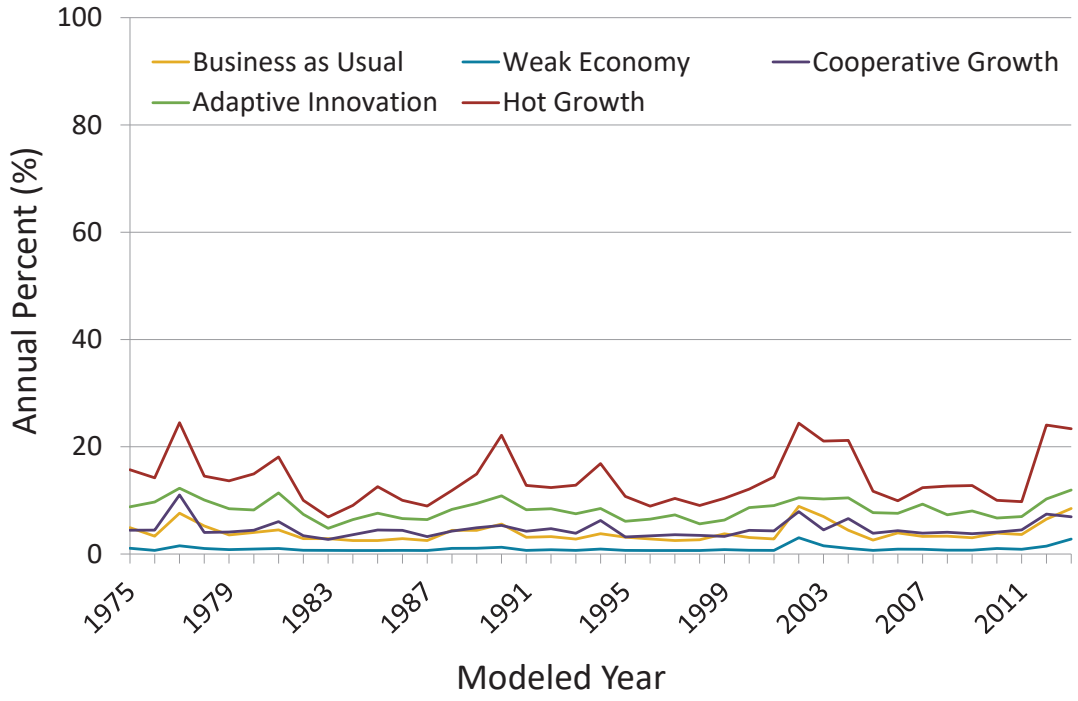


Figure 4. Modeled Annual M&I Gaps (expressed as a percent of demand unmet) for Planning Scenarios



"Modeled Years" are not a reference to historical conditions. Models used to simulate the planning scenarios consider 1975 to recent-year water supplies (in some scenarios, adjusted for climate change impacts), current administrative practices and infrastructure, and projected 2050 demands.

Agricultural Demands

DEMAND

Current and potential agricultural diversion demands for the year 2050 were estimated using CDSS modeling tools and assumptions that were informed by the planning scenarios and information from the 2015 Gunnison BIP. Due to the 2021 model revisions to Redlands Canal and reservoir operations, there was between a 1 and 2 percent change in agricultural demand for average and critically dry years. The following are observations on agricultural demand:

- Diversion demands increased in Cooperative Growth and Hot Growth due to higher irrigation water requirements (IWR) resulting from a warmer and drier future climate.
- A notable reduction in diversion demand occurred in Adaptive Innovation due to a 10 percent reduction in IWR and 10 percent increase in system efficiency.
- Agricultural diversion demands are projected to decrease in three of the five planning scenarios due to urbanization and the associated reduction of irrigated acres, and the adoption of emerging agricultural technologies in Adaptive Innovation.

Agriculture diversion demand represents the amount of water that would need to be diverted or pumped to meet the full crop irrigation water requirement. The diversion demand does not reflect historically applied irrigation amounts because irrigators often operate under water-short conditions and do not have enough supply to fully irrigate their crops.

GAPS

Current and projected agricultural diversion demands were evaluated against available water supplies in the various planning scenarios using CDSS modeling tools. Gaps are defined as periods when demand exceeds physically and legally available water supplies. The Gunnison Basin irrigated acres, IWR, agricultural diversion demand, average annual gap, incremental average annual gap, and maximum annual gap for the Baseline and planning scenarios based on model revisions are presented in Table 3 and illustrated on Figure 5. An annual timeseries of gaps in terms of percent of demand that was unmet is shown on agricultural gaps are as follows:

- Agricultural gaps are higher in climate-impacted scenarios, as shown in Table 3 and on Figure 5.
- In very dry years, agricultural gaps are projected to account for 20 to 30 percent of demand depending on the scenario, as shown on Figure 6.

Table 3. Summary of Baseline and 2050 Projected Agricultural Diversion Demands and Gaps

	Baseline[1]	Business as Usual	Weak Economy	Cooperative Growth	Adaptive Innovation	Hot Growth
Irrigated Acreage (acres)	234,700	220,000	220,000	220,000	220,000	220,000
Average IWR (AFY)	531,700	497,600	497,600	577,900	546,400	607,400
Average Annual Demand (AFY)	1,796,000	1,677,000	1,677,000	1,967,100	1,307,200	2,040,600
Average Annual Gap (AFY)	87,700	76,500	76,700	158,500	110,400	222,300
Incremental Avg. Ann. Gap (AFY)	-	-	-	70,800	22,700	134,600
Maximum Annual Gap (AFY)	368,800	322,200	322,400	473,300	326,600	596,800

[1] *Baseline agricultural demands were estimated using a model that used "current" irrigated acreage and cropping patterns and incorporated historical weather patterns.*

Calculation methodologies and assumptions for agriculture water demands are available in the Technical Update documentation.

https://cwcb.colorado.gov/colorado-water-plan/technical-update-to-the-plan

The Incremental Average Annual Gap quantifies the degree to which the basinwide gap could increase beyond what agriculture has historically experienced under water-short conditions.

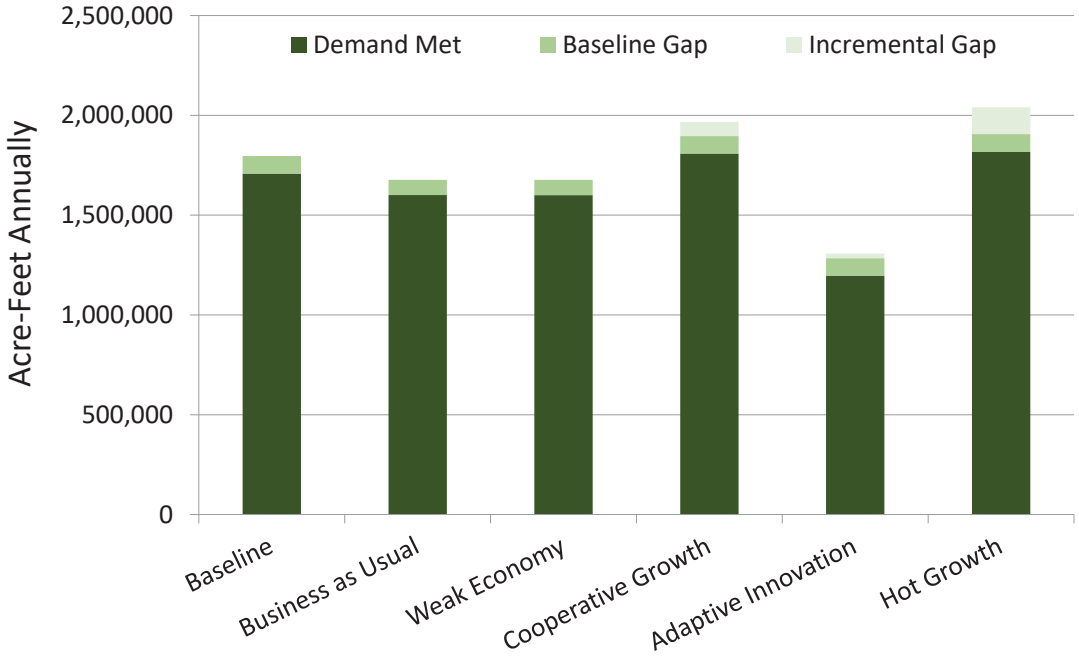


Figure 5. Baseline and 2050 Projected Average Annual Agricultural Diversion Demand, Demand Met, and Gaps

