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# YAMPA-WHITE-GREEN

## Basin Implementation Plan

# Basin Implementation Plan at a Glance

The Yampa-White-Green (YWG) Basin Roundtable will promote a sustainable and diversified economy while supporting a healthy river.

## KEY ACHIEVEMENTS

**Numerous benefits achieved through diverse project successes, including:**

- Yampa Integrated Water Management Plan
- White River Integrated Water Initiative
- Agricultural Improvement Projects
- White River Algae Research Project

## CHALLENGES

**Climate Change.** Meeting the water resource needs for agriculture, municipal and industrial (M&I), tourism and recreation, and protecting endangered species are made more difficult by the anticipated impacts of a hotter, drier climate. Water quality issues and Colorado River Compact concerns are exacerbated.
**The water-energy nexus presents unique challenges and opportunities.**

## OUTREACH STRATEGIES

Community support is gained through educating the community about water impacts, water challenges facing the YWG Basin, and proposed solutions. Informed discussions encourage locally driven collaborative solutions, and partnerships with other YWG Basin organizations provide a mechanism by which public input and feedback can be relayed to the Interbasin Compact Committee.

## GOALS + OBJECTIVES

### The basin has 8 GOALS centered around:

- ✓ **Protect the YWG Basin from compact curtailment of existing decreed water uses and some increment of future use**
- ✓ **Restore, maintain, and modernize water storage and distribution infrastructure**
- ✓ **Protect and encourage agriculture uses of water in the YWG Basin within the context of private property rights**
- ✓ **Improve agricultural water supplies to increase irrigated land and reduce shortages**
- ✓ **Identify and address M&I water shortages**
- ✓ **Quantify and protect environmental and recreational (E&R) water uses**
- ✓ **Maintain and consider the existing natural range of water quality that is necessary for current and anticipated water uses**
- ✓ **Develop an integrated system of water use, storage, administration, and delivery to reduce water shortages and meet E&R needs**

## DEMAND, SUPPLY, POTENTIAL WATER NEEDS

**Municipal and Industrial:**
The combined YWG Basin currently includes less than 1 percent of the statewide population. The YWG Basin includes about 17 percent of the statewide industrial demand. M&I gaps in the White Basin are larger than in the Yampa Basin because the White Basin lacks access to storage.

**Agriculture:** Agriculture is a primary focus, and future urbanization of irrigated lands is expected to be limited. The YWG BRT identified an additional 14,805 acres that could be brought into production in the Yampa Basin. Agriculture currently experiences gaps in the late irrigation season that are anticipated to increase under a warmer climate and be exacerbated by increased crop irrigation requirements.

**Environment and Recreation:**
The Flow Tool results projected highly variable peak flows. Projected decreases in mid- and late-summer flows create risk for fish from loss of habitat and increased water temperatures. In climate-impacted scenarios, instream flows will likely not be met during summer and winter months, and recreational in-channel diversions could be impacted.

**Water Supply:**
Available water supplies in the Yampa and White Basins vary in the planning scenarios and are primarily driven by climate-change assumptions. Scenarios with climate-adjusted conditions result in increased agriculture and M&I gaps, and increased risks to E&R. Stakeholders will need strategies to mitigate/adapt to the increased risks.

## STRATEGIC VISION

# Key strategies achieve the eight YWG Basin goals.

### These strategies include:

- **Exploring opportunities to increase agricultural efficiency while maintaining the benefits of flood irrigation return flows**
- **Exploring opportunities to deliver reservoir water to users with gaps**
- **Exploring opportunities for new or expanded storage in key locations, especially in the White Basin**
- **Implementing projects**

## FUTURE PROJECTS

**More than**
**$650 million**
**total estimated costs for project implementation***

**84 Total Projects**

**28 Tier 1 Projects**

**40 Multi-purpose Projects**

**43 Projects meet agricultural efficiency needs**

**52 Projects meet environmental and recreational 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 CWCB thanks the members of the Yampa-White-Green Basin Roundtable for their efforts in updating their Basin Implementation Plan and contributions to the update of the Colorado Water Plan.

- **Doug Monger –** *Routt County Commissioner*
- **Tom Gray –** *Moffat County Commissioner (IBCC Rep)*
- **Gary Moyer –** *Rio Blanco County Commissioner*
- **Stephen Hinkemeyer –** *Moffat County Municipality*
- **Alden Vanden Brink –** *Rio Blanco County Municipality (Chair)*
- **Ken Brenner –** *Upper Yampa Conservancy District (IBCC Rep)*
- **Mike Camblin –** *Juniper Water Conservancy District (Vice Chair)*
- **Shawn Welder –** *Yellow Jacket Water Conservancy District*
- **J Sheehan –** *Pothook Water Conservancy District*
- **Tim Winkler –** *Rio Blanco Water Conservancy District (Vice Chair)*
- **Hunter Causey –** *Colorado River Water Conservation District*
- **Callie Hendrickson –** *House Senate Appointment*
- **Brian Hodge –** *Environmental Appointment*
- **Kacey Green –** *Great Northern Water Conservancy District*
- **Sam Stein –** *CWCB Liaison*
- **Will Myers –** *Agricultural Appointment*
- **Kent Vertrees –** *Recreation*
- **Frank Alfone –** *Domestic Water Provider*
- **Rich Thompson –** *Industrial Water Interest*
- **Jeff Meyers –** *At-large Representative*
- **Jackie Brown –** *At-large Representative & CWCB*
- **Jeff Comstock –** *At-large Representative*
- **Doug Davis –** *At-Large Representative*
- **Chuck Whiteman –** *At-large Representative*
- **Deirdre Macnab –** *At-large Representative*
- **Chuck Grobe –** *At-large Representative*
- **Travis Day –** *At-large Representative*
- **Bill Badaracca –** *At-large Representative*
- **Vince Wilczek –** *At-large Representative*
- **T. Wright Dickinson –** *Green River Basin*
- **Patrick O'Toole –** *Non-voting Out of Basin Rep*

# 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, 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 Yampa, White and Green Basins, the vision for how individuals and organizations can meet future needs, and the goals and projects that provide a pathway to success. The initial Yampa-White-Green BIP was completed in 2015, and this is the first update of that plan.

| THE YAMPA-WHITE-GREEN BASIN IMPLEMENTATION PLAN CONSISTS OF TWO VOLUMES: | |
|---|---|
| **VOLUME 1:** | A summary of the Yampa-White-Green Basin's current and future water resources, focusing on goals, projects, and a strategic vision to meet future water needs. |
| **VOLUME 2:** | A more comprehensive description of Yampa-White-Green Basin achievements, challenges, goals, and strategic vision for meeting future water needs, as well as legacy and specific information on technical analyses, project data, and case studies. Note that Volume 2 is organized in a slightly different order than Volume 1. |

## Section 1. Basin Overview

The Yampa, White, and Green (YWG) Basins cover approximately 7,660 square miles in northwestern Colorado. The basin landscape is diverse and includes steep mountain slopes, high plateaus, canyons, and broad alluvial valleys. The forested mountain ranges are covered with snow in the winter, which melts into streamflow during spring and summer. Livestock, grazing, and recreation are the predominant land uses. Near the towns of Craig, Hayden, Steamboat Springs, Yampa, Meeker and Rangely, much of the land is dedicated to agricultural use. The Steamboat Springs area, featuring a destination ski resort, is likely to experience continued and rapid population growth.

The region has a rich agricultural heritage and a strong tourist economy based on snow sports, boating, fishing, and hunting. Environmental assets include wilderness areas, endangered fish species, and vast natural landscapes. The YWG Basin also contains some of the richest deposits of fossil fuels in the nation.

**AGRICULTURE**

- Agriculture is a primary focus in the Yampa Basin. Irrigated acreage in the basin consists primarily of high mountain meadows and cattle ranches in the upper reaches along tributaries and the mainstem of the Yampa River. Irrigated acreage is also located along the Little Snake River as it meanders between Colorado and Wyoming.
- Approximately 60 percent of the irrigated acres in the White Basin are concentrated along the river near the Town of Meeker. The remaining acreage is located along tributaries and spread along the lower mainstem. Grass pasture is the dominant crop, and alfalfa is also grown. These forage crops support cattle grazing and ranching operations, which is a major economic driver.

**WATERSHED**

- The Upper Colorado Basin is historical and current habitat for the humpback chub, bonytail, Colorado pikeminnow, and razorback sucker. These four endangered fish species are the focus of the Upper Colorado River Endangered Fish Recovery Program (Recovery Program). The fish species have long life spans, live in warm water, and have adapted to the high-sediment and high-flow-variability characteristics of desert rivers. The Yampa, White, and Green Rivers provide critical habitat for the wild and stocked populations of these fish.
- The Yampa and White Basins contain diverse and rich environmental and recreational resources that support activities such as kayaking, tubing, fishing, and flatwater recreation. Steamboat Lake is the basin's only designated Gold Medal fishery.

**MUNICIPAL AND INDUSTRIAL**

- Steamboat Springs and Craig are the major population centers in the Yampa Basin, with 12,900 and 8,900 residents, respectively. Rangely and Meeker are the major population centers in the White Basin, with about 2,400 residents each.
- The Green River formation within the Piceance Basin of Garfield and Rio Blanco Counties is the most significant deposit of oil shale in the world.

**COMPACTS, ADMINISTRATION, AND REGULATORY**

- The State of Colorado is party to the 1922 Colorado River Compact and the 1948 Upper Colorado River Compact. Two large reservoirs, Lake Powell and Lake Mead, serve to buffer the year-to-year water supply variability. As the total water supply for the reservoirs decline, the risk of Lakes Powell and Mead being drawn down to critically low levels and a "call" under compact administration increases. The risks specifically to the YWG Basin of a compact call are unknown because it is not certain how the Colorado State Engineer would administer such a call; however, there is the potential that water use could be curtailed.

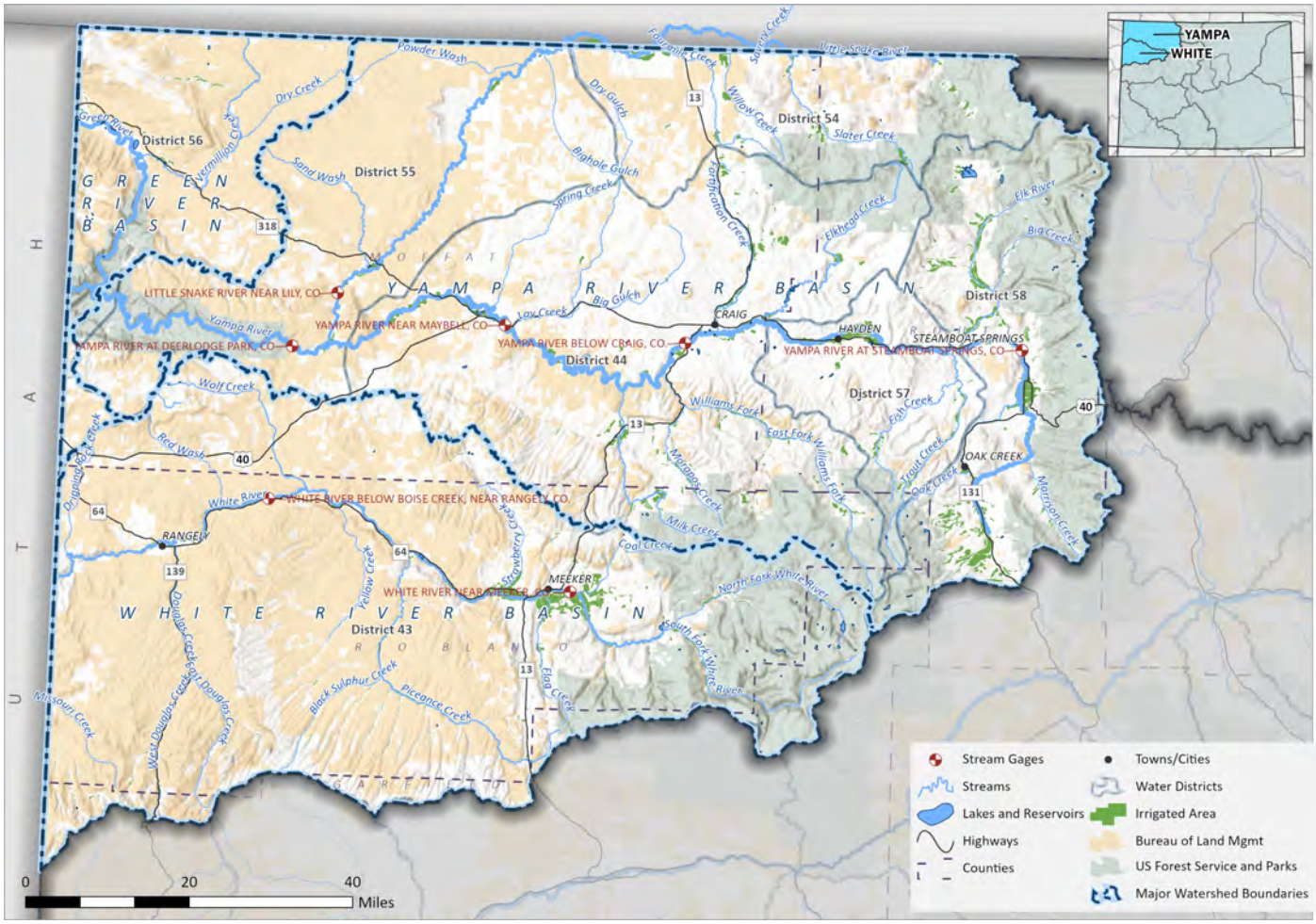



**Figure 1. Yampa-White-Green Basin Map**

# Section 2. Basin Challenges

Key future water management issues for the YWG Basin include gas and oil shale development; addressing water resources need for agriculture, tourism, and recreation; and protecting endangered species. These challenges are outlined in the Colorado Water Plan and are summarized below.

KEY CHALLENGE

**Balancing traditional economic activities with emerging consumptive demands while meeting environmental and recreational needs is the overarching challenge in the basin.**

**Table 1. Key Future Water Management Issues and Challenges in the Basin**




| AGRICULTURE | WATERSHED | MUNICIPAL AND INDUSTRIAL | COMPACTS, ADMINISTRATION, AND REGULATORY |
|---|---|---|---|
| • Agricultural producers would like to increase irrigated land by 14,805 acres but lack finances to do so.<br>• Agriculture in the White Basin does not have reservoir/supplemental supplies, which can cause late-season shortages.<br>• Agriculture is vulnerable to climate change due to the expected changes in hydrology and the increase in crop irrigation requirements due to warming temperatures. | • Stream temperatures and increasing nutrient loads are emerging water quality concerns. Increasing stream temperatures on the Yampa River have resulted in a 303(d) impaired stream listing. Benthic algae in the White River can reach uncharacteristic and nuisance levels. | • The high degree of uncertainty surrounding oil shale development and related water demands are a challenge.<br>• In the Yampa Basin, the planned closure of the coal-fired electric generation stations is a serious economic and social challenge.<br>• Population growth and future anticipated and unanticipated needs are a concern for the basin, and adequate storage, along with strong municipal conservation measures, must be coordinated with drought plans to adequately address the situation. | • While the population is rapidly growing in the Steamboat Springs area, the YWG Basin as a whole is not developing as quickly as other portions of the state. Concerns have arisen that the basin will not get a "fair share" of water under the Colorado River Compact in the event of a compact call. |

**CROSS-SECTOR CHALLENGES**

- Agriculture, tourism, and recreation are vital components of this basin's economy. As the needs of communities and industry grow, competition among sectors could increase.
- Wildfire frequency and severity is increasing in the western United States. Because wildfires have the potential to impact a watershed's water quality and quantity, water managers are joining efforts to improve forest health and create more wildfire-resistant landscapes.
- Drought impacts and their effects, potentially exacerbated by climate change, have continued to grow (the mainstem of the Yampa River saw its first-ever senior water rights call in 2018). It now appears they will be a major focus of basin water planning, particularly with respect to compact matters and possible new Colorado Basin initiatives, such as Drought Contingency Planning and Demand Management, which are aimed at addressing overall system shortages.

**IMPLEMENTATION OF A SUCCESSFUL UPPER COLORADO RIVER ENDANGERED FISH RECOVERY PROGRAM IS VITAL TO ENSURING PROTECTION OF EXISTING AND FUTURE WATER USES.**

# Section 3. Achievements

The Yampa-White-Green Roundtable (YWG BRT), one of nine roundtables in the state, has been engaged in a wide variety of projects and activities since the YWG BIP was issued in 2015. The projects and activities furthered the goals of the YWG BRT and provided numerous benefits to agricultural, environmental, recreational, and municipal water users. Several of these achievements are summarized in this section.

**Volume 2, Section 4 identifies numerous achievements related to the 2015 BIP objectives. Example achievements are described in this section.**

## Agricultural Improvement Projects

Photo Credit: Yampa IWMP Diversion Infrastructure Assessment

**Restore, maintain, and modernize agricultural infrastructure.** From 2015 to present, the YWG BRT has approved four grant applications for individual diversion improvement projects. For more information on each project, please refer to Volume 2 or the website (**https://yampawhitegreen.com/projects/**). Taken together, these projects have resulted in new headgate structures, re-designed in-river diversion infrastructure, lining of earthen canals, pond sediment removal, and check structure installation. The projects have provided direct benefit to agricultural users and the river. The upgrades have improved water delivery efficiency, enhanced water management in the ditch, and improved control over the volume of water diverted from the river. The upgrades improve river conditions by allowing water to be left in the river and improve water quality.

