SECTION 1
INTRODUCTION

Clean and reliable water supplies are essential to our way of life. All of us—agricultural producers, urbanites, environmentalists, and recreationalists—depend on it for healthy lifestyles, a vibrant economy, and a beautiful environment. These are the reasons we call Colorado home, the qualities that attract new Colorado residents, and the drivers of the Colorado Water Plan (Water Plan).

Colorado's water supplies are limited, yet our demands on those supplies continue to increase. Throughout Colorado's history, and especially in recent decades, we have experienced severe drought conditions, extreme flooding events, population booms, and economic recessions. These extremes often reflect larger shifts that highlight the importance of resiliency in our water supplies, and the need for thoughtful, collaborative planning.

The Colorado Water Plan provides a framework for developing resilient responses to our water-related challenges. It articulates a vision for collaborative and balanced water solutions led by the Colorado Water Conservation Board (CWCB) and our grassroots basin roundtable structure. The Water Plan's success will be fostered by the development of technical information and robust analysis tools that support informed decision making on how to tackle our State's challenges.

Following the 2015 launch of the Water Plan and BIPs, the CWCB began a process of updating the underlying water supply and demand analyses. The work included collaboration with TAGs, which included diverse basin roundtable representatives from each basin and subject matter experts. The TAGs helped outline the methods to be used in the Analysis and Technical Update to the Colorado Water Plan, hereafter Technical Update (formerly known as the Statewide Water Supply Initiative or SWSI), which establishes a new approach to statewide water analysis and data sharing.

While this effort stems from past water supply and demand projections (SWSI I, SWSI II, and SWSI 2010), it is markedly different in its scope and approach. Key features include more robust modeling, integration of scenario planning, incorporation of climate change, and the development of functional support tools to promote data refinement. With these enhancements, the Technical Update sets the stage for enhanced basin-level planning.

The Technical Update methods and results are described in this report, along with a description of how the study fits into the next phases of Colorado water planning. Designed for accessibility, this document summarizes the findings of the analysis and is supported by additional technical memoranda and data that can be accessed at www.colorado.gov/cowaterplan.

1.1 COLORADO'S STATEWIDE WATER PLANNING CYCLE

1.1.1 Colorado's Statewide Water Planning Cycle & Recent Water Planning Efforts

In the early 2000s, severe statewide drought, combined with increasing water demands, spurred Colorado's General Assembly to undertake long-term water planning initiatives. One key initiative established the nine basin roundtables as well as the creation of the Interbasin Compact Committee (IBCC). A second key action was the initiation of the Statewide Water Supply Initiative (SWSI). The latter, created a statewide technical analysis to quantify future demands and potential gaps in the ability to supply Colorado's water needs. The roundtables formalized a grassroots process to bolster communication and collaboration within and between major river basins.

Since the early 2000s, Colorado's statewide planning process has evolved to include additional planning phases that foster communication, transparency, and action. Updates to the SWSI data sets and analyses provided new and enhanced information for basin roundtables to use in developing strategies and tangible solutions to meet future consumptive and nonconsumptive needs.

In 2015, BIPs were completed to provide basin-focused portfolios of solutions to projected supply gaps. The BIPs provided basin-level details to the Colorado Water Plan, which sets statewide policy and implementation strategies to meet current and future water-related challenges. The timeline on the following page summarizes major water planning efforts since 2003.

MAJOR DROUGHT

The 2002-2003 drought and the 2002 Hayman Fire (Colorado's largest fire) trigger legislative action that focused on water supply planning and statewide collaboration.

SWSI I

The first Statewide Water Supply Initiative (SWSI I) provided quantification of current and future water needs through 2030.

WATER FOR THE 21st CENTURY ACT

The Water for the 21st Century Act created the nine basin roundtables and the Interbasin Compact Committee (IBCC) in an effort to build more collaborative cross-basin water planning.

SWSI II

The second phase of SWSI (SWSI II) established technical roundtable groups for Conservation, Alternative Agriculture Water Transfers, Environment and Recreation, and Water Supply Gaps.

SWSI 2010

SWSI 2010 incorporated SWSI II work group findings, analyzed future water needs through 2050, and served as the technical foundation for the Colorado Water Plan.

THE COLORADO WATER PLAN

The Colorado Water Plan (Water Plan) brought together statewide planning objectives and local implementation activities under a common banner.

RIPPLE EFFECTS

Provided an update of progress made toward meeting the actions and objectives of the Water Plan.

TECHNICAL UPDATE

In keeping with goals of the Water Plan to update SWSI efforts, the Technical Update launched in Summer 2019.