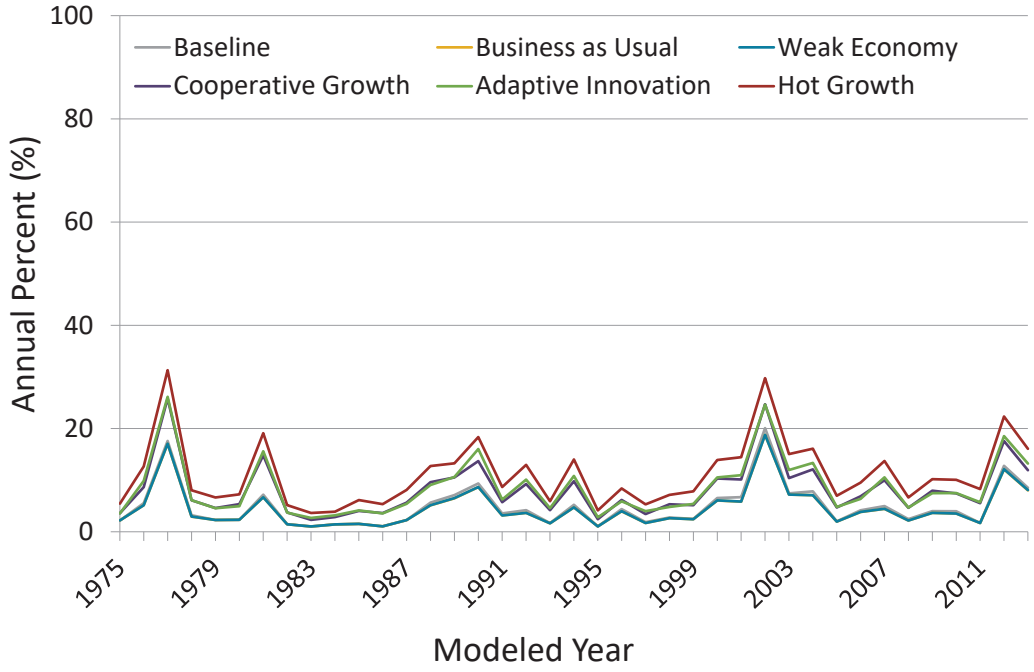


Figure 6. Modeled Annual Agricultural Gaps (expressed as a percentage of demand unmet) by Planning Scenario

Agricultural demand is a major factor in the Gunnison Basin and represents 99 percent of the total water demand. While increases in agricultural demand and gaps will occur with a warmer and drier climate, increases in system efficiency and reductions in irrigation water requirements significantly reduce diversion demand and the supply gap in Adaptive Innovation.

Environment and Recreation

During the Technical Update, current and potential future risks to environmental and recreation (E&R) attributes in the Gunnison Basin were evaluated using the Colorado Environment and Recreation Flow Tool (Flow Tool). The Flow Tool was developed to help the nine basin roundtables evaluate their portfolios of E&R projects by fostering an improved understanding of potential streamflow-related risks (both existing and projected) to E&R attributes throughout their respective basin.

The Flow Tool uses streamflow data from CDSS, modeled streamflow data for various planning scenarios, and established flow-ecology relationships to assess risks to flows and E&R attribute categories at preselected gages across the state. The Flow Tool is a high-level tool that is intended to provide guidance during stream management plan and BIP development.

A total of eight water allocation model nodes were selected for the Flow Tool in the Gunnison Basin. Figure 7 shows sub-watersheds (at the HUC 12 level) and the relative number of E&R attributes located in each watershed.

- Gunnison River near Gunnison, Colorado (09114500)
- Tomichi Creek at Sargents, Colorado (09115500)
- Cimarron River near Cimarron, Colorado (09126000)
- Uncompahgre River near Ridgway, Colorado (09146200)
- Uncompahgre River at Colona, Colorado (09147500)
- Uncompahgre River at Delta, Colorado (09149500)
- Kannah Creek near Whitewater, Colorado (09152000)
- Gunnison River near Grand Junction, Colorado (90152500)

Results and observations from the Flow Tool analysis are described in Table 4.

The identification of future risks to environmental and recreation attributes helps facilitate discussions about projects or strategies that can be implemented to reduce the risks. This type of discussion is similar to and integrates with roundtable strategies that focus on reducing the risk of municipal or agricultural supply gaps.