**PROJECT PROPONENTS:** Martin Springs irrigators, Maybell Irrigation District, The Nature Conservancy, Walker Ditch irrigators

**TIMELINE:** Various

**COST:** $618,113

# White River Algae Research Project

Photo Credit: White River and Douglas Creek Conservancy District

**Understand and mitigate benthic algae.** In the White River, benthic algae—a component of stream food webs—attached to the stream bottom can reach uncharacteristic and nuisance levels on substrates when water chemistry and physical factors are out of balance with biological and physical removal mechanisms. High levels of benthic algae in the stream have developed in the last few years and have caused serious problems for water users.

The White River and Douglas Creek Conservation Districts are leading an effort to ascertain what is driving the algae growth in the White River and ultimately improve the overall health of the watershed. A Technical Advisory Group has been convened to guide data collection and research potential causes. So far, data has been collected and analyzed by Colorado Parks and Wildlife, Trout Unlimited, and consultants. The full analysis of the collected data and a U.S. Geological Survey peer-reviewed report will be published in 2022. A better understanding of algae growth, based on science, is expected to lead to the development of mitigation strategies.

**PROJECT PROPONENTS:**
White River and Douglas Creek Conservation Districts

**TIMELINE:** Started in 2018, estimated completion in 2021

**COST:** $572,590


Photo Credit: White River and Douglas Creek Conservation Districts

# White River Integrated Water Initiative

**Community-based initiative.** In 2019, the White River and Douglas Creek Conservation Districts worked with the community and a Planning Advisory Committee (PAC) to determine the feasibility of, and level of interest in, developing an integrated water management plan (IWMP) on the White River. Through interviews and public meetings, sufficient support was found to pursue an IWMP that will protect and improve the White River and the communities that depend on it. The White River Integrated Water Initiative (IWI) is a "community-based initiative to identify actions promoting a healthy river that ensures a vibrant agricultural community and maintains healthy fisheries while protecting water rights, quantity, and quality with respect for the local customs, cultures, and property rights." The PAC set the following goals for the IWI:

- Protect and preserve existing water rights and other beneficial water uses.
- Protect and enhance water quantity and quality by promoting best management practices for forest health, riparian health, rangeland health, and favorable conditions of streamflow.
- Identify opportunities for creation or improvement of infrastructure to support efficient consumptive and nonconsumptive uses.
- Support the development and maintenance of efficient and necessary long-term storage solutions that will improve, enhance, and ensure irrigation, river health, water quantity, water quality, and native and recreational fisheries.

In 2021-2022, the PAC will continue to work with communities to develop objectives and river-segment-specific goals, as well as develop the Phase 3 Scope of Work. The effort will include a diversion structure assessment and riparian health assessment to establish a baseline and identify potential projects that would advance the above-stated mission and goals.

**PROJECT PROPONENTS:** White River and Douglas Creek Conservation Districts. Planning Advisory Committee also includes Colorado Parks and Wildlife, Fishing Representative, Irrigation Representative, Rio Blanco County, Rio Blanco County Farm Bureau, Rio Blanco Stockgrowers, Rio Blanco Water Conservancy District, River's Edge West, Town of Meeker, Town of Rangely, Trout Unlimited, West Slope Colorado Oil and Gas Association, White River Alliance, and Yellow Jacket Water Conservancy District.

**TIMELINE:** Started in fall 2019; estimated completion in December 2022

**COST:** $115,800

# Yampa Integrated Water Management Plan

Photo Credit: Kent Vertrees, Friends of the Yampa

**Using science and community input to build a healthy, productive water future in the Yampa Basin.** The YWG BRT is leading the development of an IWMP to make progress on its 2015 BIP goals through a collaborative stakeholder process. The effort combines community input with science and engineering assessments to identify actions to protect existing and future water uses and support healthy river ecosystems in the face of growing populations, changing land uses, and climate uncertainty. A group of volunteer committee members selected by the YWG BRT coordinates the project. From 2019 to early 2021, the IWMP conducted extensive engagement of agricultural, environmental and recreational (E&R), and municipal stakeholders, as well as science and engineering assessments. This included an assessment of 45 diversion structures in all four project river segments and a remote assessment of river health. Three areas of focus have emerged:

- Agricultural infrastructure - Strengthen agricultural diversion infrastructure to benefit agricultural operations while ultimately improving river health, fish, and flows.
- Riparian habitat, wetland, and natural bank stability - Identify projects and strategies that balance the needs of water infrastructure with increasing high-quality habitat in riparian lands through voluntary incentives for riverside landowners to sustainably manage their lands and livestock.
- Flows and shortages - Improve the YWG Basin's ability to meet the river flow needs of the fishery, seasonal recreational boaters, and agricultural water users by identifying preferred flows and alleviating shortages today and in the future through accurate datasets and modeling, coordinated storage of water that maintains a natural hydrograph, and better use of the array of available mechanisms to deliver water where it's most needed.

The volunteer committee and the YWG BRT will prioritize multi-benefit and/or broadly supported projects that address critical needs.

**PROJECT PROPONENTS:** YWG BRT is leading the Yampa IWMP. Funding and in-kind support is being provided by The Nature Conservancy, Trout Unlimited, Community Agricultural Alliance, River Network, Friends of the Yampa, Upper Yampa Water Conservancy District, Division of Water Resources, and Tri-State Generation and Transmission Association.

**TIMELINE:** Started summer 2019; estimated completion summer 2022

**COST:** $654,750

# Section 4. Updated Goals and Objectives

Each of the 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 BRTs and stakeholders achieve their respective basin targets. This section summarizes the goals, supporting processes, and anticipated outcomes developed by the YWG BRT.

**The goals developed by the YWG BRT ultimately seek to promote a sustainable and diversified economy supported by a healthy river.**

Eight basin goals were initially developed for the 2015 YWG BIP, and the BRT continues to support these goals. The underlying principle of the goals is to maintain and protect historical water use and protect water supplies for future in-basin needs. The goals ultimately seek to promote a sustainable and diversified economy supported by a healthy river.

Each goal includes objectives that define success metrics and describe near-term, focused activities that support the achievements of each objective. The BRT has sought to define practicable objectives that can be accomplished by the BRT or by stakeholders in the YWG Basin. The BRT continues to support objectives that were developed as part of the 2015 BIP and has developed new objectives that further their goals for this BIP update.

The YWG BRT has various ongoing initiatives that support the goals and objectives, which include the Yampa River IWMP, White River IWI, YWG BRT grants, and the Big River Committee. For more information on these topics, refer to Volume 2, Section 4.

## BASIN GOALS

- **Protect the YWG Basin from compact curtailment of existing decreed water uses and some increment of future use**
- **Restore, maintain, and modernize water storage and distribution infrastructure**
- **Protect and encourage agricultural uses of water in the basin within the context of private property rights**
- **Improve agricultural water supplies to increase irrigated land and reduce shortages**
- **Identify and address municipal and industrial water shortages**
- **Quantify and protect environmental and recreational water uses**
- **Maintain and consider the existing natural range of water quality that is necessary for current and anticipated water uses**
- **Develop an integrated system of water use, storage, administration, and delivery to reduce water shortages and meet environmental and recreational needs**

# 1 Protect the YWG Basin from compact curtailment of existing decreed water uses and some increment of future uses

Protecting present and future uses is the most important issue in the YWG Basin. The basin's vitality depends on maintaining the historical water uses that have come to define the basin since its settlement. To protect these uses, the YWG BRT seeks to pursue legal and advocacy options to protect the basin in the event of compact administration pursuant to the Colorado River Compact.

The YWG BRT continues to support the 2015 BIP objectives and has identified specific areas to prioritize in the near term. The YWG BRT has also developed new objectives, which are primarily related to the state and interstate level.

## OBJECTIVES

1. Document existing baseline of major decrees; environmental compliance agreements, including the Yampa and White Programmatic Biological Opinions (PBO); water rights administration protocols; and related operations, including documentation of permitted future depletions in basins under such PBOs.

   **NEAR-TERM FOCUS:**
   - Develop or support the development of additional documentation of water rights administration protocols.
   - Support the Upper Colorado River Endangered Fish Recovery Program's (Recovery Program) efforts to recover endangered fish.
   - Understand the depletion accounting performed by the State of Colorado as required by the Yampa PBO and document permitted future depletions. Stay involved with the development of the White River Management Plan and PBO.
   - Get involved, as appropriate, with Recovery Program actions on the Green River, especially as they intersect with the Flaming Gorge Reservoir Record of Decision.
   - Support water users installing measurement devices through financial help and education.

2. Detail the projected effects of water shortages from drought and climate change that may require additional water storage development to satisfy existing and future uses.

   **NEAR-TERM FOCUS:**
   - Support ongoing modeling of the White River for the PBO, which includes a monthly climate-change scenario along with a daily time stamp quantifying baseline conditions.

3. Review Division 6 water rights abandonment list and educate pre-compact water rights owners on how to maintain existing decreed water rights.

   **NEAR-TERM FOCUS:**
   - Educate pre-compact water rights owners on how to maintain existing decreed water rights.
   - Create opportunities for pre-compact rights to remain active.

4. Periodically update and refine estimates for anticipated and unanticipated future water uses.
5. Ensure the BRT has strong and responsive representation on the Interbasin Compact Committee (IBCC). ***New as of 2021***
6. Since 2015 the BRT has formed a Big River Committee (BRC) that is exploring Colorado River Compact matters, such as Drought Contingency Planning and Demand Management . The BRC has developed a recommended draft Demand Management Statement which articulates principles which are important in the development of a Demand Management program and offer protection of essential basin interests. And for additional details on the BRC and the full Demand Management Statement, please visit the website (**https://yampawhitegreen.com**). ***New as of 2021***
7. It is anticipated that in the near future, the Colorado State Engineer will develop rules for administering a Colorado River Compact Curtailment. The State Engineer has indicated he will request input from water users. The BRT plans on engaging in the process and encourages its members to do the same. ***New as of 2021***
8. Create a process to inform, involve, and educate the public on the IBCC's activities and progress of Colorado River Compact negotiations. ***New as of 2021***
9. Create a mechanism by which public input and feedback can be relayed to the IBCC and Colorado River Compact negotiators. ***New as of 2021***



## 2 Restore, maintain, and modernize water storage and distribution infrastructure

To preserve critical historical water rights and use as well as watershed health, existing infrastructure in the YWG Basin must be restored, maintained, and modernized. This goal is closely related to several other YWG Basin goals. For example, preserving infrastructure that enables the use of water rights that predate the Colorado River Compact helps to protect the basin's water supplies in the event of administration under the compact. Improving agricultural infrastructure helps to improve agricultural water supplies. Modernizing structures located in the Colorado River can protect environmental and recreational water uses. Improvements to infrastructure can impact discharges to the stream and water quality. For the other seven goals to be accomplished, the YWG Basin needs high-quality, high-functioning infrastructure.

Restoration or modernization efforts can serve to address multiple purposes, such as increasing diversion reliability and accuracy, adding hydropower generation, and improving fish and boat passage. There is a nexus between infrastructure improvement and watershed health that is currently being explored by the Yampa River IWMP and the White River IWI. The BRT encourages water users and stakeholders to consider multiple benefits when embarking on infrastructure projects.

### OBJECTIVES

1. Identify opportunities and constraints for agricultural water efficiency improvements that do not cause injury to other water users or environmental values. This may include interviewing agricultural producers to understand the efficiency, conservation, and/or preservation expectations for the YWG Basin.

   **NEAR-TERM FOCUS:**
   - The BRT supports the completion of an agricultural return flow study.

2. Identity specific locations in the YWG Basin where infrastructure requires improvement or replacement to preserve existing uses. This may include identifying the potential for value-added, multi-purpose to be included, i.e., hydropower to finance agricultural storage, and diversion structure improvements to increase water supply and improve fish and boat passage.

   **NEAR-TERM FOCUS:**
   - Continue to support the Yampa IWMP, White River IWI, and other stakeholders in the basin undertaking multi-benefit infrastructure projects.
   - Where applicable, monitor the reduction in the loss of water through more efficient water use, which includes less seepage of water through leaky ditches, headgates, and storage ponds. Monitor impacts to return flows and groundwater levels.

3. Recommend potential solutions in collaboration with local water users. The evaluation of infrastructure projects includes an initial assessment of cost, financing, permitting issues, and potential impacts to other water users. An example may include lining of earthen delivery systems and taking inventory of the capacities of existing reservoirs and repairing storage-limited older projects. Research opportunities and constraints to maintain the existing water storage capacity in the YWG Basin.

   **NEAR-TERM FOCUS:**
   - The Colorado Water Conservation Board (CWCB) has a reservoir dredging program that could assist local efforts.

4. Research potential grant programs for infrastructure improvements.

   **NEAR-TERM FOCUS:**
   - Work with Colorado River District Community Funding Partnership to increase the success of YWG stakeholder applications.
   - Work with federal grant programs, such as the National Resource Conservation Service and Bureau of Reclamation WaterSMART, to assist stakeholders in applying for grants.

5. Identify and include collective partnerships for infrastructure improvements that may provide multi-use benefit, (e.g., fish passage).

   **NEAR-TERM FOCUS:**
   - Continue to support the Yampa IWMP and White River IWI.
   - Support stakeholders in finding partnerships.

6. Evaluate appropriate measuring infrastructure for improved administration of the river.

   **NEAR-TERM FOCUS:**
   - Conduct public outreach to raise awareness of funding opportunities, such as the Upper Yampa Water Conservancy District (UYWCD) grant program.
   - Lobby to increase the number of stream gages in the basin.

7. Conduct a headgate study in all three river basins that compiles information on the efficiency and effectiveness of existing infrastructure, accessibility to diversion point, and use.

8. Support avenues to share best management practices for municipal systems to address leak detection, tank inspections, etc. ***New as of 2021***

9. Create demonstration projects to use as educational tools for best management practices. ***New as of 2021***

# 3 Protect and encourage agriculture uses of water in the YWG Basin within the context of private property rights

This goal is primarily focused on policy and education. The YWG BRT supports the continuation of viable agriculture in the basin. This goal seeks to strike a balance between supporting agricultural water users remaining in agriculture and preserving their legal ability to change their water use. While the YWG BRT opposes the dry-up of agricultural land in the basin, it also recognizes the importance of private property rights in the successful operation of Colorado's long-standing water rights system. Therefore, the YWG BRT is committed to encouraging the preservation of agriculture through any effective voluntary means. To further that goal, future education efforts of the YWG BRT may also focus on encouraging the preservation of agricultural land in the basin. Of particular interest are projects that can use senior agricultural water rights that may be at risk of abandonment.

An emerging concern related to this goal is the conversion of working ranches to second homes for absentee landowners. The aesthetic quality of the ranch may be preserved, but agricultural production declines. The BRT encourages keeping agricultural lands in production in order to maintain a viable agricultural economy.

The YWG BRT would like to highlight the importance of conservancy and conservation districts in the basin. These districts can represent the needs of agricultural water users and help promote policy discussions that benefit agriculture. Local districts can also educate their constituents on water issues. In the White Basin, the White River and Douglas Creek Conservation Districts are leading the White River IWI effort. This is one example of how local districts can bolster agricultural water use and seek partnerships with municipal, industrial, environmental, and recreational groups.

## OBJECTIVES

1. Evaluate potential cooperative and/or incentive programs to reduce agricultural water shortages.
2. Identify projects that propose to use at-risk water rights, alternative transfer methods, and water banking that protect and encourage continued agricultural water use.
3. Encourage and support municipal and industrial (M&I) projects that have components that preserve agricultural water uses.
4. Encourage land use policies and community goals that enhance agriculture and agricultural water rights.
5. Support local conservancy and conservation districts with efforts to bolster agricultural water use and seek partnerships with municipal, industrial, environmental, and recreational groups. ***New as of 2021***
6. Engage agricultural users in water policy and management discussions by using proven and effective communication tools that reach agricultural producers. ***New as of 2021***
7. Invest in education and outreach efforts that inform a broader audience (both in-basin and statewide) about agricultural water management and needs and how they can be met in the YWG Basin. ***New as of 2021***

# 4 Improve agricultural water supplies to increase irrigated land and reduce shortages

This goal is closely related to the previous goal but focuses on infrastructure and research instead of policy and education. While it is common for agricultural areas in Colorado to be water-short, agricultural shortages represent a real need and opportunity for improvement. In areas around the YWG Basin, irrigators presently practice deficit irrigation due to lack of water supplies. Agriculture is vulnerable to climate change due to the expected changes in hydrology and the increase in crop irrigation requirements due to warming temperatures. In addition, the YWG Basin is the only basin in the state projecting the addition of up to 14,805 irrigated acres in the Yampa Basin and up to 2,800 irrigated acres in the White Basin. The potential for new developable irrigation lands in the Yampa was documented in the YWG BRT's Agricultural Needs Study (2010). In the White Basin, the Rio Blanco Water Conservancy District has completed a study identifying non-federal lands with high suitability for farming. The analysis undertaken in the BIP update seeks to better define the "ag gap" in the YWG Basin. This fits with the CWCB's emphasis comparing agricultural, M&I, and E&R gaps on equal footing.

As discussed above, the YWG BRT has initiated the Yampa IWMP and supports the White River IWI. Both of these projects seek to identify multi-benefit projects that will address agricultural water supplies and improve E&R conditions.

## OBJECTIVES

1. Identify specific locations in the YWG Basin where agricultural shortages exist and quantify the shortages in times, frequency, and duration. Consider the potential effects of climate change, drought, and compact administration on water availability. Identify projects that will bring new irrigable lands in the YWG Basin into production using new water diversions.