NEXT STEPS

Building on 2018-2019 BIP update scoping, basins will work with the CWCB to use the methodologies, findings and recommendations from the Technical Update to revise BIPs and update the Water Plan.

2000 2002 2004 2005 2007 2010 2015 2017 2019 2020

Moving Forward Under the Colorado Water Plan

Colorado water users understand that making specific predictions of future conditions is impossible. From precipitation to population, there are any number of possible shifts that could significantly impact water availability. Being responsive to these drivers of change requires thoughtful planning and adaptive management. This involves using the best data available to predict a range of variant futures, which helps ensure Colorado's water planning is robust and flexible enough to address future concerns. The five planning scenarios identified in the Colorado Water Plan were born from this effort and were developed through an iterative process with the basin roundtables and the IBCC.

Holistic Planning

Colorado recognizes the evolutionary nature of water resource planning and implementation. The two are not mutually exclusive, and occur simultaneously at several scales. Colorado's cyclical, statewide planning process is made up of three phases:

A **Analysis and Technical Update Phase** – includes the statewide Analysis and Technical Update to the Water Plan with standard tools, datasets, and analyses quantifying future supplies, demands, and resource gaps.

B **Basin Plan Update Phase** – includes local, basin-wide planning conducted through BIP updates that integrate information from the analysis phase and work to identify projects that address gaps and other priority basin needs.

C **Comprehensive Update Phase** – includes the Water Plan update itself with a focus on metrics, goals, timelines, and strategies that honor the values in the Water Plan and work toward implementation.

These phases occur cyclically and are, by design, iterative. To that end, the Water Plan process in its entirety (phases A, B, and C) are constantly being updated, planned for, and implemented. Each phase works in concert to refine the understanding of existing and future gaps in water supply and to identify solutions for addressing these gaps.

1.1.2 Advanced Methodologies and Refined Objectives

Advanced Methodology

The Technical Update addresses a variety of questions using new TAG-supported methodologies and analysis tools. The analysis leverages the State's 25+ year investment in Colorado's Decision Support Systems (CDSS), which has made significant gains in basin modeling since SWSI 2010. Use of CDSS and more robust modeling has been incorporated into the new analysis methodologies.

The new analysis tools help prepare for the future in a more robust manner; however, more in-depth modeling capabilities also help us shed light on new questions that previous SWSI studies were not able to accurately integrate or fully consider, such as potential effects of climate change, variable hydrology, and water rights. At the same time, several new planning concepts are being incorporated into the Technical Update that were not part of prior versions of SWSI. Most notably, incorporating the scenarios in the Water Plan offers a new way of evaluating Colorado's water needs that is significantly different from earlier versions of SWSI. A shortlist of key differences in this Technical Update and SWSI 2010 follows:

- **Scenario planning and adaptive management**

  The Colorado Water Plan developed five plausible water supply/demand year 2050 scenarios that consider varying levels of high-impact drivers such as population increase, agricultural water needs, adoption of conservation measures, social values, and climate conditions. These scenarios are foundational to the analyses and modeling in this Technical Update.

- **Climate change impacts to demand and supply**

  Climate change is a consideration in three of the five planning scenarios described in the Colorado Water Plan. The Technical Update evaluates how potential impacts from climate change affect flows, diversions, crop demand, reservoir storage and more through the use of StateMod water allocation models and StateCU consumptive use models that have been fully developed in most basins. These CDSS modeling tools enable analysis of variable supply and demand conditions and provide a broader view of gaps and how they may vary in response to changing supply and demand drivers.