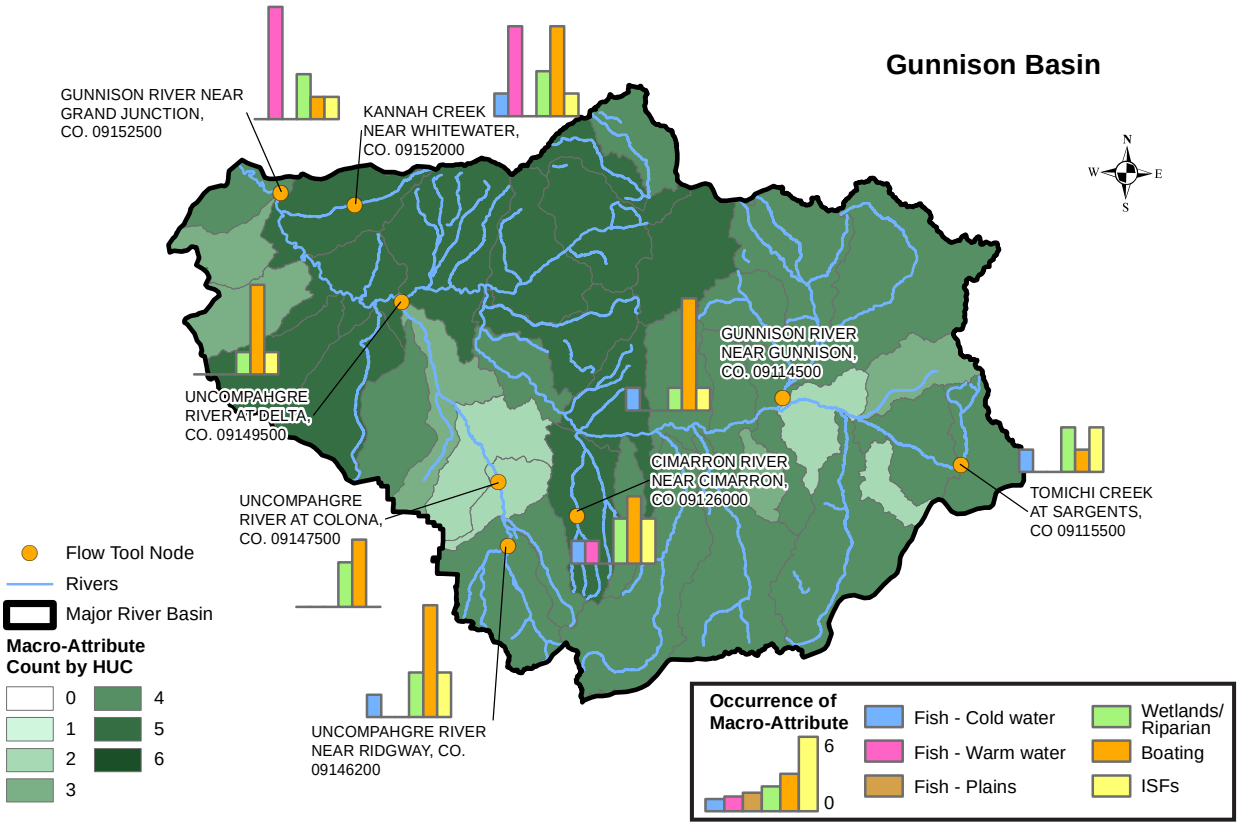


Figure 7. Flow Tool Nodes Selected

Table 4. Summary of Flow Tool Results

Category	Observation
Projected Flows	• At higher elevations (e.g., Gunnison River at Gunnison), mean annual flow under Baseline conditions are close to naturalized conditions compared to farther down in the watershed. This shows that M&I and agriculture use is projected to be less farther up in the watershed. Under climate-impacted scenarios (Cooperative Growth, Adaptive Innovation, Hot Growth), annual flows are projected to decrease in the entire Gunnison Basin, with growing depletions farther downstream in the watershed. • Along the mainstem Gunnison River, spring runoff peak is estimated to occur sooner in April and May for the climate-impacted scenarios compared to the peak occurring in June for Baseline, Business as Usual, and Weak Economy. Subsequently, mean monthly flows are projected to be reduced in climate-impacted scenarios for all other months of the year (July through March). • Tributaries to the Gunnison River are projected to have peak flows during the same months as Baseline but overall have lower monthly mean flows across all months of the year. • Below major reservoirs on the Uncompahgre and Gunnison mainstems, spring runoff in April and May is projected to be greater compared to Baseline for climate-impacted scenarios but greatly reduced in June and subsequent months compared to Baseline. • At locations higher in the watershed, mid- to late-summer mean monthly flows are reduced in climate-impacted scenarios compared to Baseline. Farther downstream near the outflow of the watershed, the decrease is projected to become even more severe for the mid- to late-summer monthly mean flows compared to Baseline. • At lower elevations and on mainstems that are impacted by storage and diversions, peak flows are projected to decrease in scenarios impacted by climate change.
Ecological Risk	• Ecological risk (riparian/wetland plants and fish habitat) related to projected changes in peak flow magnitude is generally low to moderate at higher elevations. Under climate-change scenarios, this risk is projected to increase at most locations. • Mid- and late-summer flows are projected to decline under climate-change scenarios, though flow-related risk to coldwater fish (trout) is projected to remain moderate; however, the metric used to assess risk for fish does not include the month of July because, historically, July flows are sufficient. Under Cooperative Growth, Adaptive Innovation, and Hot Growth, July flows are predicted to drop, which would increase risk for fish by reducing habitat and increasing stream temperatures. In at least one location (Cimarron River), winter flows are projected to decrease, which also puts fish at risk. • Due to the shift in mean monthly peak flows for the climate-impacted scenarios to an earlier spring peak runoff and lower mid- to late-summer flows, both spawning windows for various species and summer low-flow conditions could adversely affect fish species. Lower flow conditions combined with warmer air temperatures due to climate change could result in warmer water temperatures that could negatively affect coldwater fish species.
Instream Flows and Recreational In-channel Diversions	• In several locations, instream flows may be met less often, and at least one RICD (in Gunnison) may be met less often. In critical endangered species habitat, lower mean annual flows and reduced flows in mid and late summer will make it more difficult to meet flow recommendations.
E&R Attributes	• Under Baseline conditions and Business as Usual and Weak Economy, current flow issues related to E&R attributes arise from in-basin diversions and storage of peak flows in reservoirs. • Under climate-change scenarios, the shift in the timing of peak flow, reductions in total runoff, and increasing consumptive demands are projected to contribute to reductions in mid- and late-summer flows. Several water management programs implemented in the context of the Upper Colorado River Endangered Fish Recovery Program, including on the Gunnison River below the Apsinall Unit, have demonstrated that flow timing and magnitude can be planned in a way that better meets the needs of E&R attributes. These same strategies may be implementable in other areas within the Gunnison Basin to protect habitat in reaches below storage facilities.

Focus Area Mapping

Since the 2005 passage of the Colorado Water for the 21st Century Act, the nine BRTs and the CWCB have worked to characterize Colorado's E&R water needs. The effort has included extensive inventory, analysis, and synthesized mapping of each basin's E&R attributes. Through this process, each basin created Focus Area maps that identify streams or watersheds where environmental and recreational attributes are located and/or where these attributes may be at risk. The Focus Area maps were included in the 2010 version of the Statewide Water Supply Initiative (SWSI 2010) and were updated by some basins during the development of the 2015 BIPs.

During the 2015 BIP effort, the Gunnison BRT E&R Workgroup reviewed information and resources provided by CWCB subsequent to the SWSI 2010 effort and refined the Gunnison Basin's E&R needs. To better target future environment and recreation projects in the basin, the workgroup identified additional E&R focus segments where future E&R or multi-purpose projects could have the largest beneficial impacts. Eight stream segments were added to the 21 segments previously identified during SWSI 2010, for a total of 29 focus area segments.

During the current BIP update effort, the E&R subcommittee of the Gunnison BRT did not identify specific streams to add to the Focus Area maps; however, the subcommittee expressed that updates may be needed to some of the E&R attribute mapping used to identify focus areas. The subcommittee recommended, in the future, that the attribute mapping and the resulting focus areas be updated. Figure 8 shows the current Focus Area map for the Gunnison BRT.

The Focus Area maps were created to:

1. **Help guide water supply planning**
2. **Help identify where projects could reduce risks to E&R attributes**
3. **Identify potential collaborative projects**