   **NEAR-TERM FOCUS:**
   - Return flow study
   - Support ongoing modeling of the White River for the PBO, which includes a monthly climate change scenario along with a daily time stamp quantifying baseline conditions. This modeling may be useful for identifying specific reach shortages.
   - Wolf Creek Reservoir includes an augmentation component that could be used to support use of junior water rights to irrigate new ag lands or better irrigate existing ag lands.

2. Recommend possible site-specific solutions in collaboration with local water users. Recommendations include an initial analysis of hydrology (water variability), cost, financing, and permitting. Recommended projects could include new storage, especially locations for small-scale agricultural water storage projects, enlargement or repair of existing reservoirs, infrastructure to improve irrigation system efficiency, etc.

   **NEAR-TERM FOCUS:**
   - Continued support for the Yampa IWMP and White River IWI processes, which will result in project recommendations.
   - Investigate and pursue opportunities to improve agricultural efficiencies and place the saved water in storage for late-season releases to agriculture.
   - Encourage project proponents for projects such as Lake Avery Enlargement and Wolf Creek Reservoir to include agriculture as they continue to advance their projects.



3. Evaluate multiple objectives of recommended solutions.

   **NEAR-TERM FOCUS:**

   - Continue support for the Yampa IWMP and White River IWI processes, which are looking for multi-benefit solutions.
   - Continue support for the Yampa IWMP and White River IWI as they complete diversion infrastructure assessments and refine nonconsumptive needs characterizations.

4. Develop methods to assist with streamlining permitting in a cost-effective manner.

   **NEAR-TERM FOCUS:**

   - The Lower White River Storage Project Pre-Permitting grant scope of work issued by the CWCB includes a specific task referring to the "Colorado Water Supply Planning and Permitting Handbook" (October 2017), developed after a "Lean Process Improvement Event" hosted by the State of Colorado and U.S. Environmental Protection Agency.

5. Preserve the current baseline of approximately 119,000 irrigated acres and expand by 12 percent by 2030.
6. Reduce agricultural shortages basinwide by 10 percent by the year 2030.
7. Support refining CWCB's irrigated acreage assessment, specifically the acreage-to-ditch assignments. The total number of irrigated acres is updated every 5 years. Ditch service areas were assigned in 1993 and are only updated if a problem is identified. The irrigated acreage assessment is a key input to the Colorado Decision Support System (CDSS) models, which are used to identify water shortages. ***New as of 2021***
8. Support a return flow study. The usual agricultural practice in the YWG Basin is flood irrigation, which increases the soil moisture and generates lagged return flows that come back to the river later. More information is needed to understand the potential trade-offs to the river if high-efficiency irrigation methods are implemented on a large scale. ***New as of 2021***
9. Support research and education on alternative irrigation regimes, impacts of invasive species and noxious weeds, improved hydrological forecast modeling, cloudseeding, and climate change adaptation. ***New as of 2021***
10. Support education and programs that improve soil and range health. ***New as of 2021***
11. Support education and programs that improve forest/watershed health. ***New as of 2021***
12. Refine the Agricultural Needs Assessment, especially to produce a user-friendly and accessible map of lands of significant agricultural value. ***New as of 2021***

## 5 Identify and address M&I water shortages

As the YWG Basin continues to grow, its M&I water needs must be identified and addressed. Population growth and future anticipated and unanticipated needs are concerns. The Technical Update reports that "between the years 2015 and 2050, it is projected to change from approximately 44,000 people to between 39,000 and 103,000 people in the low- and high-growth projections, respectively." Adequate storage, along with strong municipal conservation measures, must be coordinated with drought plans to adequately address the situation. Additionally, supply source redundancy is an important consideration for municipal providers in the YWG Basin to prepare for potential wildfire impacts to municipal watersheds. Projects useful for both drought and supply redundancy planning should be identified and pursued. Municipal and domestic water providers regularly engage in planning for their systems. The YWG BRT supports these planning efforts and encourages water suppliers to execute their plans. Recently, the YWG BRT identified a new objective to support smaller water providers in performing water supply master planning based on best practices.

Industrial demands in the YWG Basin are in a time of great uncertainty. Traditionally, the largest users of industrial water in the Yampa Basin have been coal-fired power plants at Craig Station (operated by Tri-State Transmission and Generation) and Hayden Station (owned and operated by Xcel Energy), and the supporting coal mines (ColoWyo Mine and Trapper Mine). Both Tri-State and Xcel have announced that their plants and supporting coal mines will be closing. The entities are exploring their options with regard to their land and water rights assets. The YWG BRT supports a new industry coming to the Yampa Basin to replace the lost jobs and encourages Tri-State and Xcel to find creative uses for their water rights.

In the White Basin, the future of energy development remains uncertain. As discussed in the Energy Development Water Needs Assessment Update Phase III Final Report (2014), the Piceance Basin in the White River contains extensive deposits of conventional oil and oil shale. Currently, oil and gas companies are extracting oil and natural gas in the White Basin at a modest scale, but the potential for development is large.

## OBJECTIVES

1. Identify specific locations in the YWG Basin where M&I shortages may exist in drought scenarios and quantify the shortages in time, frequency, and duration.
2. Identify impacts throughout the basin in the context of water shortages (drought and climate change), wildfire, and potential compact compliance obligations on M&I demands.
3. Identify projects and processes that can be used to meet M&I needs.

   **NEAR-TERM FOCUS:**
   - Support the Yampa IWMP and White River IWI.

4. Encourage collaborative multi-purpose storage projects.

   **NEAR-TERM FOCUS:**
   - Support the Yampa IWMP and White River IWI.

5. Support efforts of water providers to secure redundant supplies in the face of potential watershed impacts from wildfire.

   **NEAR-TERM FOCUS:**
   - The City of Steamboat Springs and Mt. Werner Water are in the process of expanding their Yampa wells to provide redundancy.

6. Encourage municipal entities to meet some future municipal water needs through water conservation and efficiency.

   **NEAR-TERM FOCUS:**
   - Continue to support water conservation for all suppliers of M&I water.

7. Support water supply master planning as a way for entities to identify their water supply gaps and develop strategies. In particular, the YWG BRT will connect smaller water providers with the necessary resources to develop water supply master plans. ***New as of 2021***
8. Encourage water providers' planning processes to look beyond 2050. While the BIP update has a planning horizon of 2050, other planning efforts should not feel so constrained. ***New as of 2021***
9. Identify challenges for municipal providers in light of new regulations. These include corrosion control for drinking water supplies to reduce in-home levels of lead and copper, and wastewater system nutrient, temperature, metals regulations, and wastewater collection system inflow and infiltration requirements. The BRT can play a role in developing strategies that work across the basin. ***New as of 2021***
10. Identify and implement source water protection programs. This objective could be accomplished through partnerships across the basin. ***New as of 2021***
11. Connect municipal and special district water providers with technical resources and grant programs and provide a forum for a two-way exchange of ideas to enhance participation. ***New as of 2021***

# Quantify and protect environmental and recreational water uses

Environmental and recreational water uses are critical to the economy and way of life in the YWG Basin. The YWG BRT recognizes the economic value of the relatively natural flow regimes of the Yampa and White River systems. This goal addresses how to protect these values.

The YWG BRT has been at the forefront of quantifying E&R water uses. In 2010, the Environmental and Recreational Nonconsumptive Focus Mapping was completed. This study identified important nonconsumptive characteristics by reach. In 2012, the Watershed Flow Evaluation Tool (WFET) was developed, which evaluates the risk to E&R attributes based on changes to the flow regime. For the Technical Update, the WFET framework was applied statewide to produce the Flow Tool. The Flow Tool provides a common platform for nonconsumptive needs and flow-ecology relationships throughout Colorado. In the original YWG BIP, the YWG BRT inventoried and mapped environmental and recreational projects. This list has been updated for the BIP update and incorporated into the Project Database.

The Colorado Water Plan encouraged the use of stream management plans (SMP) and other tools to help protect E&R attributes. The YWG BRT has taken this recommendation seriously. The YWG BRT provided grant funding to support the City of Steamboat's Yampa River Management Plan in 2016 and the implementation of the Yampa River Forest Restoration Project and Temperature Mitigation Project, which are some of the actions identified in the plan. As discussed above, the YWG BRT is leading the Yampa IWMP. This project seeks to collect new data to better quantify environmental water uses in the four segments of interest and to protect agricultural and E&R water uses through multi-benefit projects. The BRT also supports the White River IWI and looks forward to partnering with conservation districts as they move through their community-driven process.

Recovery of the endangered fish native to the Yampa, White, and Green Rivers is important to the YWG BRT. The BRT would like to call attention to how the fish use the Yampa, White, and Green Rivers as one connected habitat and encourage the U.S. Fish and Wildlife Service (USFWS) to consider a holistic approach, when appropriate and feasible under the constraints of the existing and future PBOs and management plans, and the Flaming Gorge Record of Decision.

## OBJECTIVES

1. Identify specific locations in the YWG Basin where identified nonconsumptive needs are not being met. Apply the findings and results on flow-alteration risks and nonconsumptive needs from the WFET, alternative transfer methods, and projects and methods studies for the YWG Basin and compare those with the hydrologic, operational, and depletion assumptions for the PBO and proposed BIP projects. Otherwise, quantify flow needs in time, frequency, and duration at nodes identified in the study.
2. Recommend potential site-specific solutions and projects in collaboration with local water users. Recommended solutions may include an initial analysis of the hydrology, the impact of climate change, interstate compacts, cost, financing, and permitting

   **NEAR-TERM FOCUS:**
   - Continue to support the on-going efforts of Yampa IWMP and White River IWI.

3. Perform analyses to maximize the effectiveness of recommended solutions for meeting multiple objectives (i.e., consumptive and nonconsumptive). Examples of projects include the appropriation of new instream flow water rights; water rights and storage leasing; diversion, headgates, structures, and river improvement to allow irrigation efficiencies; and riparian restoration and habitat improvement to improve specific and general watershed health for consumptive and nonconsumptive uses alike.

   **NEAR-TERM FOCUS:**
   - Continue to support the on-going efforts of Yampa IWMP and White River IWI.

4. Recognize that floodplains, riparian areas, and wetlands are natural storage reservoirs, and implement restoration projects to maintain and improve these storage reservoirs. Rehabilitation of degraded riparian areas and reconnection of floodplains in degraded stream systems allows spring floods to recharge groundwater tables for slow release to the stream system later in the summer, which supports low flows and helps maintain nonconsumptive benefits.

   **NEAR-TERM FOCUS:**
   - Track restoration projects and support maintenance of restored habitats.
   - Implement riparian restoration activities identified in Steamboat SMP, Yampa IWMP, White River IWI, and Steamboat Wetland Restoration Feasibility Study.
   - Lower White River Weed and Pest District is undertaking a riparian restoration project, which is specified as a goal of the White River IWI.
   - Reconnect streams with floodplains. Maintain and restore wetland and riparian habitats.

5. The PBO and its depletion coverage for the Yampa Basin for existing and future anticipated and unanticipated depletions will meet base flow targets in critical habitat areas and assist with endangered fish recovery.

   **NEAR-TERM FOCUS:**
   - Continue support of Elkhead Reservoir operations to assist with recovery.
   - Continue to have BRT members engage in the implementation of the Yampa Management Plan, including if, in the future, the flow recommendations are revisited.

6. A PBO for the White Basin would provide certainty for existing and a portion of future anticipated depletions and would assist with endangered fish recovery.

   **NEAR-TERM FOCUS:**
   - Continue to support the finalization of the White River Management Plan and PBO.
   - Encourage the USFWS to consider a holistic approach, when appropriate and feasible, to recovering the endangered fish in the Yampa, White, and Green Rivers.

7. Investigate the flow needs of nonconsumptive attributes not included in the WFET.

   **NEAR-TERM FOCUS:**
   - Yampa IWMP
   - White River IWI

8. Research and design multi-purpose projects to improve riparian or aquatic ecology and bank stability without changing the existing flow regime while voluntarily modernizing irrigation diversion systems and reducing bedload deposits. Similar projects will be researched and designed to improve recreational boating for existing flows while voluntarily modernizing irrigation systems.

   **NEAR-TERM FOCUS:**
   - Yampa IWMP
   - White River IWI

9. Recognize and protect the economic values of the relatively natural flow regimes of the Yampa and White Rivers' systems.

10. Analyze the impact of projects on nonconsumptive needs. Ascertain whether further nonconsumptive projects need to be identified.

11. Quantify nonconsumptive demand for municipalities (drives wastewater discharge permits and infrastructure needs) and strategies to meet those targets. ***New as of 2021***

12. Support development or increased flexibility of delivery mechanisms for points of diversion, such as instream flow designations or other tools. ***New as of 2021***

13. Support the Yampa River Fund. Launched in 2019, the fund "is a collaborative community-based organization dedicated to identifying and funding activities that protect the water supply, wildlife habitat, and recreational opportunities provided to us by the Yampa River. The Yampa River Fund will invest in conservation and restoration activities that positively impact Yampa River flows to support the livelihoods of recreation outfitters and ranchers throughout the valley, and to ensure that a healthy, flowing Yampa River remains the thriving center of our communities for generations to come". For more information, please visit the website. (**https://www.yampariverfund.org**) ***New as of 2021***

14. Invest in education and outreach efforts that inform a broader audience (both in-basin and statewide) about E&R water needs and how they can be met in the basin, and provide a forum for a two-way exchange of ideas to enhance participation. ***New as of 2021***

# 7 Maintain and consider the existing natural range of water quality that is necessary for current and anticipated water uses

The quality of water in the YWG Basin reflects the robust health of the natural environment of the western slope of Colorado. Water quality and quantity are intrinsically linked, in that quality directly affects the value of a water right for all uses—M&I, agriculture, and E&R. As demands for use of this resource increase, water quality management becomes more critical.

## OBJECTIVES

1. Encourage and support water quality protection and monitoring programs in the subbasins of the YWG Basin through watershed groups, municipalities, land management agencies, and other efforts.

   **NEAR-TERM FOCUS:**
   - Partner with weed and pest districts to support integrated pest management in the White Basin.
   - Support implementation of the 2016 Upper Yampa River Watershed Plan.
   - Support the continuation of a water quality study in the lower Yampa and the White Basins.
   - Support River Health Scorecard by Friends of Yampa (IPP 2020-0054).
   - Support the Steamboat Springs stream temperature monitoring program.

2. Evaluate solutions to address how stream temperature problems might be alleviated in the face of a warming climate. ***New as of 2021**

3. Address sediment transport on lower White River. ***New as of 2021**

4. Support nutrient management throughout the basin. Increase data collection and studies to address algae blooms in Stagecoach Reservoir and Steamboat Lake. Support the completion of the White River algae study and any necessary follow-up work. ***New as of 2021**

5. Increase public access to data and facilitate better coordination with the water quality work currently being done in the basin. Investigate the feasibility of a single database or data portal. ***New as of 2021**

6. Support non-point-source water quality efforts (i.e., riparian and flow restoration and land use practices) that benefit point-source dischargers, such as wastewater treatment facilities, through water quality trading and improved assimilation capacity. ***New as of 2021**

7. Engage in collaborative efforts to address wildfire-watershed risks. ***New as of 2021**

8. Facilitate public awareness of threats to water quality, including catastrophic wildfire, and promote participation in efforts to mitigate those threats. ***New as of 2021**

# Develop an integrated system of water use, storage, administration, and delivery to reduce water shortages and meet environmental and recreational needs

The YWG Basin has the opportunity to create a system of coordinated operation to meet multiple goals stated for the YWG Basin. An appropriately planned system of storage, use, and administration will be conceived to optimize river operations in a manner agreed upon by basin interests and within the context of private property rights. This system can make these rivers firm for delivery of needed water for M&I systems, reduce agricultural shortages, and decrease low-flow threats to environmental needs. With good design and operation, concerns about significant reductions of high-flow processes can be mitigated or eliminated. The YWG BRT will use modeling to understand the synergy between storage deliveries and return-flow delay by agricultural use and conservation. This system can be realized with full recognition of existing uses and future PBO depletion allowances.

## OBJECTIVES

1. Use CDSS modeling to evaluate storage operation, delivery locations, and river flows.
2. Evaluate contracting possibilities with existing and proposed storage options.

   **NEAR-TERM FOCUS:**
   - Investigate the necessary legal mechanisms or cooperative inter-government agreements to coordinate water deliveries from Stagecoach Reservoir or other UYWCD reservoirs to supplement streamflow to support the endangered species in the Lower Yampa Reach (YW-2020-0056).
3. Discuss river administration opportunities.

   **NEAR-TERM FOCUS:**
   - Installing flow measurement devices is a top priority for Douglas Creek and White River Conservation District, and theYellow Jacket, Rio Blanco, and Upper Yampa Conservancy Districts. The YWG BRT is also supporting measurement devices through the IWMP and IWI projects.
4. Review needs for infrastructure improvements

   **NEAR-TERM FOCUS:**
   - White River IWI is conducting a diversion structure assessment in 2021.
5. Encourage cooperative partnerships
6. Foster public awareness of water scarcity challenges associated with climate change. Provide a forum for state representatives to educate constituents on the Colorado River Compact and associated policies and administration. Create opportunities for public engagement on future projects implementation. ***New as of 2021***
7. Implement the stakeholder engagement, diversion structure improvements, and riparian and flow restoration opportunities to be outlined in the Yampa IWMP. ***New as of 2021***
8. Implement the stakeholder engagement, diversion structure improvement, and riparian and flow restoration opportunities to be outlined in the White River IWI. ***New as of 2021***

# Section 5. Demand, Supply, and Potential Water Needs

## Water in the Basin

The Yampa and White Basins have headwaters in high-precipitation areas, from the Park Range in the north to the Flattop Mountains and Gore Range in the south. Elevations range from more than 12,000 feet in the headwaters areas to just over a mile high at the state line with Utah. Average annual precipitation varies from more than 60 inches near Rabbit Ears Pass to approximately 10 inches near the Utah state line. River hydrology is dominated by snowmelt and, like most rivers in Colorado, flows vary greatly from the low flows of winter and summer to the high flows of the spring runoff. The timing and the volume of flows also varies greatly year to year.