- **Agricultural diversion demand gaps**

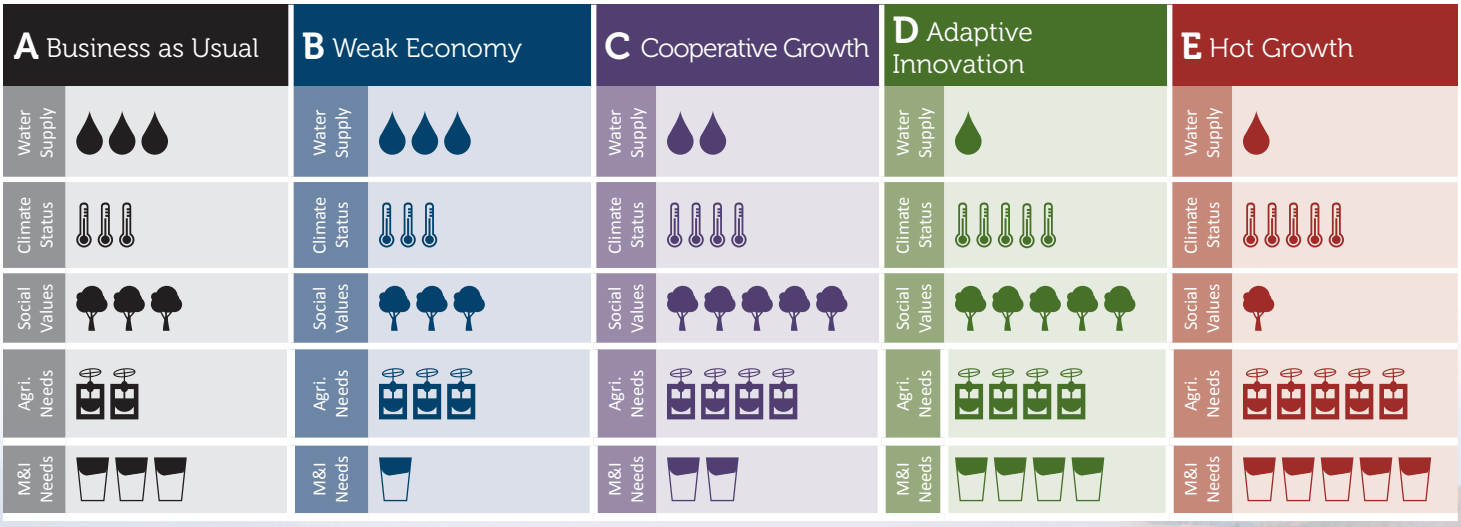
  The SWSI 2010 update quantified historical, field-level agricultural water shortages by comparing crop water demands with historical water deliveries to farms. The Technical Update takes this a step further by using CDSS consumptive use and water allocation models to estimate agricultural gaps in terms of agricultural diversion demands. Diversion demands account for crop demands, application and conveyance efficiencies, and available supply. As a result, agricultural gaps are larger than the field-level shortages quantified in SWSI 2010. The previous methodology was updated to provide basin roundtables with information and tools to use in analyzing "what if" scenarios and for evaluating the effectiveness of future projects, and to provide consistency with estimates of municipal and industrial demands.

Refined Objectives

Given the context and the new planning concepts described above, the primary objectives of the Technical Update report are to:

- Update and recharacterize future gaps and the ability to meet municipal, self-supplied industrial, and agricultural water needs. This recharacterization considers variable hydrology and variable demands in the context of five planning scenarios. The results help basin roundtables account for future uncertainties and develop planning strategies to mitigate future shortages.
- Evaluate environmental and recreational flow needs with new tools. The tools include an enhanced database of E&R attributes and a standardized tool for high-level review of future scenario impacts on streamflows.
- Create user-friendly standardized tools and data products for BIP updates, basin-level project and cost planning, and improved communication and outreach—all aimed at helping basins mitigate future shortages.

Figure 1.1.1 CWP Planning Scenarios and Key Drivers Graphical Summary



1.2 TECHNICAL ADVISORY GROUPS AND OUTREACH

The CWCB enlisted TAGs to develop analysis methodologies and modeling inputs in a collaborative manner. Four TAGs were formed consisting of stakeholders, subject matter experts, and basin roundtable members. The TAGs focused on the following four topics:

- Planning Scenarios
- Environment and Recreation
- Municipal and Self-supplied Demands
- Agricultural Diversion Demands

Each TAG evaluated proposed methodologies through a similar process. First, draft methodologies were distributed to TAG members for review. Comments were discussed at length in the first of two TAG workshops. Consultants updated draft methodologies in response to comments and active discussion and then redistributed the revised drafts to TAG members for re-review. A second meeting was held to describe changes to the methodologies and discuss any final concerns. All final technical memoranda were posted to the CWCB website. A list of TAG members, their organizations, and the basins they represent are included in Appendix D.

In addition to TAG meetings, CWCB staff used the following outreach efforts during the Technical Update process:

- Produced easy-to-read fact sheets that summarized proposed Technical Update methodologies
- Presented progress reports at CWCB board meetings and basin roundtable meetings
- Held targeted stakeholder meetings with basin stakeholders (many of whom were TAG members) to obtain basin-specific information to improve modeling input data
- Hosted webinars to present methodologies and results of various Technical Update components
- Gave presentations at water-related forums such as Colorado Water Congress, farm shows, and conventions
- Conducted live polling and surveys at various intervals to allow for real-time feedback throughout the update process
- Updated and maintained website content, including recordings of various meetings
- Sought feedback from the Implementation Working Group—a group convened by the CWCB that includes basin roundtable and Interbasin Compact Committee members—to help inform Technical Update recommendations and next steps.