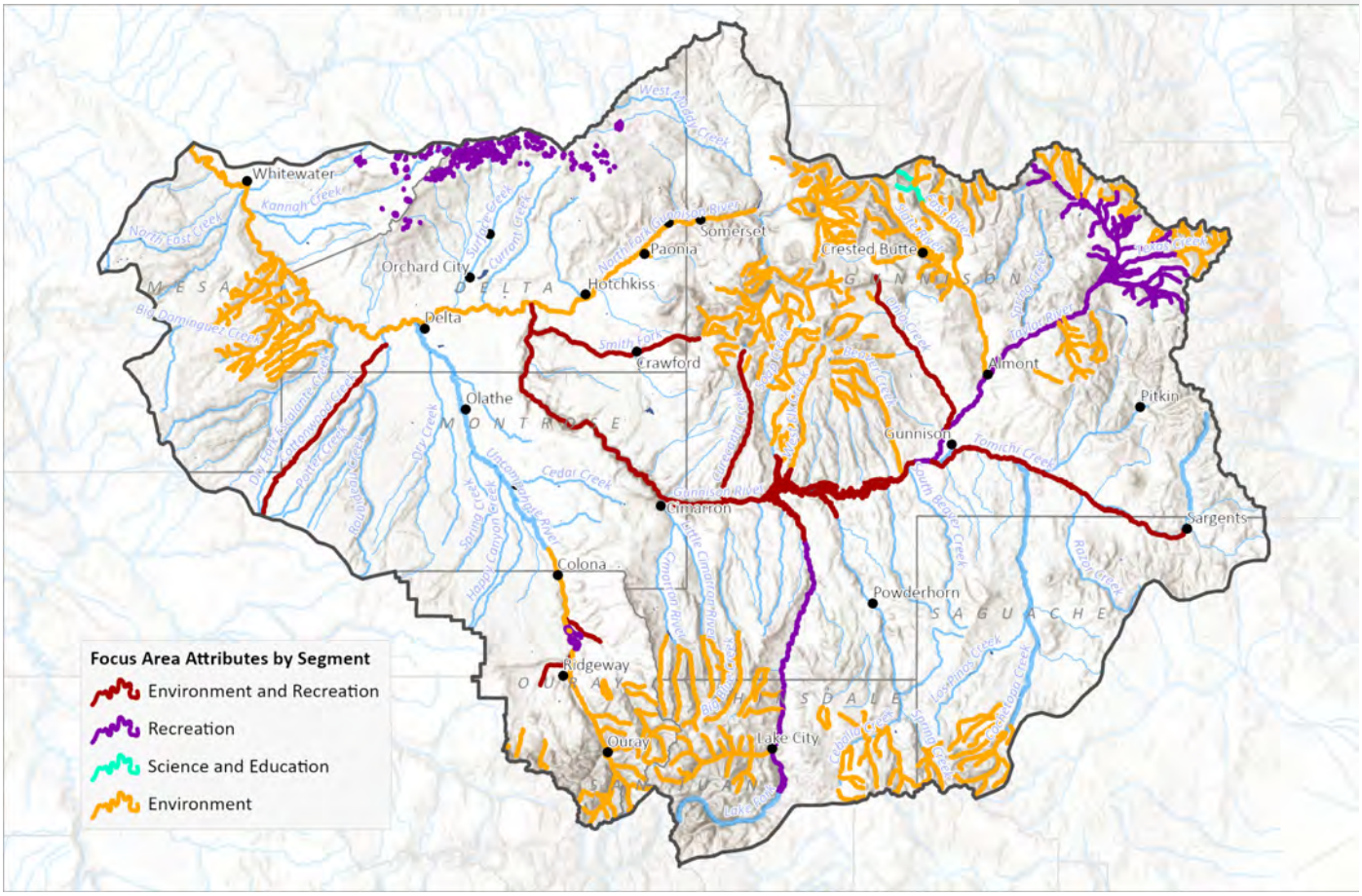


FIgure 8. Focus Area Map of the Gunnison Basin

Water Supplies

Available water supplies in the Gunnison Basin vary by location and are impacted by contributing drainage area, diversions, storage facilities, and the prior appropriation system. The CDSS model used to evaluate current and projected future available supplies includes supply evaluations at numerous locations throughout the Gunnison Basin.

An example location was selected to illustrate current and projected available flows. Figures 9 and 10 show simulated available flow at a location on the Gunnison River below Gunnison Tunnel, specifically below the Aspinall Unit and Gunnison Tunnel diversions but upstream of the Redlands Canal, which is the primary calling right in the lower basin. The canal diverts for power and irrigation, and return flows accrue to the Colorado Basin, which reflects a total depletion to the Gunnison River.

Figures 9 and 10 also show that flows are projected to be available in many years, though the amounts will vary greatly on an annual basis and across scenarios (available flows under the scenarios impacted by climate change are less than in other scenarios). In Hot Growth and Adaptive Innovation, very little flow may be available at this location for long periods of time during dry times. Peak flows are projected to occur earlier in the year under scenarios impacted by climate change.

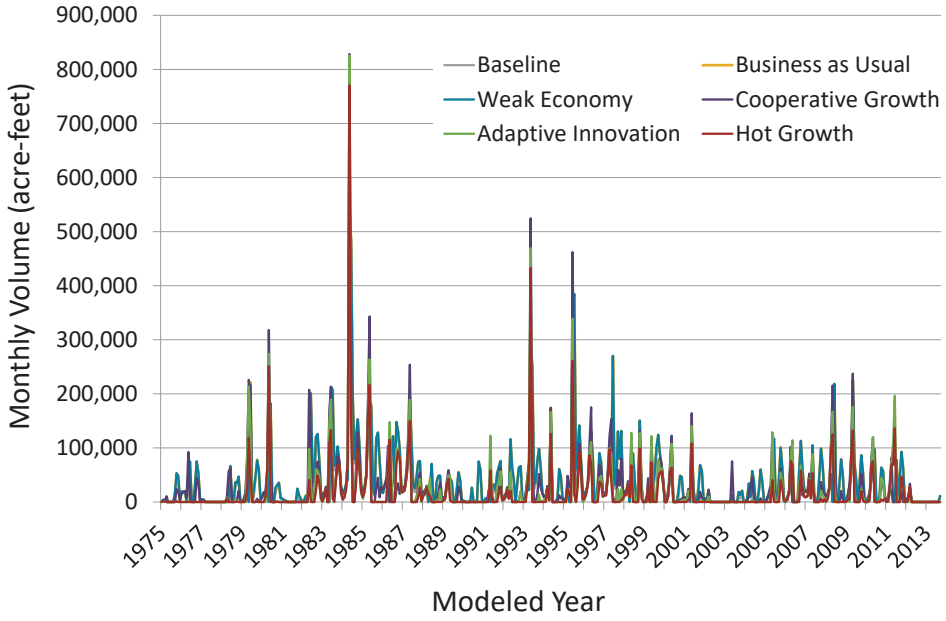


Figure 9.
Simulated Hydrograph of Available Flow at Gunnison River below Gunnison Tunnel