Beginning in the Wind River Range of Wyoming, the Green River flows south through the Green Basin and into Flaming Gorge Reservoir. Scheduled releases from the reservoir largely control the flows downstream into Brown's Park in the northwest corner of Colorado.

The Technical Update largely keeps the analysis at the basin scale. To that end, both the Yampa and the White Basins were explicitly modeled, and basin-specific as well as combined results are shown in this section.

Note that tributaries of the Green River have five diversions and one instream flow water right, and these are included in the model for the Yampa Basin. The demands and potential gaps from these structures are included in the Yampa Basin results.

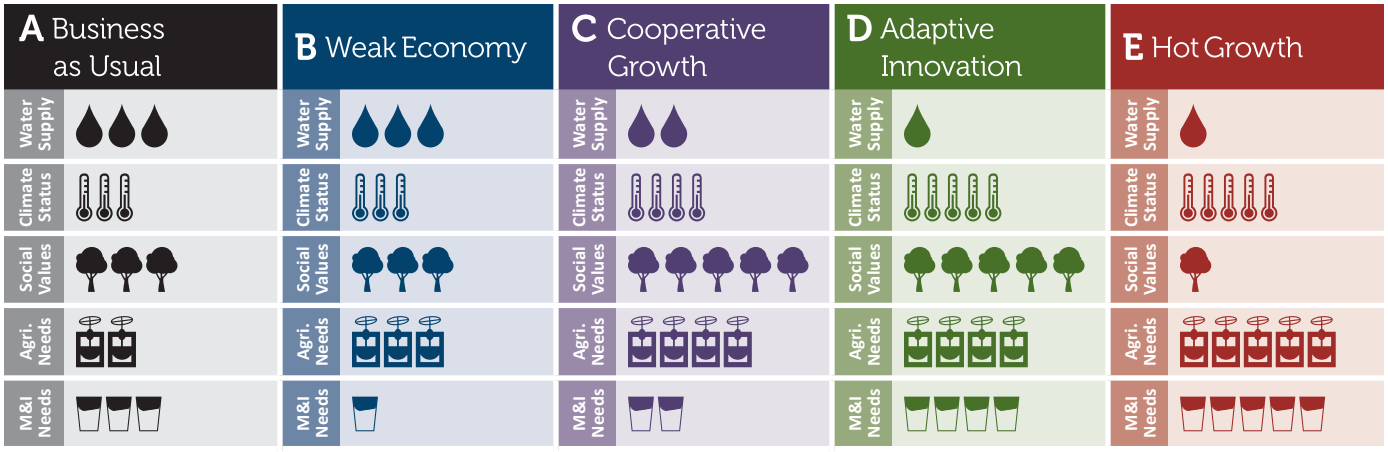
## Planning Scenarios

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 associated with the YWG Basin 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 for the basin in the Technical Update and are described in Section 4.10 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.

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 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**

- 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.

**E Hot Growth**

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

## Refinements to Technical Update Modeling

During the BIP update process, some BRTs 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.

Some model revisions were made since the Technical Update of the YWG Basin. Revisions to the White model involved refining industrial demands.

- In the Technical Update, the model included diversions to Chevron Oil demand via the California Co Pipeline. The California Co Pump Station has been used more frequently in recent years and was added to the White model.
- In the Technical Update, sand and gravel, mining, and golf course demands were not considered. These uses were added to the White model.

Revisions to the Yampa model involved refining industrial demands, reservoir operations associated with meeting M&I demands, the USFWS's flow recommendations, and adjustments to agricultural crop demands under climate change.

- In the Technical Update, it was assumed that Hayden Station, Craig Station, and associated coal mines would be in operation in 2050. Under some of the planning scenarios, it was assumed that water demands for the thermoelectric plants would increase. After the Technical Update was published, it was announced that the power plants would be decommissioned prior to 2050. For the five planning scenarios, the industrial demands were revised to account for this new information. The current level of demands associated with the power plants were applied to the five planning scenarios, and the use-type was changed from thermoelectric to large industry.
- Sand and gravel mining and golf course demands were refined.
- Long Lake Reservoir was added to the Yampa model. This reservoir is located in the Fish Creek watershed and supplies the City of Steamboat Springs.
- Stagecoach Reservoir operations and users were revised to be consistent with the 2021 Stagecoach Reservoir Fill and Release Policies document.
- The Recovery Program Critical Reach streamflow targets supplemented by releases from Elkhead Reservoir were updated to reflect the "Procedures for Releasing and Administering Water from Elkhead Reservoir to Augment Yampa River Flows for Endangered Fish." [1]
- Corrections were made to the agricultural efficiencies used with climate-change conditions.
- In a future modeling refinement, application of water rights to urbanized lands could be assessed differently. It could assume the associated water rights from urbanized acres will be converted to municipal use.

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

[1] Upper Colorado River Endangered Fish Recovery Program (2017). Procedures for Releasing and Administering Water from Elkhead Reservoir to Augment Yampa River Flows for Endangered Fish.

# Municipal and Industrial Demands

## POPULATION PROJECTIONS

The combined Yampa-White Basin currently includes less than 1 percent of the statewide population. Between the years 2015 and 2050, it is projected to change from approximately 44,000 people to between 39,000 and 103,000 people in the low and high low- and high-growth projections, respectively, as shown in Table 2.

## DEMANDS

Sources of water demand data, such as 1051 or municipal water efficiency plans data, were scarce in the Yampa and White Basins, and Baseline water demands were largely estimated.

The Yampa-White Basin includes about 17 percent of the statewide industrial water demand. Approximately 85 percent of the Baseline industrial demands are in the Yampa Basin and 15 percent are in the White Basin. Industrial demands in the Yampa-White Basin are associated with all four sub-sectors: large industry, snowmaking, energy development, and thermoelectric.

**Observations on the Yampa Basin M&I diversion demands include:**

- Demands generally follow the population patterns, which shows the influence that population has within this region, as shown on Figure 2.
- Municipal diversion demands are smaller than industrial diversion demands. Municipal diversion demands range from 6,300 acre-feet per year (AFY) in Weak Economy to 15,000 AFY in Hot Growth, and Industrial diversion demands range from 20,900 AFY in Weak Economy to 31,500 AFY in Hot Growth.

**Observations on the White Basin M&I diversion demands include:**

- Demands generally follow the population patterns, which shows the influence that population has within this region, as shown in Figure 2.
- Adaptive Innovation demands include higher levels of water conservation, which keep municipal demands lower despite similar assumptions of high population growth used in Hot Growth.

## GAPS

Current and projected municipal and industrial water demands were evaluated against available water supplies in the various planning scenarios using CDSS modeling tools. Gaps were calculated when physically and legally available water supplies were unable to meet demands.

**Observations on the Yampa Basin M&I diversion gaps include:**

- The average annual M&I gap ranges from about 20 acre-feet (AF) for Weak Economy, and up to 2,000 AF for Hot Growth, as shown on Figure 3.
- In general, projected M&I gaps under the scenarios are projected to be relatively modest with the exception of Hot Growth.
- M&I providers and systems with more robust water rights portfolios and access to storage (i.e., systems that were explicitly modeled) will likely have lower gaps than other providers without access to supplemental supplies.
- Higher M&I diversion demands, along with lower water availability due to climate impacts, drive higher estimated gaps in Hot Growth.
- Figure 4 shows M&I gaps are present under Adaptive Innovation and Hot Growth and increase during dry periods.

**Observations on the White Basin M&I diversion demands and gaps include:**

- The average annual M&I gap ranges from about 600 AF for Weak Economy, Cooperative Growth, and Adaptive Innovation up to 27,400 AF for Hot Growth, as shown on Figure 3.
- The average annual M&I gaps are largest in Business as Usual (2,900 AFY) and Hot Growth (27,400 AFY) and are driven by relatively large energy development demands.
- The maximum M&I gap for the five planning scenarios ranges from 740 AF to 33,400 AF.
- M&I gaps in the White Basin are larger than in the Yampa Basin because the White Basin lacks access to water storage.
- Figure 4 shows M&I gaps are present under all scenarios and increase during dry periods, especially in the climate-adjusted scenarios.

**Current and future diversion demands for municipal water users are driven by population and water usage rates. Population estimates were based on SDO projections, with upward or downward adjustments based on the scenario description.**

**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** | | | | | | |
| Yampa Basin | 37,200 | 59,900 | 34,400 | 63,500 | 86,000 | 91,900 |
| White Basin | 6,500 | 7,400 | 4,200 | 7,000 | 10,600 | 11,300 |
| **Total Yampa/White Basin** | **43,700** | **67,300** | **38,600** | **70,500** | **96,600** | **103,200** |
| **Systemwide Per Capita Demands (gallons per capita per day)** | | | | | | |
| Yampa Basin | 224 | 172 | 197 | 161 | 150 | 180 |
| White Basin | 252 | 240 | 254 | 240 | 231 | 269 |
| **Municipal Diversion Demand (AFY)** | | | | | | |
| Yampa Basin | 9,100 | 9,400 | 6,300 | 9,300 | 11,700 | 15,000 |
| White Basin | 2,800 | 3,500 | 2,600 | 3,400 | 4,100 | 5,200 |
| **Total Yampa/White Basin** | **11,900** | **12,900** | **8,900** | **12,700** | **15,800** | **20,200** |
| **Industrial Diversion Demand (AFY)** | | | | | | |
| Yampa Basin | 23,700 | 24,100 | 20,900 | 23,000 | 23,000 | 31,500 |
| White Basin | 4,300 | 8,300 | 5,300 | 5,300 | 5,300 | 37,600 |
| **Total Yampa/White Basin** | **28,000** | **32,400** | **26,200** | **28,300** | **28,300** | **69,100** |
| **Total Municipal and Industrial Diversion Demand (AFY)[2]** | | | | | | |
| Yampa Basin | 32,800 | 33,500 | 27,200 | 32,300 | 34,700 | 46,500 |
| White Basin | 7,100 | 11,800 | 7,900 | 8,700 | 9,400 | 42,800 |
| **Total Yampa/White Basin** | **39,900** | **45,300** | **35,100** | **41,000** | **44,100** | **89,300** |
| **Average Annual Gap (AFY)[3]** | | | | | | |
| Yampa Basin | 50 | 100 | 20 | 150 | 760 | 2,000 |
| White Basin | 0 | 2,900 | 570 | 610 | 680 | 27,400 |
| **Total Yampa/White Basin** | **50** | **3,000** | **590** | **760** | **1,400** | **29,400** |
| **Maximum Annual Gap (AF)[3]** | | | | | | |
| Yampa Basin | 310 | 470 | 210 | 420 | 1,200 | 3,100 |
| White Basin | 0 | 3,800 | 740 | 800 | 1,200 | 33,400 |
| **Total Yampa/White Basin** | **310** | **4,300** | **950** | **1,220** | **2,400** | **36,500** |

[1]*Baseline year is 2015.*

[2]*M&I demands may vary slightly from the M&I Demand section of the Technical Update (Section 4.10.5) due to updated and refined industrial demands.*

[3]*CDSS water allocation model in this basin calculates small baseline M&I gaps, and they are due to industrial shortages.*