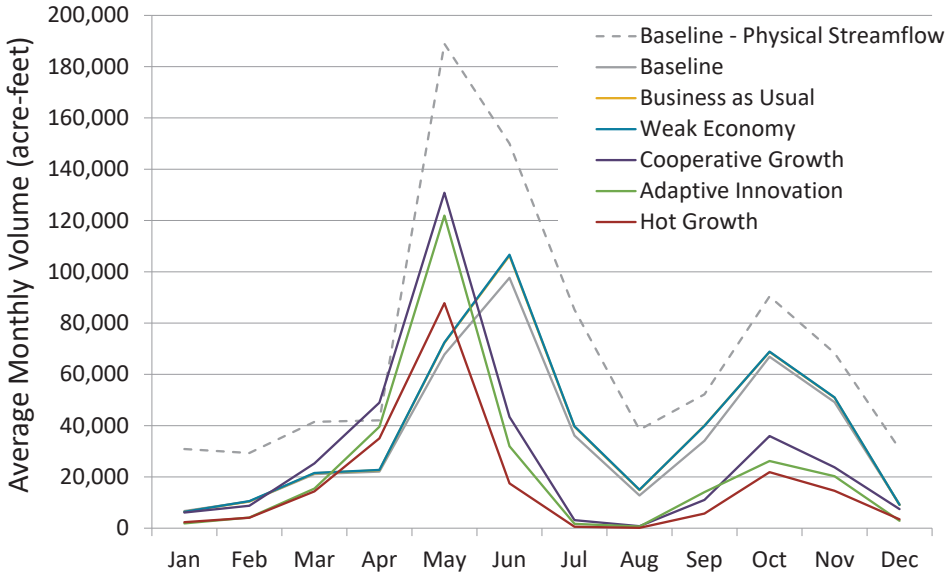


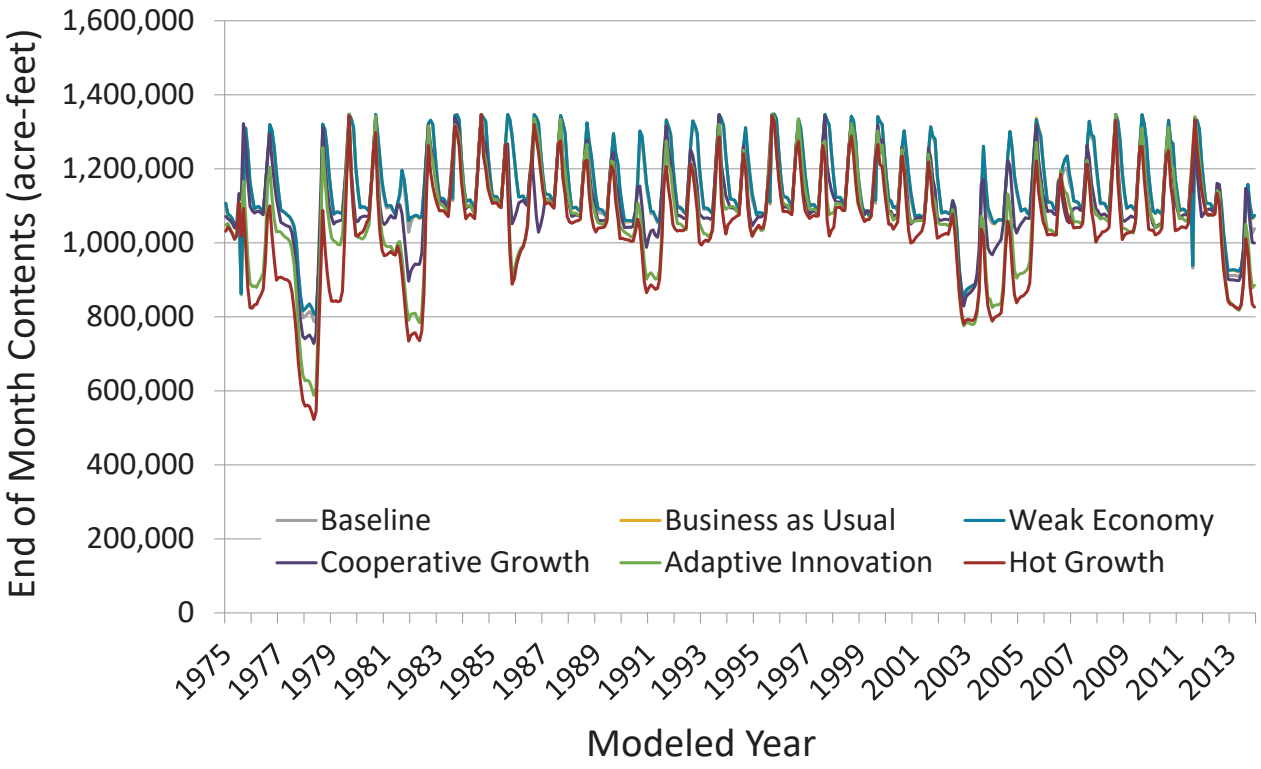
Figure 10.
Average Monthly Simulated Hydrographs of Available Flow at Gunnison River below Gunnison Tunnel

Storage

Total simulated reservoir storage from the Gunnison River water allocation model is shown on Figure 11. Baseline conditions show the highest levels of water in storage (in general), while the lowest is in Hot Growth. Cooperative Growth, Adaptive Innovation, and Hot Growth show lower amounts of water in storage during dry periods than the two scenarios that do not include the impacts of a drier climate; however, storage levels generally recover back to Baseline levels after dry periods.

While climate-impacted scenarios show lower amounts of water in storage during dry periods than non-climate-impacted scenarios, storage levels generally recover back to Baseline levels after dry periods.

Figure 11. Basin Total Simulated Storage



Section 6. Strategic Vision for the Future

The goals, processes, and measurable outcomes described in Section 4 provide a long-term vision for the Gunnison Basin and the steps that stakeholders can engage in to help protect existing water uses in Gunnison Basin. This section provides an outline of specific strategies where the Gunnison BRT will focus efforts in the near-term to make progress toward these goals and ensure that projects supported and funded through the Gunnison BRT align with the goals.

Summary of Strategies

1 IMPLEMENT PROJECTS

Project implementation, carried forward from the 2015 BIP, remains the primary strategy for addressing basin goals. An important function of the Gunnison BRT is to provide funding for projects through the CWCB's Water Supply Reserve Fund (WSRF) grant program, which relies on the recommendation of the nine basin roundtables in its funding approval process. Gunnison Basin projects seeking this funding source must apply through the Gunnison BRT. Projects that come before the Gunnison BRT are evaluated based on their alignment with basin goals and the vision of the Gunnison BRT to protect existing water uses. In addition, the Gunnison BRT can provide non-monetary support for projects through education, collaboration, and partnership building. These important functions are all integral to the Gunnison BRT's strategy to implement projects.

Section 7 summarizes the basin's updated Project Database, which compiles projects that are being developed to meet important and diverse water needs. The projects identified by the Gunnison BRT and included in the Project Database have been compiled and reviewed to assess the impact each will have on achieving Gunnison Basin goals and reducing potential future water shortages. Figure 12 summarizes the categories of current projects (e.g. concept, planned, or implementing) added in 2020 from the updated Project Database as described in more detail in Section 7. Projects focusing on agricultural needs make up a majority of identified projects. Projects supporting improvements to infrastructure (efficiency and rehabilitation) are also numerous in Gunnison Basin.

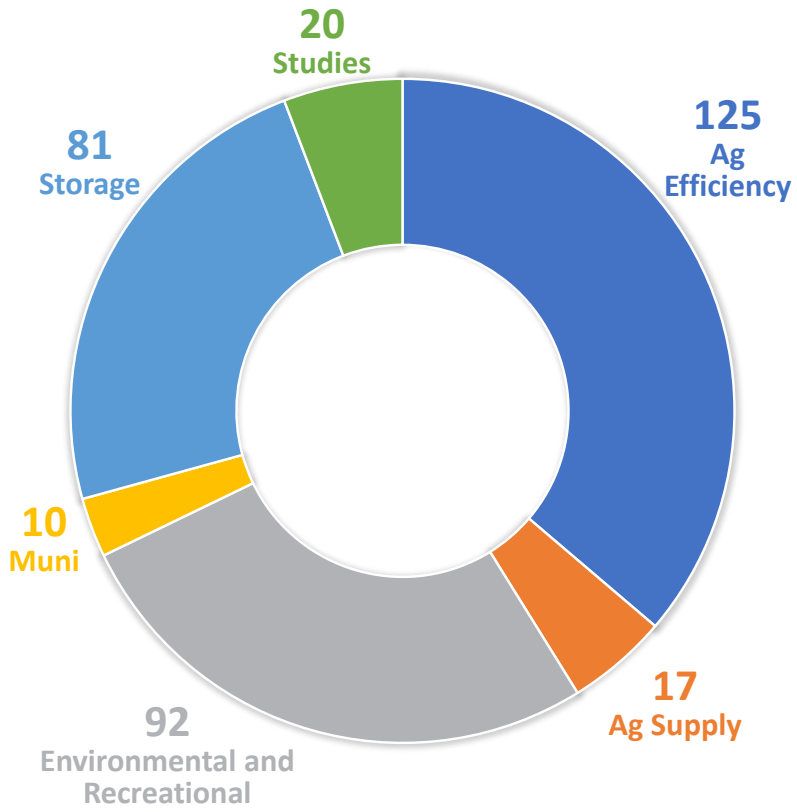


Figure 12. Gunnison Basin 2020 Current Projects Categories

The Gunnison BRT has established a specific goal to encourage multi-use projects, particularly those that benefit both agriculture and E&R uses. The Project Database has identified 18 projects that serve needs in both areas. The Gunnison BRT can use its ability to educate stakeholders, promote collaboration, and build partnerships so that more projects can be identified for multi-use benefits.

The Gunnison BRT recognizes that many stakeholders may not have the resources to keep the Gunnison BRT updated on its planned projects or to apply for funding. Providing funding for a BIP Coordinator may be a solution to better support project implementation.

2 LEVERAGE FUNDING OPPORTUNITIES

Historically, projects in the Gunnison Basin have made significant use of federal funding for agricultural water programs and have made a significant impact on water use and management in the basin. Additionally, the Colorado River Water Conservation District recently implemented its Community Funding Partnership (CFP), which will help entities leverage federal funds. The CWCB Technical Assistance for Federal Cost Share (TAFC) grants have also been impactful in leveraging federal funds in the recent past. The following federal funding sources are actively being used in the Gunnison Basin:

- The Colorado River Basin Salinity Control Program administered by the U.S. Bureau of Reclamation is used by ditch companies to improve conveyance infrastructure.
- The Environmental Quality Incentive Program administered by the NRCS is used by individual landowners to improve on-farm irrigation efficiency.
- The Watershed and Flood Prevention Operations Program administered by the NRCS is currently being used to fund agricultural water management and flood prevention projects.
- The Regional Conservation Partnership Program administered by the NRCS is being used within the Gunnison Basin to fund agricultural water management and efficiency projects.
- Upper Colorado River Basin Fund Memorandum of Agreement (MOA funds) can be used for specific qualifying U.S. Bureau of Reclamation projects within the Upper Colorado River Basin, including a number of projects within the Gunnison Basin. The Colorado River Water Conservation District's CFP is a relatively new source of funding that will likely be impactful for water users looking to leverage their funding dollars. The CFP funds projects in five categories: productive agriculture, infrastructure, healthy rivers, watershed health and water quality, and conservation and efficiency.
- TAFC grants are an important source of funds for smaller entities seeking to engage in federal programs. These grants allow small ditch companies to begin the process of engaging with federal agencies for larger infrastructure projects.