**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**

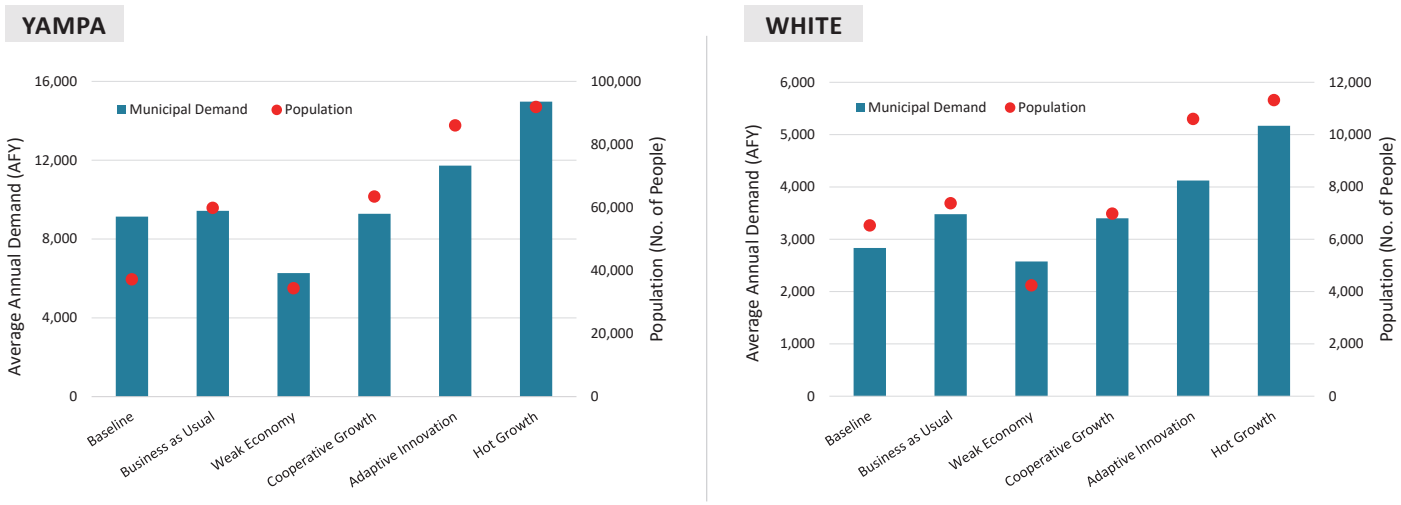



**Figure 3. Baseline and 2050 Projected Maximum Annual M&I Demand Met and Gaps**

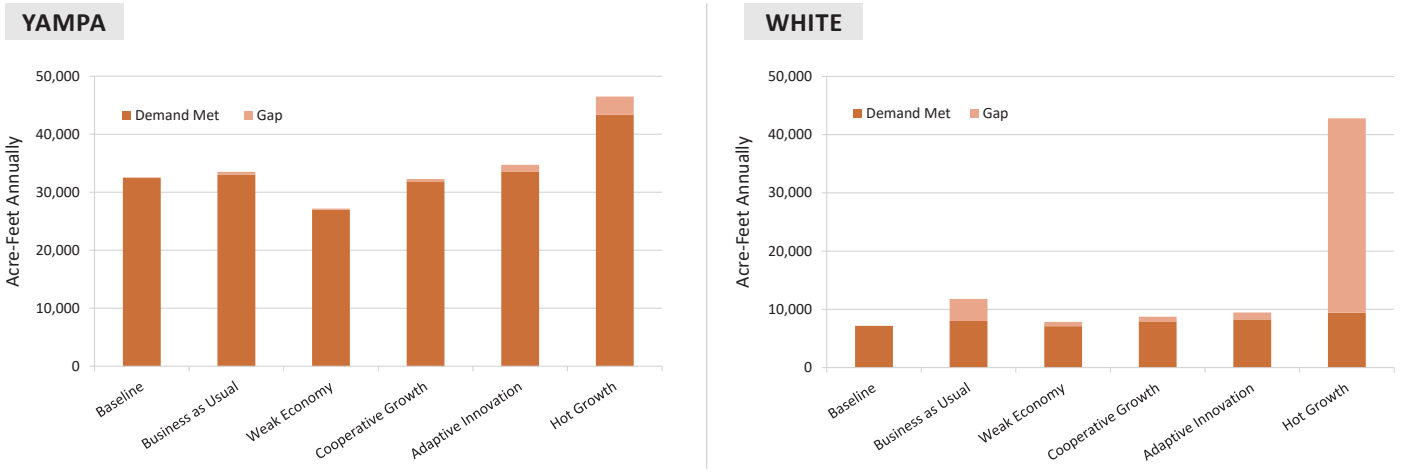
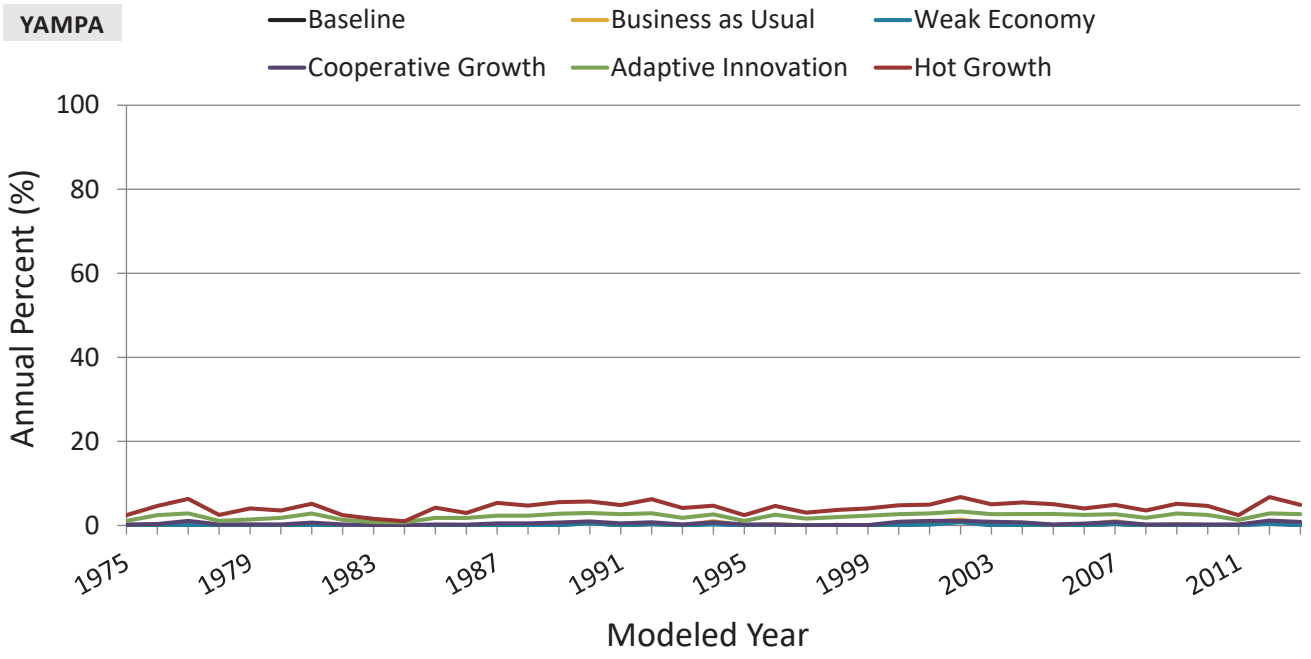
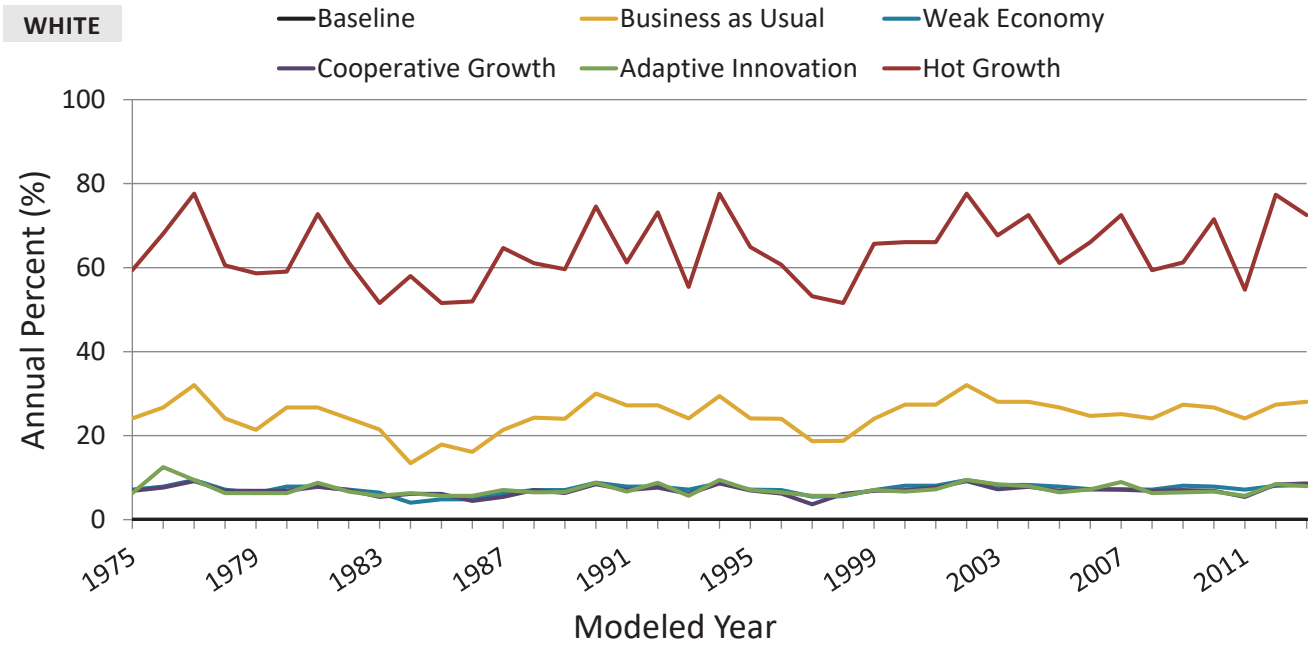


**Figure 4. Modeled Annual M&I Gaps (expressed as a percent of demand unmet) by Planning Scenario**




**"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

Agriculture is a primary focus in the Yampa Basin. Irrigated acreage consists primarily of high mountain meadows and cattle ranches along the Yampa River and its tributaries. Irrigated acreage is also located along the Little Snake River as it meanders between Colorado and Wyoming.

Approximately 60 percent of the irrigated acres in the White Basin are concentrated along the river near the Town of Meeker. Grass pasture is the dominant crop, and alfalfa is also grown. These forage crops support cattle grazing and ranching operations, which is a major economic driver.

Table 3 summarizes the acreage, irrigation water requirement (IWR), and the agricultural diversion demand for surface water supplies in the Yampa and White Basins for Baseline conditions and the five planning scenarios. Several key adjustments to drivers for agricultural diversion demand were incorporated into the estimates of potential future demands:

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.

### Yampa

- Population projections anticipate significant growth in the Yampa Basin. Future urbanization of irrigated lands is estimated to be 1,500 acres.
- The Yampa Basin supports increasing agricultural acreage by bringing new lands under irrigation. In previous studies, the YWG BRT has identified locations that are well suited for irrigation.

### White

- Future urbanization of irrigated lands is expected to be relatively limited in the White Basin, with 360 acres total in and around the towns of Meeker and Rangely projected to be urbanized.
- Population projections in Rio Blanco County are expected to decline in Weak Economy, and urbanization in this scenario was set to zero.

### Observations on agricultural demands in the Yampa Basin include:

- Climate change drives demands up in relevant scenarios.
- Efficiencies in Adaptive Innovation offset some of the climate-change drivers that increase demands.
- Potential acreage increases in the Yampa drive up diversion demands.

### Observations on agricultural demands in the White Basin include:

- The largest variation in the White Basin occurs in Adaptive Innovation due to a 10 percent reduction in IWR and 10 percent increase to system efficiency. In this basin, the combined impact of Adaptive Innovation adjustments results in an agricultural diversion demand that is lower than the current demand.

## GAPS

Current and projected agricultural diversion demands were evaluated against available water supplies in the various planning scenarios using CDSS modeling tools. Gaps were calculated when physically and legally available water supplies were unable to meet demands.

### Observations on agricultural gaps in the Yampa Basin include:

- The Yampa Basin currently experiences an agricultural diversion demand gap, but the gap is not projected to significantly increase under Business as Usual or Weak Economy.

- Agricultural diversion demand gaps increase in Cooperative Growth, Adaptive Innovation and Hot Growth due to additional demand from planned agricultural projects with junior water rights and higher IWR concurrent with lower water supply due to a drier and warmer climate.
- The incremental gap ranges from 250 AFY in Weak Economy to 63,600 AFY in Hot Growth, as shown on Figure 5.
- Agricultural water users do not have access to significant reservoir storage in the Yampa Basin. Gaps in Cooperative Growth, Adaptive Innovation, and Hot Growth are impacted by earlier runoff seasons and lower water availability during the latter part of the growing season.
- Figure 6 shows agricultural gaps are present under all scenarios and increase during dry periods, especially in the climate-adjusted scenarios.

### Observations on agricultural gaps in the White Basin include:

- The White Basin currently experiences an agricultural diversion demand gap, but the gap is not projected to significantly increase under Business as Usual or Weak Economy.
- Agricultural diversion demand gaps increase in Cooperative Growth, Adaptive Innovation, and Hot Growth.
- The incremental gap ranges from 10 AFY in Business as Usual and Weak Economy to 4,600 AFY in Hot Growth, as shown on Figure 5.
- Figure 6 shows agricultural gaps are present under Cooperative Growth, Adaptive Innovation, and Hot Growth and increase during dry periods.

**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)** | | | | | | |
| Yampa Basin | 78,900 | 78,400 | 78,400 | 82,400 | 92,300 | 92,300 |
| White Basin | 28,100 | 27,700 | 28,100 | 27,700 | 27,700 | 27,700 |
| **Total Yampa/White Basin** | **107,000** | **106,100** | **106,500** | **110,100** | **120,000** | **120,000** |
| **Average IWR (AFY)** | | | | | | |
| Yampa Basin | 151,400 | 151,200 | 151,200 | 191,300 | 214,900 | 239,600 |
| White Basin | 46,800 | 46,200 | 46,800 | 55,900 | 56,000 | 62,200 |
| **Total Yampa/White Basin** | **198,200** | **197,400** | **198,000** | **247,200** | **270,900** | **301,800** |
| **Average Annual Demand (AFY)** | | | | | | |
| Yampa Basin | 402,500 | 403,600 | 403,600 | 522,500 | 461,000 | 684,300 |
| White Basin | 246,700 | 242,900 | 246,700 | 293,900 | 177,800 | 319,700 |
| **Total Yampa/White Basin** | **649,200** | **646,500** | **650,300** | **816,400** | **638,800** | **1,004,000** |
| **Average Annual Gap (AFY)** | | | | | | |
| Yampa Basin | 13,600 | 13,900 | 13,900 | 36,500 | 50,500 | 77,200 |
| White Basin | 1,200 | 1,200 | 1,200 | 3,200 | 3,400 | 5,900 |
| **Total Yampa/White Basin** | **14,800** | **15,100** | **15,100** | **39,700** | **53,900** | **83,100** |
| **Incremental Avg. Ann. Gap (AFY)** | | | | | | |
| Yampa Basin | - | 260 | 250 | 22,900 | 36,900 | 63,600 |
| White Basin | - | 10 | 10 | 2,000 | 2,200 | 4,600 |
| **Total Yampa/White Basin** | **-** | **270** | **260** | **24,900** | **39,100** | **68,200** |
| **Maximum Annual Gap (AFY)** | | | | | | |
| Yampa Basin | 64,900 | 63,900 | 63,700 | 95,800 | 104,100 | 154,300 |
| White Basin | 6,000 | 6,100 | 6,100 | 9,600 | 8,600 | 12,300 |
| **Total Yampa/White Basin** | **70,900** | **70,000** | **69,800** | **105,400** | **112,700** | **166,600** |

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

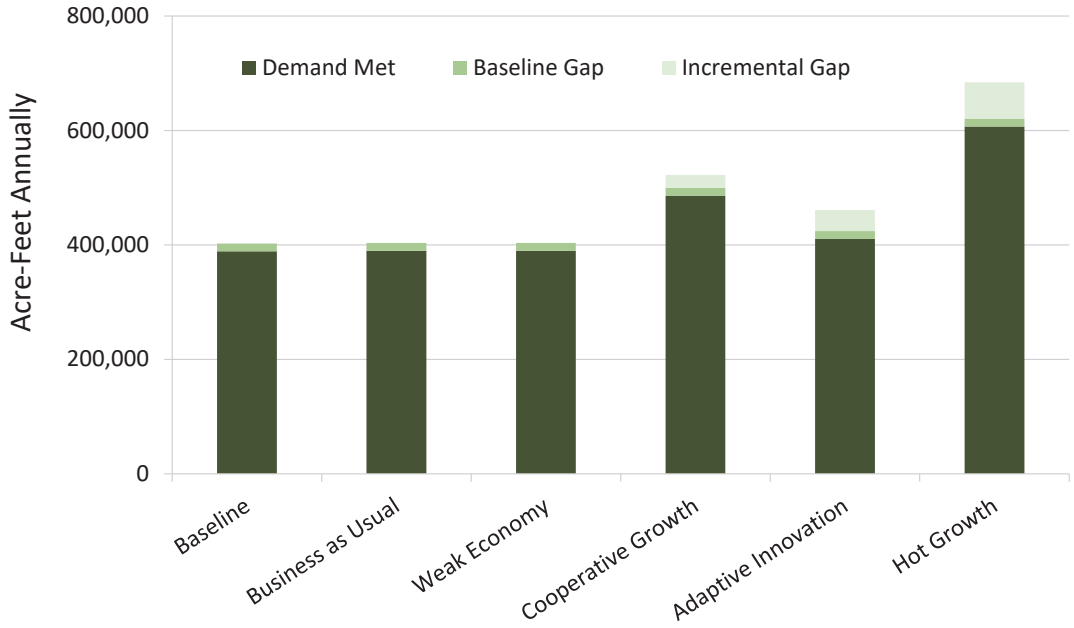
**Calculation methodologies and assumptions for agriculture water demands are available in the Technical Update documentation.**

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**

**YAMPA**




**WHITE**

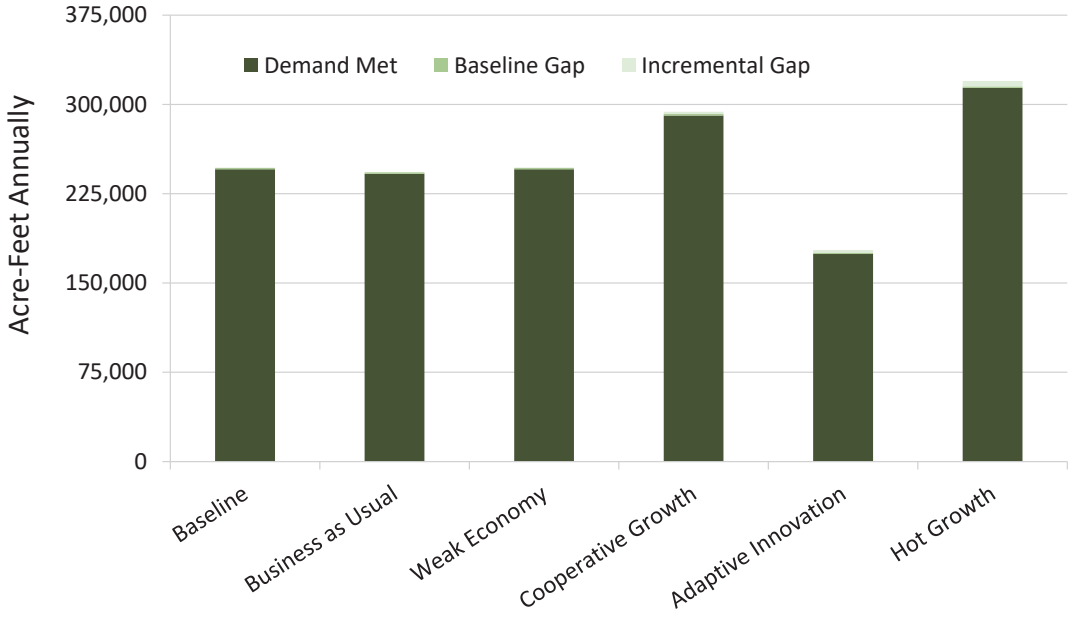
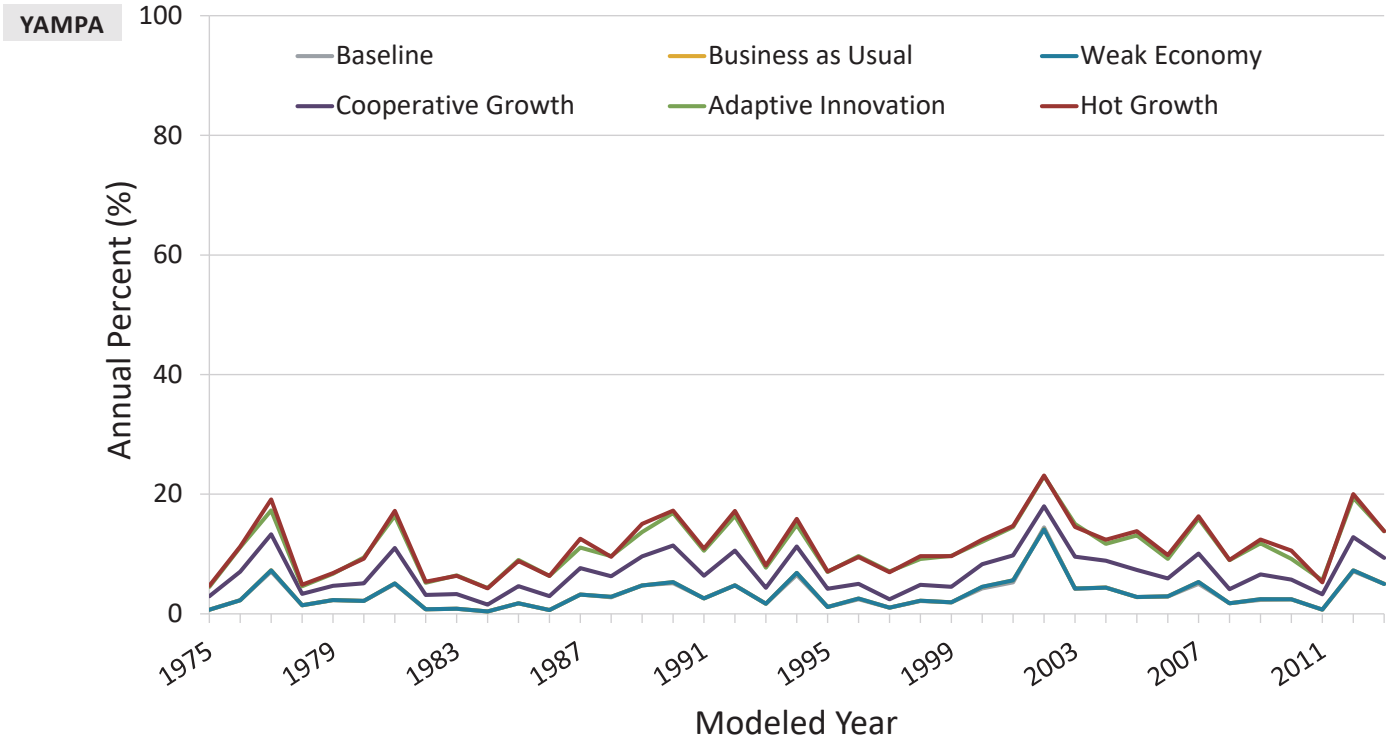
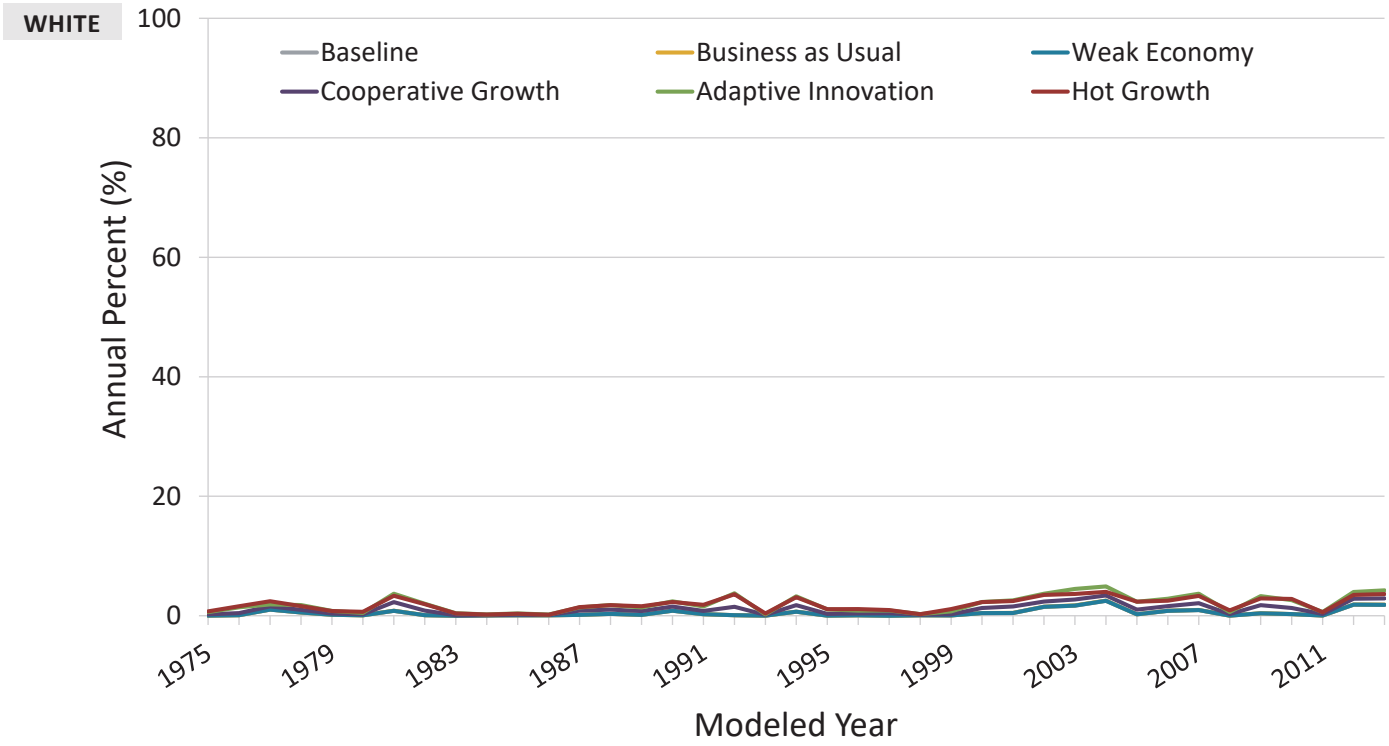