The Gunnison BRT will continue to leverage federal funding where applicable for agricultural infrastructure and watershed health projects, as this strategy will maximize basin dollars spent toward achieving Gunnison Basin goals. Highlighting opportunities for matching funds and facilitating partnerships are significant roles that the Gunnison BRT can play toward this effort. Given the Gunnison Basin's significant use of agricultural water, federal programs have already had a large impact on infrastructure.

The Gunnison BRT can also stay informed of future funding opportunities that align with basin goals and help conceptualize new projects that could take advantage of this funding. For example, the Gunnison Basin anticipates federal programs related to fire mitigation and watershed health to be made available through agencies like the NRCS and is encouraged by federal support in this arena. Supporting projects that protect and improve the existing infrastructure from which forests, wetlands, and soils benefit will remain a high priority for the Gunnison BRT.

Example Projects

GUN-2020-108 - Crawford Reservoir and Related Infrastructure Ditch Piping

The Crawford Reservoir Ditch Piping project is part of the Lower Gunnison Project, an NRCS Regional Conservation Partnership Program project. The Lower Gunnison Project focuses on increasing water use efficiency, agricultural

productivity, and sustainability by integrating and coordinating modernized conveyance systems with upgraded on-farm high-efficiency irrigation application systems. The project is a cooperative agricultural water use efficiency project taking place in four primary focus areas of the Lower Gunnison Basin, with both federal and local funding partners.

GUN-2020-1114 - Paonia Reservoir Sediment Removal and Outlet Modification Project (Phase 2)

Paonia Reservoir was designed to store 21,000 AF of water, which is used for irrigation, flat-water recreation, fishing, augmentation, and improved late-season flows to the North Fork of the Gunnison. Over the last 50 years, the reservoir has lost 24 percent of its total capacity due to sedimentation build up. The goal of this project is to investigate long-term sediment management options, with the intent of minimizing future losses and possibly restoring current capacity losses. This project leverages both federal and local funding.

3 EXPAND WEATHER MODIFICATION PROGRAMS

Two weather modification programs currently operate in mountainous regions in the Gunnison Basin—seeding storms to increase snowpack, and monitoring streamflow conditions during runoff. As summarized in Section 5 of Volume 2 (Weather Modification in the Gunnison Basin) and reflected on Figure 13, the Grand Mesa Program impact area is located along the northern edge of the Gunnison Basin, and the Upper Gunnison Program impact area covers the headwaters of tributaries that generally flow into the Aspinall Unit. Actual estimates of increased snowpack are difficult to determine; however, recent reports from the programs indicate a 5 percent to 16 percent increase in snowpack as a result of cloud seeding. Additional studies estimated that a 6 percent increase in snowpack upstream of Blue Mesa Reservoir would result in more than 55,000 AF of additional runoff into the reservoir, while an increase of 11 percent in snowpack would result in more than 100,000 AF of additional runoff into the reservoir.

There is opportunity to expand the weather modification programs in the basin, most notably in the Uncompahgre River Basin and the North Fork of the Gunnison Basin. Extrapolating the Blue Mesa Reservoir inflow estimates, expanding the program into these two basins could increase streamflow by a total of 26,500 AF to 48,500 AF based on a 6 percent and 11 percent increase in snowpack. This estimate relies on the following assumptions that would need to be thoroughly investigated prior to implementing an expanded weather modification program:

- The meteorological conditions in the expanded basins can support a cloud seeding program
- A program would be financially and operationally feasible
- The potential for cloud seeding will continue in the future (i.e., limited impact due to climate-adjusted conditions)
- The expanded basins would produce similar results to other basins currently covered by the programs

Example Project

GUN-2020-0224–Additional Weather Modification

Expanding the existing weather modification programs could lead to additional water supplies in portions of the Gunnison Basin to meet current and future agricultural, municipal, and industrial demands; increase storage supplies; and improve streamflow

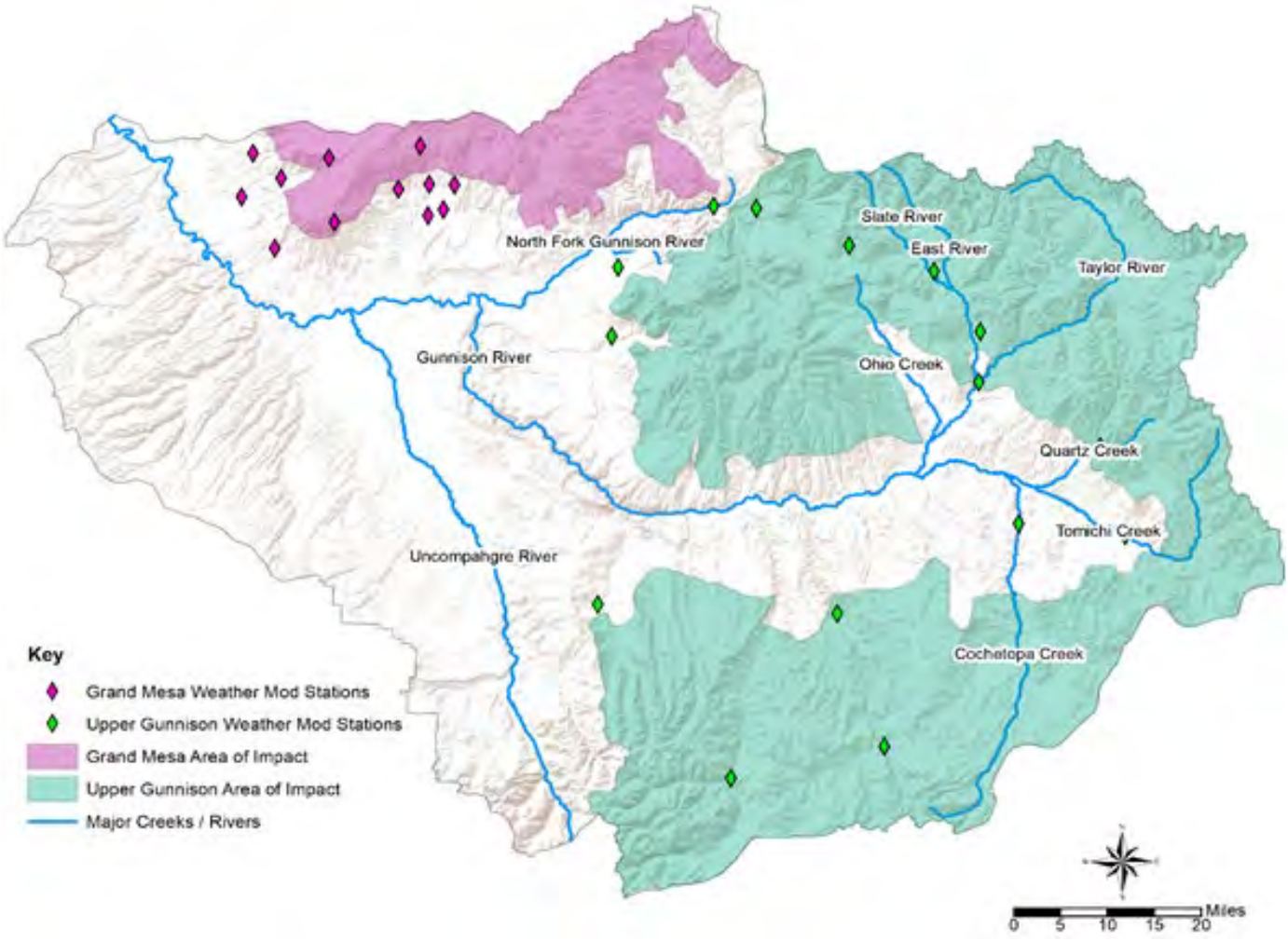


Figure 13. Gunnison Basin Cloud Seeding Program Impact Areas

conditions for environmental and recreational needs. An expanded program directly supports several of the Gunnison BRT's stated goals, including protecting existing water uses in the basin (Goal 1); improving agricultural water supplies to reduce shortages (Goal 4); and protecting environmental and recreational uses (Goal 5). The Gunnison BRT proposed additional weather modification as a project in the 2015 BIP and carried that project forward into this effort.