**Figure 6. Modeled Annual Agricultural Gaps (expressed as a percentage of demand unmet) by Planning Scenario**



# Environment and Recreation

During the Technical Update, current and potential future risks to E&R attributes in the YWG Basin were evaluated using the Colorado Environment and Recreation Flow Tool (Flow Tool). The Flow Tool was developed to help 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 stream flow 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 SMP and BIP development.

Flow Tool nodes in the YWG Basin are provided below and shown on Figure 7.

- Yampa River at Steamboat Springs, Colorado (09239500)
- Elk River at Clark, Colorado (09241000)
- Elkhead Creek near Elkhead, Colorado (09245000)
- Yampa River near Maybell, Colorado (09251000)
- Little Snake River near Lily, Colorado (09260000)
- Yampa River at Deerlodge Park, Colorado (09260050)
- White River below Meeker, Colorado (09304800)
- White River near Watson, Utah (09306500)

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

**The identification of future risks to E&R 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 experiencing municipal or agricultural gaps.**

**In the Yampa and White Baseline models, CWCB instream flow reaches, recreational in-channel diversions, and other locations have streamflow targets represented as a monthly volume. A summary of streamflow targets and percent of months streamflow targets are met is described in Volume 2, Section 5.**

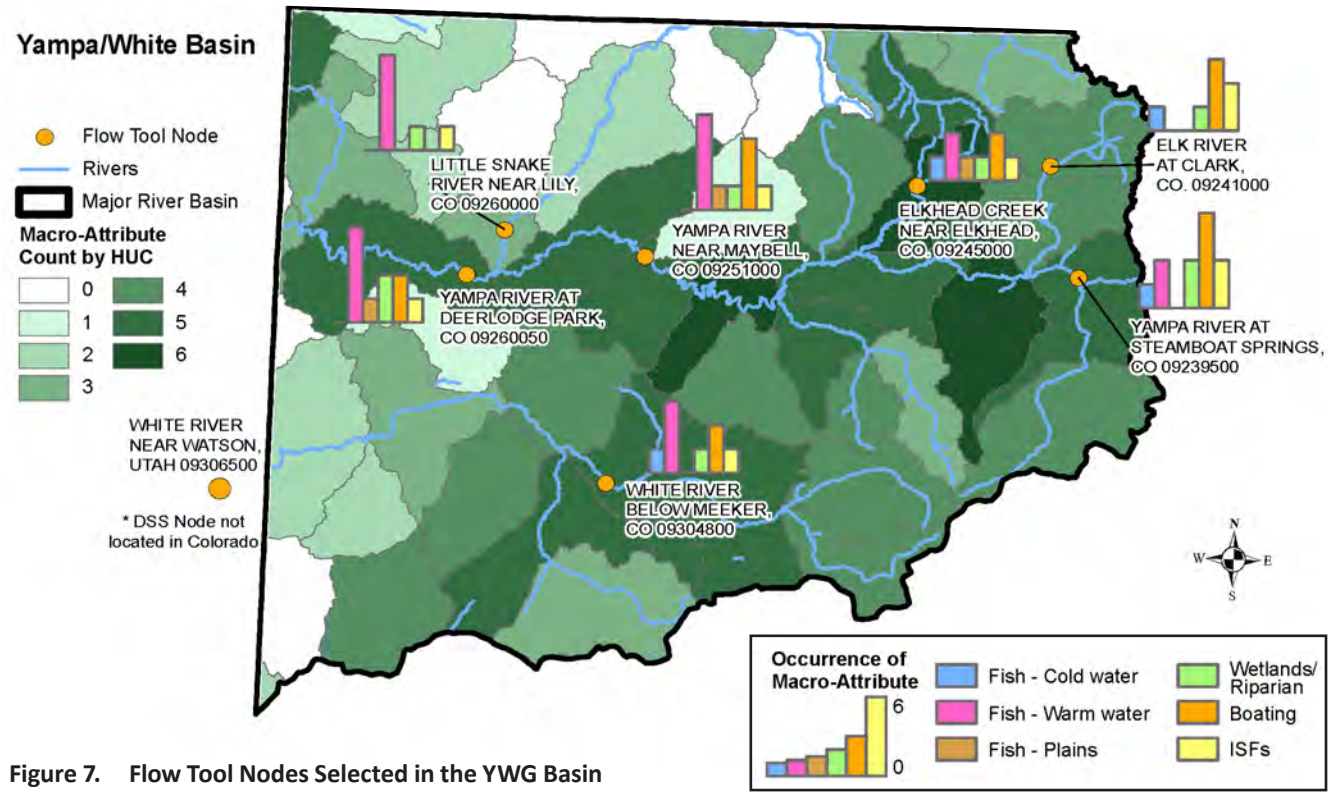



**Figure 7. Flow Tool Nodes Selected in the YWG Basin**

**Table 4. Summary of Flow Tool Results in the Basin**

| Category | Observation |
|---|---|
| **Projected Flows** | • Patterns of monthly mean peak flows are projected to be highly variable across the YWG Basin based on location. The projections below are divided between the Yampa and White Basins:<br>• In the White Basin, annual total flow volumes are estimated to be smaller in Adaptive Innovation and Hot Growth due to climate-impacted hydrology. Monthly mean peak flows may occur earlier in April and May for climate-impacted scenarios compared to Baseline, Business as Usual, and Weak Economy. Mid- and late-summer monthly mean flows are lower as well for the climate-impacted scenarios.<br>• In the Yampa Basin, annual total flow volumes are generally projected to be smaller for the climate-impacted scenarios (Cooperative Growth, Adaptive Innovation, and Hot Growth). For Cooperative Growth, wet years project greater annual total flow volumes compared to historical conditions. Monthly mean peak flows may occur earlier in April and May for climate-impacted scenarios compared to Baseline, Business as Usual, and Weak Economy. Mid- and late-summer monthly mean flows are lower as well for the climate-impacted scenarios. The magnitude in monthly mean flows differences is greatest upstream in the watershed and lessens farther downstream in the watershed. |
| **Ecological Risk** | • Peak flows across the YWG Basin under Baseline conditions are insufficient to pose a risk to riparian/wetland plants and fish habitat. This risk increases under climate-change scenarios. Projected flow decreases in mid- and late-summer flows and create risk for fish from loss of habitat and, in trout regions, increased water temperatures.<br>• 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 would negatively affect cold-water fish species. |
| **ISFs** | • Many of the tributaries and portions of the White River have an instream flow (ISF). It is likely that these ISFs will not be met during the summer and winter months for most scenarios, and particularly the climate-impacted scenarios. |
| **RICDs** | • There is one recreational in-channel diversion (RICD) for a water park near Steamboat Springs on the Yampa River. It is possible this RICD could be impacted during the summer months for most scenarios, and particularly the climate-impacted scenarios. |

## Focus Area Mapping

Since the 2005 passage of the Colorado Water for the 21st Century Act, the nine basin roundtables 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, Focus Area maps for each basin were created 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 and were updated by some basins during the development of the 2015 BIPs.

During the current BIP update effort, the E&R subcommittee of the roundtables identified specific segments that should be added or revised on the Focus Area maps. The recommended updates outlined below should be considered when the maps are updated:

- Cutthroat fisheries on East Fork of the William's Fork
- Cutthroat and whitefish present on the White River through Meeker
- Piceance Creek has good fisheries
- Yampa River from Catamount to Chuck Lewis Wildlife area E&R attributes are not adequately mapped

Figure 8 shows the current Focus Area Map for the Yampa, White and Green Basins.

**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**

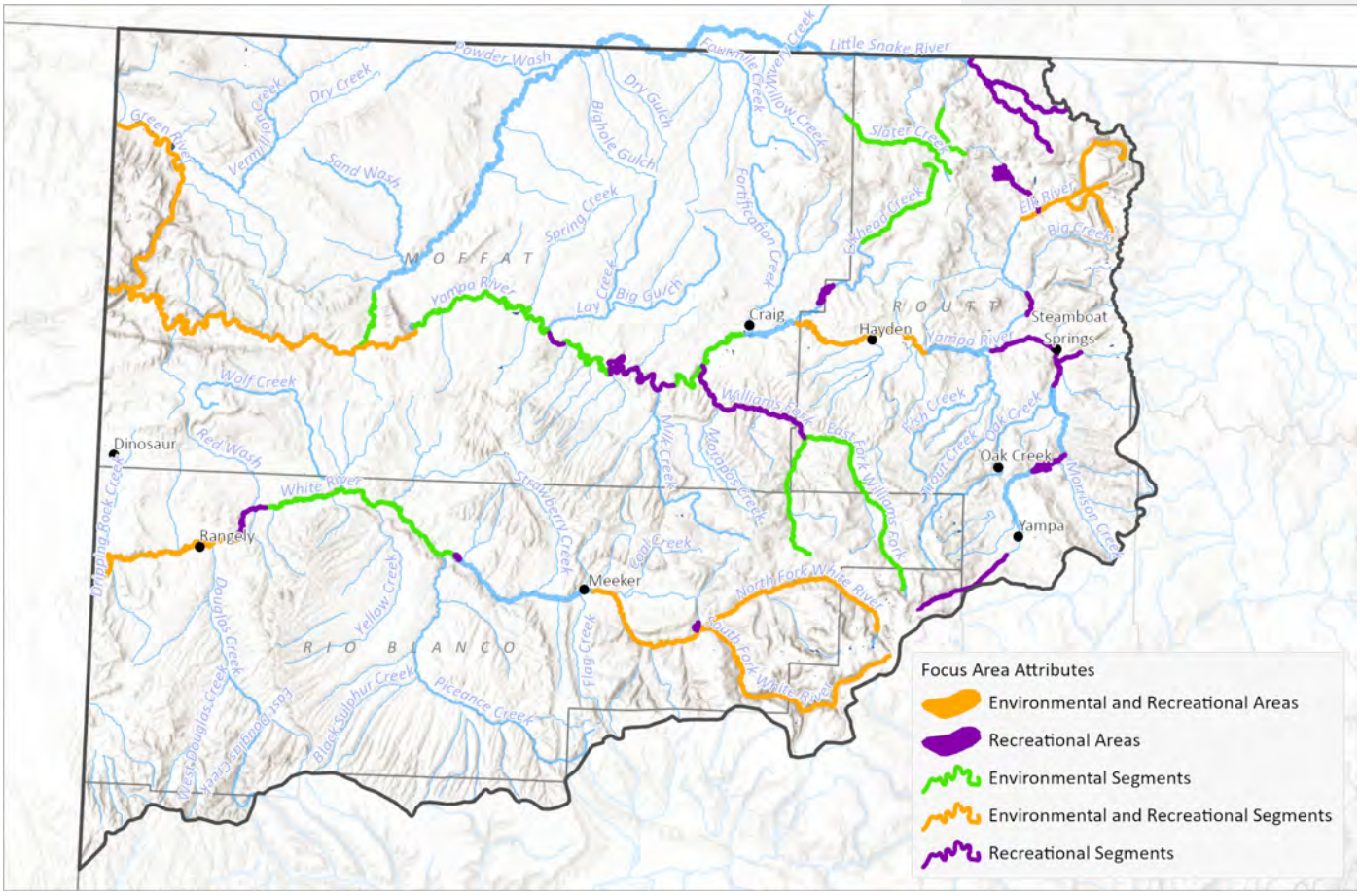



**Figure 8. Focus Area Map of the YWG Basin**

# Water Supplies

Available water supplies in the Yampa and White Basins 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 in the Yampa and White Basins includes supply evaluations at numerous locations throughout the basin.

Figure 9 shows simulated monthly available flow on the Yampa River near Maybell, and Figure 10 shows an average monthly simulated hydrograph of available flow at this location. Available flow at this location is similar to the physical flow in the stream. The figures show that flows are projected to be available each year, though the amounts will vary annually and across scenarios (available flows under the scenarios impacted by climate change are less than in other scenarios). Peak flows are projected to occur earlier in the year under scenarios impacted by climate change.

Figure 11 shows simulated monthly available flow on the White River below Boise Creek, which is just above Kenney Reservoir, and Figure 12 shows an average monthly simulated hydrograph of available flow at this location. The reservoir has a hydropower water right that is not fully satisfied and serves as the calling right in the basin. The figures show that flows are projected to be available in most years, though the amounts will vary annually and across scenarios (available flows under the scenarios impacted by climate change are less than in other scenarios). In some years, very little to no flow is available under current and future conditions at this location. Peak flows are projected to occur earlier in the year under scenarios impacted by climate change.

**Figure 9. Simulated Hydrograph of Available Flow at Yampa River near Maybell**

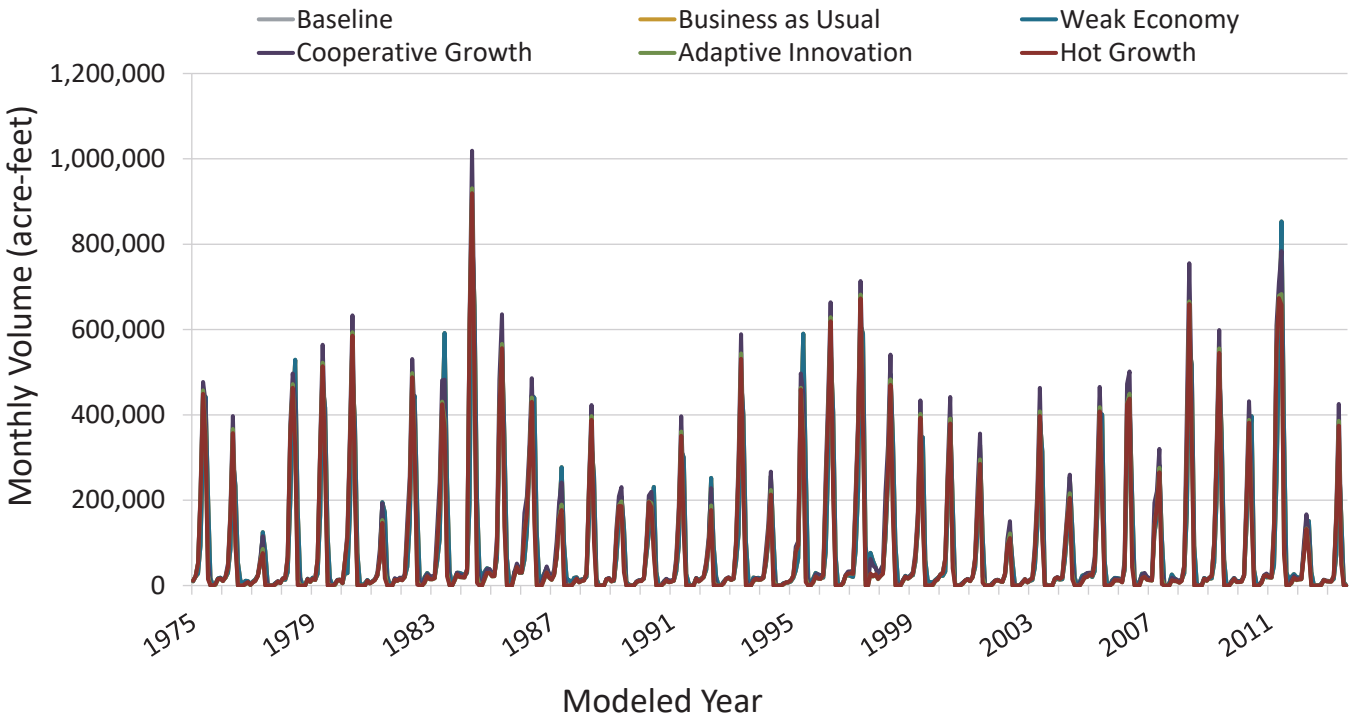


**Figure 10. Average Monthly Simulated Hydrographs of Available Flow at Yampa River near Maybell**

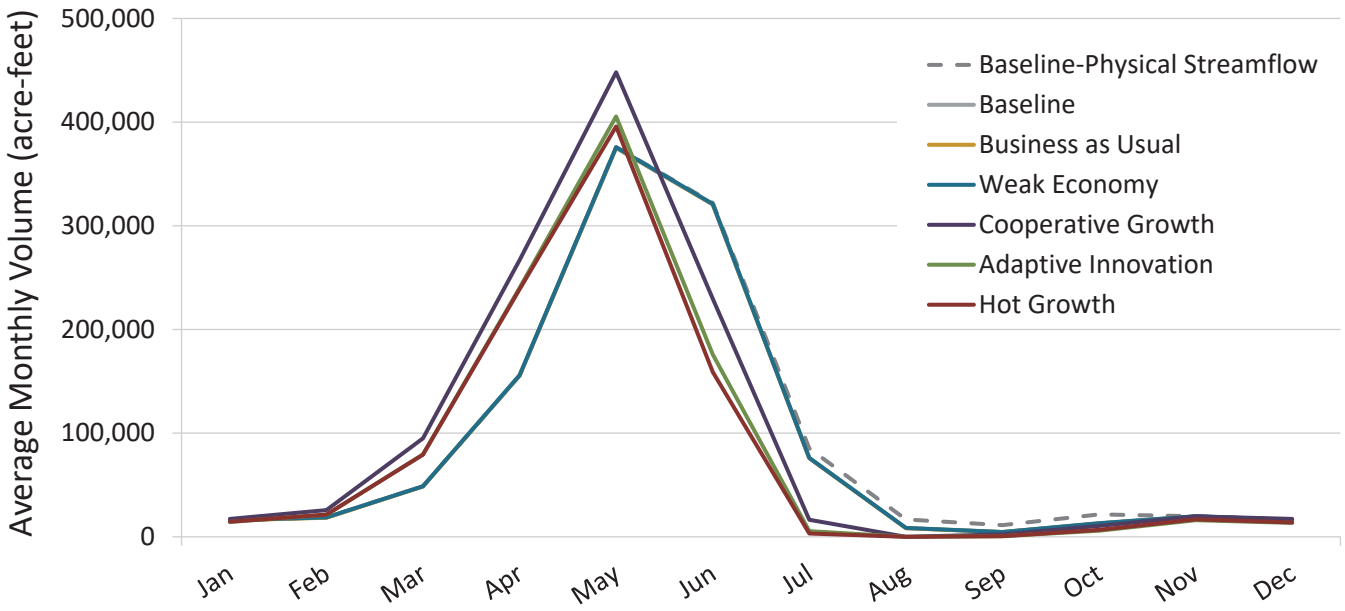



**Figure 11. Simulated Hydrograph of Available Flow at White River below Boise Creek**

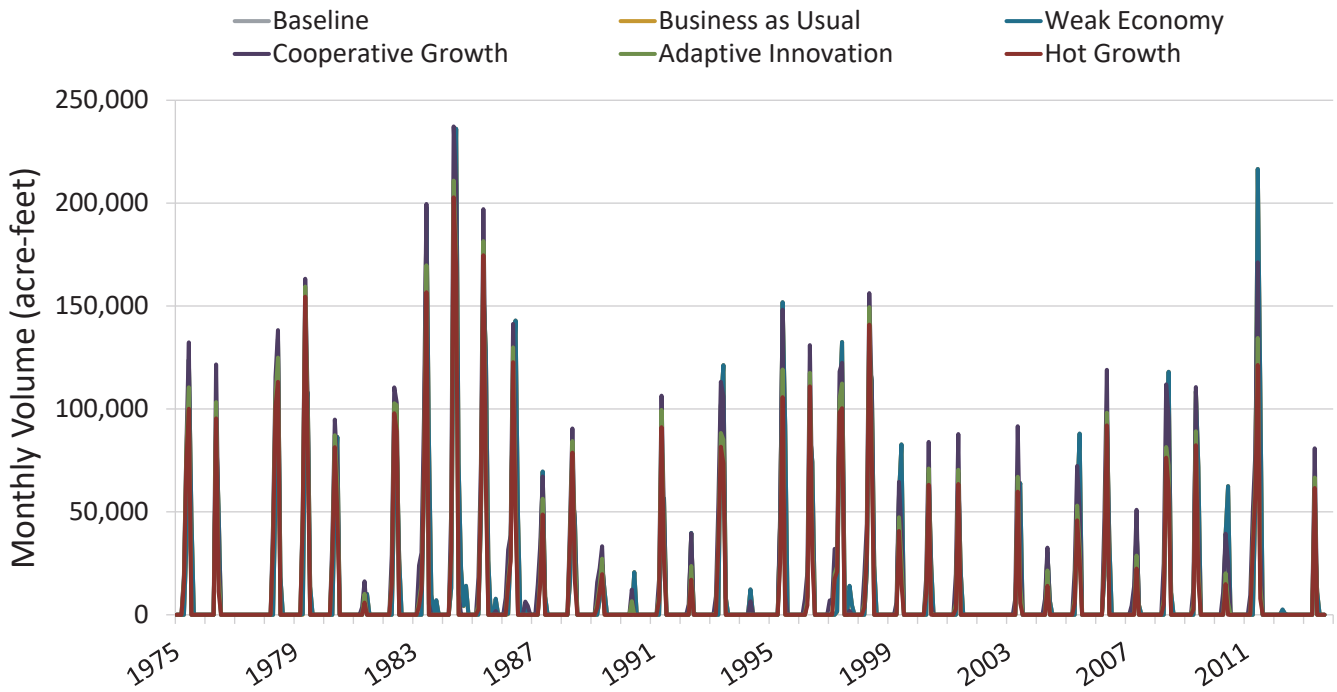
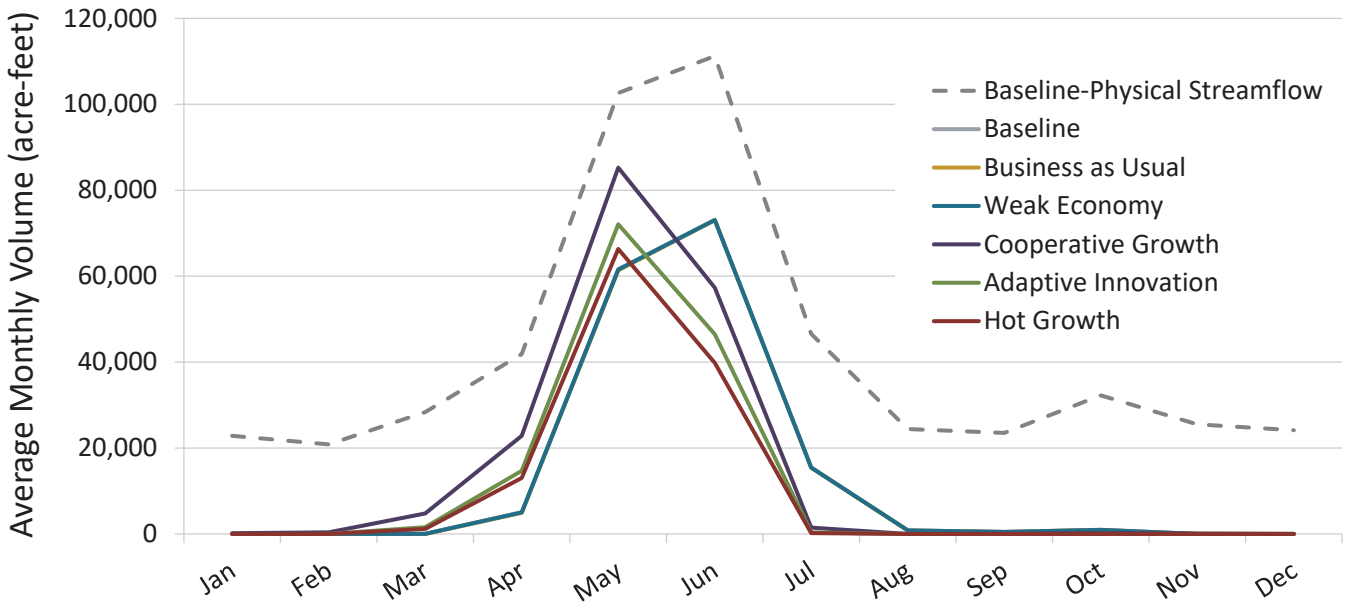


**Figure 12. Average Monthly Simulated Hydrographs of Available Flow at White River below Boise Creek**




## Storage

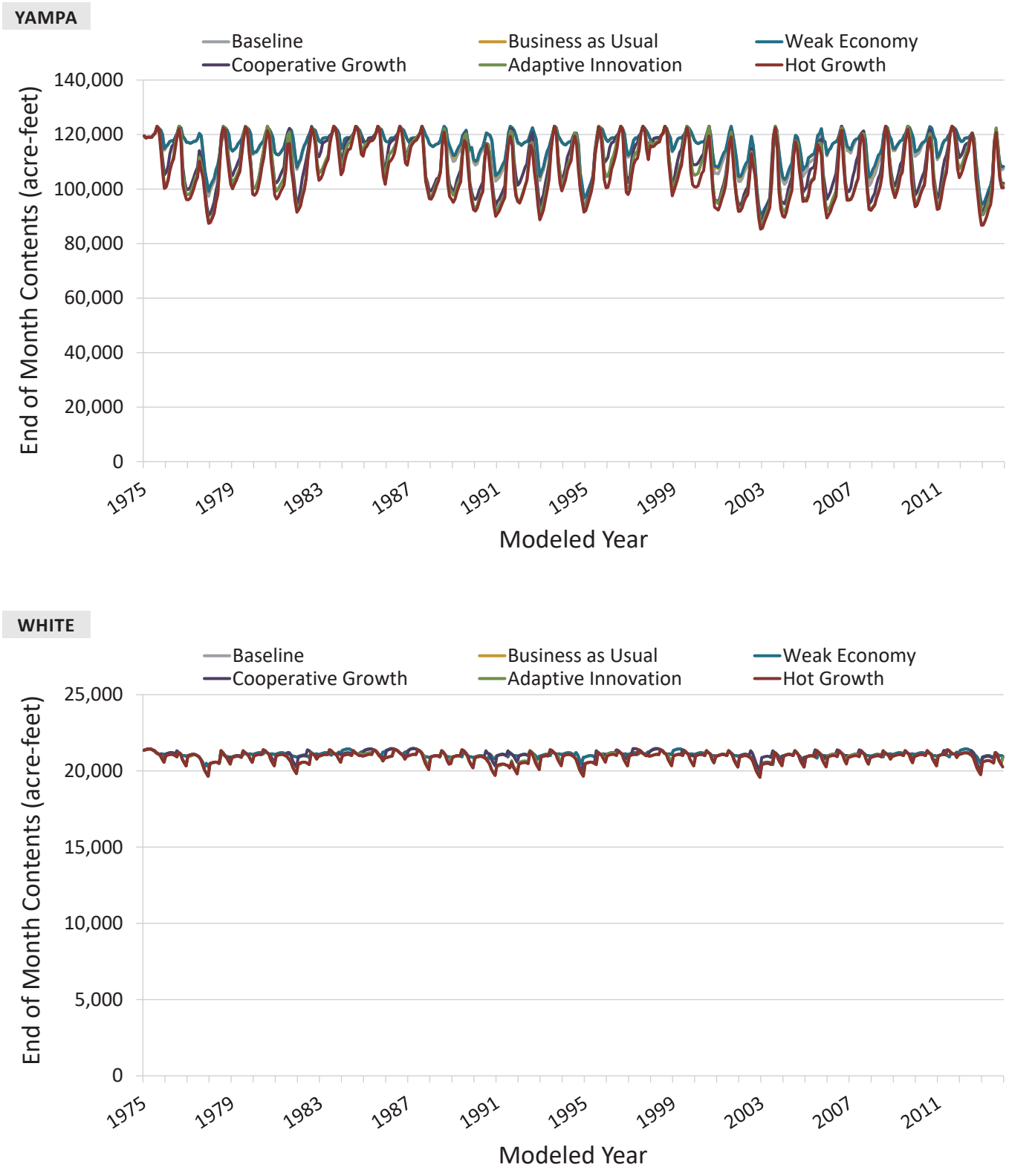
Total simulated reservoir storage from the Yampa River water allocation model is shown on Figure 13. Baseline conditions show the highest levels of water in storage (in general), and the lowest is in Hot Growth. Cooperative Growth, Adaptive Innovation, and Hot Growth show lower amounts of water in storage 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.

Total simulated reservoir storage from the White River water allocation model is shown on Figure 13. Basinwide storage levels do not significantly change in any of the planning scenarios because there is limited storage available in the basin.

**The White Basin has limited storage.**

**Lake Avery is used for wildlife purposes, and Kenney Reservoir is used for hydropower and emergency reserve supply for the Town of Rangely.**

**Figure 13. Basin Total Simulated Storage**



# Section 6. Strategic Vision for the Future

The strategic vision for the future in the YWG Basin is described in this section. Meeting future water needs and implementing projects are the primary strategies of the YWG BRT to achieve basin goals.

## Summary of Strategies

### 1 MEET FUTURE WATER NEEDS

To explore possible options for meeting future water needs, the BRT modeled three alternative management strategies. Results from the model are intended to help the YWG BRT understand the trade-offs of the alternative management strategies. The BRT has not taken a position on the effectiveness of the strategies, nor should this document be interpreted as an endorsement of any of the alternative management strategies. Additionally, the YWG BRT is only using the model to explore the technical challenges. Legal and policy constraints were not considered. This section highlights the potential benefits and risks of the alternative management strategies. If stakeholders choose to pursue one or all of these alternative management strategies, this document can help guide the implementation to maximize the benefits and minimize the risks. For additional details on the strategies, refer to Volume 2, Section 6.

## Alternative Management Strategy #1 - Agricultural Efficiency

The YWG BRT is interested in understanding the benefits and risks of increasing agricultural irrigation efficiency at a large scale. Agricultural irrigation efficiency is defined as the ratio between the crop consumptive use and the total amount of water diverted from the river. In the CDSS model, agricultural irrigation efficiency depends on the irrigation method (flood or sprinkler) and the conveyance infrastructure (unlined ditch or lined ditched/pipe). Note that this alternative management strategy does not consider changing the consumptive use of agriculture, which is referred to as conservation.

About 92 percent of irrigated acreage in the Yampa and White Basins is flood irrigated. Flood irrigation has the benefit of generating return flows that come back to the river later; however, flood irrigation generally has low efficiency because diversions from the river must be significantly larger than the crop irrigation requirement. For example, in the Yampa and the White Basins, the maximum flood irrigation efficiency is assumed to be 54 percent compared to an assumed maximum sprinkler irrigation efficiency of 72 percent.

### Yampa Basin

The YWG BRT is interested in understanding the benefits and risks of large-scale conversion of flood irrigation to sprinkler irrigation. For this Alternative Management Strategy #1, it was assumed that 20 percent of flood-irrigated acreage under each ditch was converted to sprinkler. This allows the YWG BRT to investigate wide-spread adoption of sprinkler irrigation methods throughout the basins. A more targeted conversion from flood to sprinkler could yield different results.

### White Basin - Alternatives 1a and 1b

For the White Basin, two options were considered. Similar to the Yampa Basin, the crop irrigation requirement does not change in these alternatives.