4 IMPROVE INFRASTRUCTURE

More than 50 percent of the projects identified in the Gunnison Basin Project Database address aging infrastructure, and thus do not directly contribute to reducing future water shortages. The large number of agricultural infrastructure improvement (including increasing efficiency) and rehabilitation projects points to an increased need for this work in a basin dominated by farming and ranching. In many instances, these projects allow irrigators to divert the full amount of water they are legally entitled to and more easily convey the water to their fields. Support of these projects are a good investment, because reduced yields from existing water supply, storage, and delivery projects will only make water supply issues worse.

Roundtable support of aging infrastructure rehab and reconstruction projects is closely tied to the Gunnison Basin goal of protecting existing uses. When infrastructure improvements are implemented, consideration of multiple purposes can help to meet additional needs, such as environmental and recreational uses.

Example Project

GUN 2020-0088 North Fork Farmer's Ditch Improved Diversion

This project is an outcome of the stream management planning efforts undertaken by the North Fork Water Conservancy District, West Slope Conservation Center, and other partners. This project aims to improve diversion operations and management for irrigation purposes while also improving recreational safety and addressing fish passage issues at certain flow regimes.

5 PROTECT ENVIRONMENT AND RECREATION VALUES

The Gunnison Basin will need to protect and enhance its watersheds and associated E&R attributes while meeting its future M&I water needs and preserving agriculture. Doing so will require collaboration among stakeholders, strategic planning, and successful implementation of projects. The Gunnison BRT can achieve its goals of protecting E&R values through the following strategies:

- **Collaboration.** The Gunnison BRT can encourage the consideration of impacts to water quality and watershed health during water project development and implementation. Documentation and information sharing is encouraged regarding successful approaches on tools and strategies, such as on water quality best management practices, stream restoration methods, and stream health assessment methodologies. Collaboration is critical to identifying the best ways to incorporate environmental and/or recreational enhancements to water projects that can enhance the overall health of Gunnison Basin watersheds.
- **Strategic Planning.** Successful planning requires a solid understanding of existing conditions and challenges. With an understanding of existing conditions, planning can be better informed and the results of projects or strategy implementation can be assessed.
- **Action.** The Gunnison BRT identified numerous watershed-focused projects in its Project Database Gunnison BRT hopes to encourage and support the implementation of watershed, environmental, and recreational projects through funding assistance, and by fostering collaboration and encouraging multi-purpose projects.

Example Projects

While many projects have been identified in the Gunnison Basin Project Database with the purpose of protecting and/or restoring E&R attributes, the Gunnison BRT is seeking a process to prioritize such projects for maximum benefit. Using E&R attribute data and information described in Section 5, and improving on those data sources where possible, are key steps in characterizing the E&R needs in the basin. The Gunnison BRT, through its E&R subcommittee, can support several processes that will help the Gunnison BRT determine how to prioritize E&R projects, including:

- Reviewing and recommending E&R database improvements, including mapping of additional key E&R attributes, such as water quality impairments, burn areas, insect infestations, nonconsumptive needs assessment of at-risk waterbodies, and additional recreational attributes, among others
- Supporting the next iteration of Flow Tool improvements, including adding nodes in the upper basin
- Supporting the development of stream management plans in high-priority watersheds

6 PREPARE FOR CLIMATE CHANGE

Hotter and drier conditions are projected to occur by 2050 in three of the five planning scenarios—conditions that would lead to an increase in agricultural and municipal demands and a reduction and shift in the timing of runoff. As outlined in the Gunnison BIP Update Volume 2, projected conditions in the Gunnison Basin may result in a 22 percent to 30 percent average increase in the need for agricultural irrigation supplies and a 4 percent to 16 percent reduction in natural flow (i.e., streamflow absent the effect of humans). Additionally, runoff is projected to occur up to a month earlier in some tributaries. There are several strategies that can be used in the Gunnison Basin to help adapt to, and partially offset, the effects of changing climate and hydrological conditions.

- **Agricultural Water Supply.** There are several opportunities in the agricultural sector that may help protect farming and ranching operations from the full impact of climate-adjusted conditions. Producers that plant annual crops have more flexibility than those with perennial crops, which allows those producers to monitor snowpack and runoff conditions and make planting decisions before the irrigation season. Producers in the Gunnison Basin may also be able to take advantage of innovations in crop hybrids that are more drought tolerant and produce the same or increased yield with less water. On-farm improvements, both to infrastructure and irrigation scheduling, can stretch supplemental reservoir supplies longer into the irrigation season, which is critical to offset the impact of an earlier runoff, lower late-season flows, and drier conditions. Collectively, these strategies focus on maintaining flexibility while maximizing available water supplies to produce more crop per drop of water under changing climate conditions.
- **Municipal Water Supply.** Flexibility is one of the best ways to plan for and manage uncertainty regarding potential future climate conditions. Municipalities can explore how flexible agricultural leasing opportunities can be used to meet municipal demands during drought conditions. Colorado has supported and helped develop several programs that allow municipalities to develop partnerships with agricultural producers and enter into water sharing agreements. These partnerships are an alternative to the traditional ”buy-and-dry“ of irrigated land and provide flexibility to both the municipality and the agricultural producer. Additionally, municipalities can continue to implement water conservation strategies to reduce the demand for water to meet indoor and outdoor municipal needs. Finally, municipalities can implement drought restrictions that limit lawn watering based on available supplies.
- **Reservoir Storage.** Reservoir storage is an integral part of the water supply and operation of the Gunnison Basin and its tributaries. Storage supplies in the basin are used to create hydropower, regulate streamflow levels for environmental purposes, provide Colorado River Storage Project storage, and meet agricultural and municipal needs. Creating flexible agreements that consider the effects of changing hydrology on reservoir operations can help maximize the use of storage supplies in the future. Many agricultural reservoirs are operated to fill and release their full contents each year. Reservoir operations that allow for more carry-over storage can be evaluated and implemented to provide more protection against droughts. Implementing the reservoir projects proposed by the Gunnison BRT in the projects list, including rehabilitating existing storage and building new storage, will increase supplies for multiple purposes and provide the Gunnison Basin with more flexibility and drought protection.

Example Project

GUN-2020-0151–Uncompahgre Valley “Water and Land Committee” Working Group

The Water and Land Committee working group was formed to address issues related to land management and water use, with a large focus on planning for an uncertain future. Their mission is to facilitate discussion among all stakeholders to positively affect growth through sustainable best practices, policies, and education, with the goal of managing the Uncompahgre Valley’s water resources for all users. The committee is comprised of cities, counties, land development groups, agricultural water users and growers, federal agencies, and private entities.

Section 7. Future Basin Projects

The Gunnison BRT identified projects that will further progress toward achieving basin goals. The purpose of the Project Database is to keep a record of all projects considered by the Gunnison BRT through the BIP process, both in the past and into the future. As part of the BIP Update, considerable effort was made to gather as much information about each proposed project as possible. This focus on data collection makes the Project Database a more useful tool for planning purposes. Table 5 provides a snapshot summary of the Project Database during the 2020 BIP Update. Additional information on the Project Database and its content are provided in Volume 2 of the BIP Update.

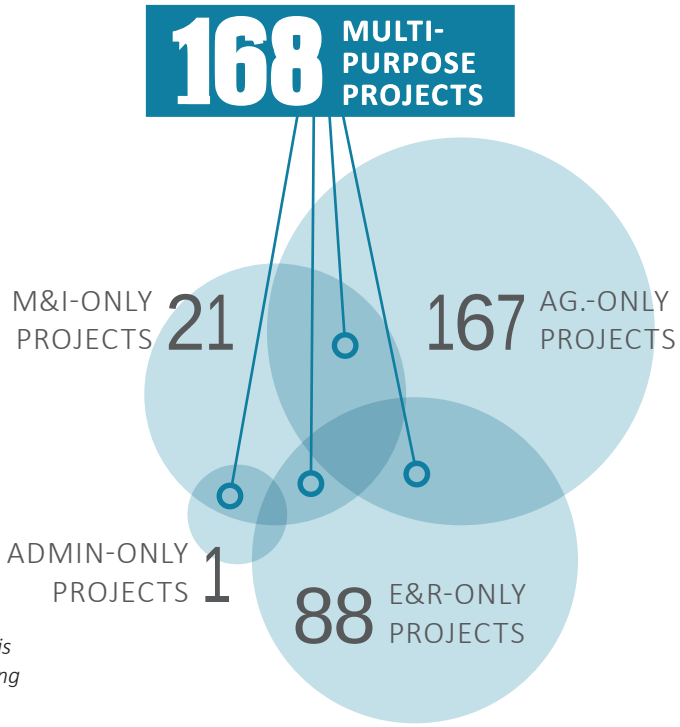
Table 5. Snapshot Summary of Basin Projects

Total Projects	453
New projects added in 2020	344
Projects completed	56
Projects being implemented	112
Projects identified as meeting M&I needs	103
Projects identified as meeting Ag needs	322
Projects identified as meeting E&R needs	199
Tier 1 projects	133
Tier 2 projects	166
Tier 3 projects	154
Tier 4 projects	0
TOTAL COST OF ALL PROJECTS	**$1.3 billion**
PERCENTAGE OF PROJECTS WITH AN ESTIMATED COST	**62%**

Projects that are concepts, planned, or are being implemented were the basis for the above data summary (with the exception of data specifically describing projects completed or being implemented)

Total estimated costs for project implementation top $1 billion

(for projects that have identified a project cost)



Project Tiering and Level of Readiness

A new feature of the projects list for the BIP Update is the assignment of "tiers" to projects. The project tiering exercise is a tool roundtables can use to do a preliminary characterization of their projects and associated project readiness. It facilitates a "first-pass" process and helps standardize data-gathering to allow for project updates and movement through the tiers as they advance toward funding. Project tiering was initially developed as a tool for basin-level WSRF grant approval discussions, where the data fields describing alignment with BIPs, local planning, and criticality are likely to be considered. Note that some of these categories are subjective and were considered differently across basins. Tiering has no bearing on whether a project can be funded. Project proponents can apply for CWCB funding whether or not their project is in the database, and inclusion of a project in the database does not guarantee funding. For the CWCB in the long term, it will be useful for identifying immediate- and long-term project costs and associated funding needs. Data fields describing level of readiness, alignment with the Colorado Water Plan, and the amount of available project data will also be considered.

TIER 1	**Supported and Ready** *Ready to launch and has full data set*
TIER 2	**Supported and Pursued** *Almost ready to move forward and has a significant amount of data*
TIER 3	**Supported and Developing** *Project is developing but still needs to be fleshed out*
TIER 4	**Considering** *Project not yet moving forward but should be kept on the list*

Section 8. Education and Outreach

The update to the Gunnison BIP continues the public education, participation, and outreach (PEPO) work that the Gunnison BRT has been engaged with for more than 15 years. These activities have included:

- Annual State of the River meetings co-hosted with the River District.
- Numerous roundtable meetings in Montrose, Gunnison, and Hotchkiss. Meetings are typically held in all months except January, July, and September.
- The preparation and distribution of a booklet titled: The Gunnison Basin, A Handbook for Inhabitants. This widely distributed handbook includes a compendium of basic information about water use, water law, and water organizations in the basin.

In addition to monthly Gunnison BRT meetings, Gunnison BRT members held targeted technical outreach meetings with specific groups of stakeholders (farmers and ranchers, municipal and industrial providers, recreational interests, and environmental interests, among others) to update current project data and identify new projects for the BIP Update.

The Gunnison Basin PEPO Workgroup developed an Education Action Plan for 2020-2021 in support of Colorado Water Plan goals and objectives and consistent with the Gunnison BIP to provide water education for current and future Coloradans with a focus on Gunnison Basin topics.

This plan has the following elements:

1 **Continue and expand efforts to develop and distribute water resources information related to the Gunnison Basin, including, but not limited to, regional and basin-specific water supplies and demands, related hydrology and watershed information, water quality influences, and challenges and opportunities facing citizens. Methods of information distribution will include:**

- Operating and maintaining the GunnisonRiverBasin.org website
- Actively managing multiple integrated digital social marketing platforms (i.e., Twitter and Facebook)
- Creating and distributing a monthly Gunnison Basin electronic newsletter (and archived on publicly accessible website(s) and social media)

2 Customize and market the water resources information to several distinct audiences, including:

- Basin residents, state citizens, community leaders, and decision makers
- The "next generation" of Gunnison Basin water users, such as K-12 and post-secondary education students as well as young farmers/ranchers of the Gunnison Basin
- Experienced and new water users in all sectors, including municipal and industrial water providers
- Current and potential Gunnison BRT participants and WSRF applicants, especially those that are focused on Colorado Water Plan and Gunnison BIP activities
- New target audiences, as appropriate, that may be identified

3 Use the Gunnison BRT and PEPO educational platforms to engage and inform Coloradans by:

- Promoting relevant water news and events in the Gunnison Basin
- Organizing and distributing information related to Gunnison BRT meeting activities, agendas, minutes, and events
- Publicizing relevant events and maintaining an electronic calendar of events related to water organizations including, but not limited to, water conservancy districts (Upper Gunnison, North Fork, Crawford, Grand Mesa, Tri-County, Upper Uncompahgre River Watershed, and others)
- Highlighting and explaining important news, hydrological conditions, and reservoir operations for major reservoir systems, including by not limited to, the Aspinall Unit, Taylor Park, Ridgway, Paonia, and Crawford
- Providing a public venue or "electronic bulletin board" for informational postings for watershed-related groups, such as the Coal Creek Watershed Coalition, Friends of the River Uncompahgre, Gunnison Basin & Grand Valley Selenium Task Force, High Country Citizens' Alliance, Lake Fork Valley Conservancy, Lake Fork Watershed Working Group, Ridgway Ouray Community Coalition, Uncompahgre Watershed Partnership, and the Western Slope Conservation Center, as desired and appropriate
- Publicizing river festivals and river events, such as in those held in Gunnison, Ridgway, and Hotchkiss
- Advertising and partnering with sponsors of public water educational meetings, such as the periodic "State of the River" meetings convened by the Colorado River District
- Collaborating with K-12 educators, especially those involved with water-related activities (e.g., seminars, field trips, and public forums)
- Partnering with related higher-education facilities, such as the Water Center at Colorado Mesa University, Western Colorado University's Environmental and Sustainability Program (water emphasis section), and Water Education Colorado to share pertinent water resources information
- Participating in state and regional activities that are consistent with guidance in the Statewide Water Education Action Plan