In Alternative 1a, it was assumed that the change in irrigation method did not result in a change to the headgate demand. This assumption is intended to show how a ditch might continue to divert up to the full water right, or how a ditch may put more water on lands that remain flood irrigated. This alternative changed the application efficiency, which could impact the consumptive use and/or return flows generated by the diversion. Note that efficiency is defined as the ratio between the crop consumptive use and the total amount of water diverted from the river. Therefore, this alternative is not a true efficiency scenario because the amount of water diverted from the river does not change. This alternative provides useful information about potential on-farm impacts.

In Alternative 1b, it was assumed that the conversion from flood irrigation to sprinkler irrigation would reduce the demand at the headgate. It was assumed that 80 percent of the acreage would continue to operate based on the historical monthly efficiency patterns, using the wet/dry/average year-type data. Twenty percent of the acreage would be converted to sprinkler irrigation and operate at a minimum of 70 percent and a maximum of 72 percent efficiency.

## Alternative Management Strategy #2
## New Release from Existing Reservoirs

The YWG BRT is interested in understanding how existing reservoirs in the Yampa Basin could help supply supplemental water. This Alternative Management Strategy explored new releases from existing storage. This alternative was only considered in the Yampa Basin because of the extremely limited storage available in the White Basin. The YWG BRT is interested in exploring the technical challenges associated with increasing supplies to water-short users; it did not consider legal or policy constraints on these operations.

With the permission and cooperation of the reservoir owners, the YWG BRT selected the following reservoirs to consider. The description includes new releases that are contemplated in the alternative.

- Steamboat Lake – The City of Steamboat fills its 1,200-AF pool with the conditional Juniper Reservoir rights. Water could be released from storage to supplement water supply to the future Elk River diversion point and future water treatment plant.
- Elkhead Reservoir – Reservoir storage currently held by Tri-State for use at the Craig Station are also made available to the Recovery Program. The release limit to the Lower Yampa Critical Habitat Reach could be increased from 50 cubic feet per second (cfs) to 75 cfs. Reservoir storage currently held by the Colorado River District could be made available to agricultural users downstream of Elkhead Reservoir at a maximum rate of 25 cfs.
- Stagecoach Reservoir – Reservoir storage that is currently not under contract could be made available to new future demands located in UYWCD boundaries. Additionally, water from the General Supply Pool could be made available to the Lower Yampa Critical Habitat Reach after releases from Elkhead Reservoir. Please refer to Volume 2, Section 6 for additional details on the modeling assumptions.

## Alternative Management Strategy #3
## Additional Storage

Alternative #3 builds on Alternative #2. The model continues to show the new releases from existing storage. For Alternative #3, additional storage was included as well. In the White Basin, additional storage is shown in two locations:

- Enlarge Lake Avery by 2,644 AF. Up to 20 cfs could be released in the months of July, August, September, and October when the CWCB instream flow reach measured at the White River above Coal Creek gage (09304200) is short. Water could be made available to augment future municipal and industrial demands (including future energy development) in Yellow Jacket Water Conservancy District (YJWCD) boundaries.
- Include Wolf Creek Reservoir. The reservoir is represented at the off-channel location on Wolf Creek. The storage capacity is 66,720 AF. It is filled with a 400-cfs pump station located on the White River, just downstream from the confluence with Wolf Creek. The reservoir operates to meet future M&I augmentation demands in Rio Blanco Water Conservancy District and YJWCD boundaries. Total releases are limited to 7,000 AFY, as stipulated in the conditional water rights decree (14CW3043).

In the Yampa River, additional storage is shown through:

- Rehabilitating Stillwater Reservoir so the full capacity of 6,088 AF is available for use. Currently, the reservoir has a storage restriction that limits the contents to 5,175 AF. The current users benefit from the enlarged storage.
- Enlarging Elkhead Reservoir by 4,300 AF. The additional storage could increase the size of the Fish Lease account to a total of 3,932 AF and the River District account to a total of 4,825 AF.

## Results

The impacts of the three management strategies on agriculture, municipal and industrial uses are summarized in Table 5 and Table 6. Refer to Volume 2, Section 6 for additional details on model results.

**Table 5. Yampa River Model Alternative Results**

| Management Strategy | Yampa River Results |
|---|---|
| **ALTERNATIVE 1**<br>20 percent of flood-irrigated acreage is converted to sprinkler irrigation, headgate demand is reduced due to increased efficiency, no change in crop irrigation requirement. | **AGRICULTURE** - The average annual headgate demand decreases due to the increase in agricultural irrigation efficiency. In all five planning scenarios, the average annual gap and the average annual consumptive use gap increase slightly. This does not produce the desired result of efficiency increases, which are intended to improve conditions for agricultural users. The large-scale change in return flows decreases water availability in the late irrigation season. In addition, decreased diversions of post-compact water rights could put these water rights at risk for abandonment.<br><br>**MUNICIPAL** - There are gaps in the municipal water provider supplies. These are located at the aggregate nodes. The model does not contain details regarding the smaller water providers that are serving this population. A more detailed representation of these water providers could help inform the YWG BRT about the true nature of the water supply gap.<br><br>Under Alternative 1, the maximum year gap is unchanged, except in Cooperative Growth, which has a slight decrease in the gap. Alternative 1 generally does not impact municipal water supplies.<br><br>**INDUSTRIAL** - Future industrial uses have a large amount of uncertainty. For Business as Usual, Weak Economy, Cooperative Growth, and Adaptive Innovation, there is a consistent gap of 192 AF in the maximum gap year for industrial users caused by physical and legal shortages to aggregate industrial users in Water District 55 - Little Snake River.<br><br>Under Hot Growth, aggregate industrial users in Water District 55 and Water District 44 experience a gap.<br><br>Under Alternative 1, the maximum year gap is unchanged. |
| **ALTERNATIVE 2**<br>Steamboat Lake has a 1,200-AF pool.<br><br>Elkhead Reservoir increases Lower Yampa Reach release limit to 75 cfs. Allow releases from Tri-State's pools to the Lower Yampa Reach. Release up to 25 cfs from River District's pool to agricultural diversions.<br><br>Stagecoach Reservoir releases to future municipal/domestic water providers and industrial users in UYWCD boundaries. Release to the Lower Yampa Reach (after Elkhead releases). | **AGRICULTURE** - Water from the River District's pool in Elkhead Reservoir is made available to agricultural users downstream of the reservoir. Releases from storage cause a modest decrease in the average annual gap and the average annual consumptive use gap for the entire YWG Basin. If releases from Elkhead Reservoir reduce or hold off calls on the Yampa River, this would reduce gaps for junior water users.<br><br>**MUNICIPAL** - New reservoir releases in Alternative 2 help reduce the municipal gaps. Some gaps remain in areas that are not easily served by reservoir releases.<br><br>**INDUSTRIAL** - The reservoir releases in Alternative 2 do not serve the industrial users that have a gap; therefore, the gaps are unchanged. |
| **ALTERNATIVE 3**<br>Continue to make releases as described in Alternative 2.<br><br>Increase Stillwater Reservoir storage to 6,392 AF.<br><br>Increase Elkhead Reservoir storage by 4,300 AF. New storage is shared between the Lower Yampa Reach and agricultural users. | **AGRICULTURE** - Water from the River District's pool in Elkhead Reservoir is made available to agricultural users downstream of the reservoir. Under Alternative 3, the River District's pool is enlarged. Releases from storage cause a modest decrease in the average annual gap and the average annual consumptive use gap for the entire YWG Basin.<br><br>**MUNICIPAL** - New reservoir releases in Alternative 3 help reduce the municipal gaps. Some gaps remain in areas that are not easily served by reservoir releases.<br><br>**INDUSTRIAL** - The maximum annual industrial gap is smaller in Alternative 3 because additional releases from Elkhead Reservoir supply the Water District 44 industrial aggregate users. |

## Yampa River Selected Reservoir Results

The figures below highlight trends in the reservoir storage results.

Figure 14 and Figure 15 present Elkhead Reservoir simulated storage contents for Business as Usual and Hot Growth. The graphs show that the Technical Update and Alternative 1 have almost identical results for the reservoir. The change in agricultural irrigation efficiency does not impact the storage in Elkhead Reservoir. Alternative 2 departs from the Technical Update because the reservoir is making additional releases to the Lower Yampa Reach. The release limit has been increased from 50 cfs to 75 cfs, and the available storage has increased by allowing releases from Tri-State's pools. Additionally, new releases are made to agricultural users from the River District pool. In Figure 14 (Business as Usual), the reservoir storage is not needed in wet periods, such as the mid-1980s. In average or moderately dry years, the reservoir releases about the same amount of water from storage in the Technical Update, Alternative 1 and Alternative 2. The additional storage water made available in Alternative 2 is only needed in dry years, such as 1977, 2000 to 2003, and 2012. The enlarged reservoir in Alternative 3 helps meet agricultural shortages in the dry years. The reservoir is able to refill every year.

In Figure 15 (Hot Growth), reservoir storage is used every year. The lower streamflows caused by climate change result in shortages to the Lower Yampa Reach targets, and supplemental water is needed from Elkhead Reservoir and Stagecoach Reservoir. Shortages also increase to the agricultural users. Despite the lower streamflows, Elkhead Reservoir refills every year.

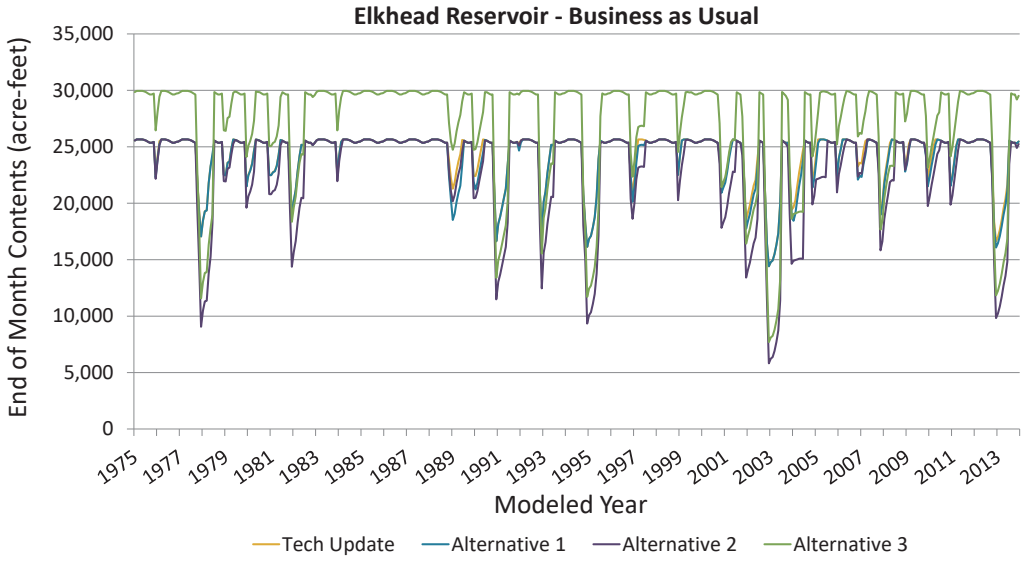



**Figure 14. Comparison of Elkhead Reservoir Storage Contents for Business as Usual and the Alternatives**

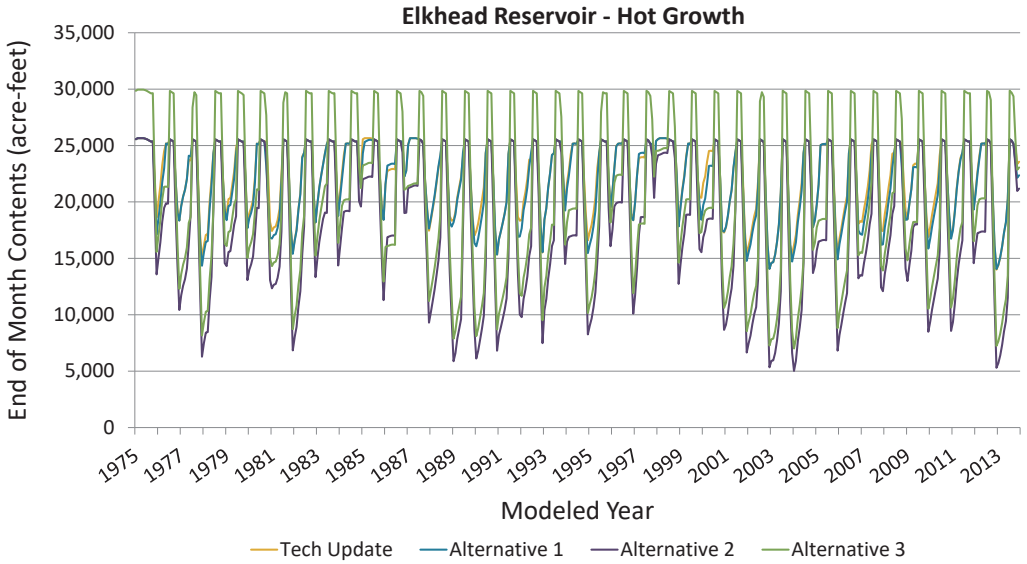



**Figure 15. Comparison of Elkhead Reservoir Storage Contents for Hot Growth and the Alternatives**

## Yampa River Selected Stream Gage Results

Monthly streamflow volumes are shown for Yampa River Near Maybell gage (09251000) location. Results are only shown for Business as Usual because the impacts of the three alternatives are similar across the planning scenarios. The streamflow results are primarily driven by hydrology. The gage is representative of the Lower Yampa Reach, which provides critical habitat for the endangered fish species. The Lower Yampa Reach starts at the confluence with Elkhead Creek and stretches to the confluence with the Green River. This large geographic area includes diversions to Craig Station, the City of Craig, and agricultural users. The reach also hosts multiple areas of high recreational value for fishing, rafting and kayaking, and the proposed Craig Whitewater Park. In addition to the endangered fish species, the reach has significant riparian plant communities and provides habitat for the roundtail chub and river otter.

As part of the Yampa River Management Plan and PBO, streamflow is supplemented by releases from Elkhead Reservoir. The target streamflow for July through October is the black dashed line. The levels vary based on the year type (wet/average/dry). Releases are generally dependent on the flow levels recorded at the U.S. Geological Survey gage near Maybell. Figure 16 shows the full range of streamflow at this gage location. Figure 17 focuses on the low-flow levels.

**Figure 16. Comparison of Monthly Streamflow Volume for the Lower Yampa Reach, Business as Usual**

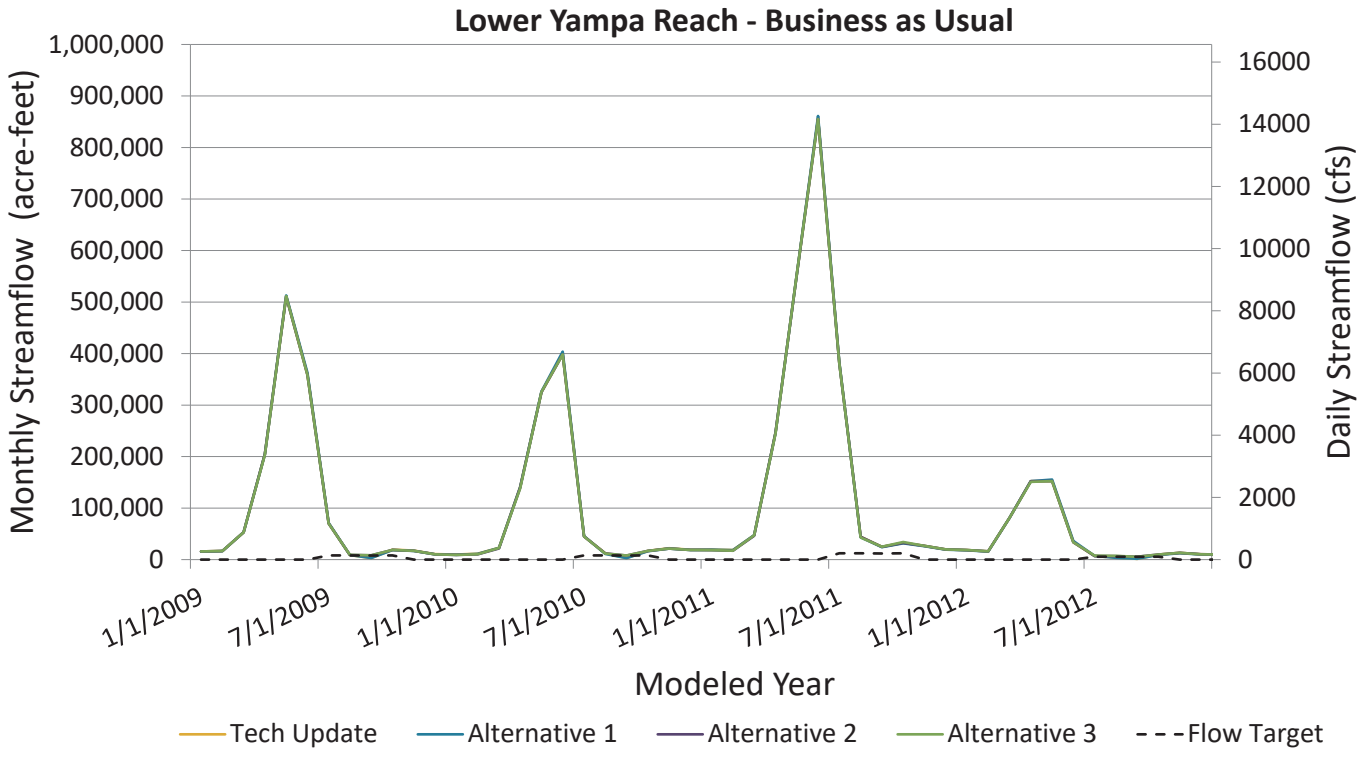
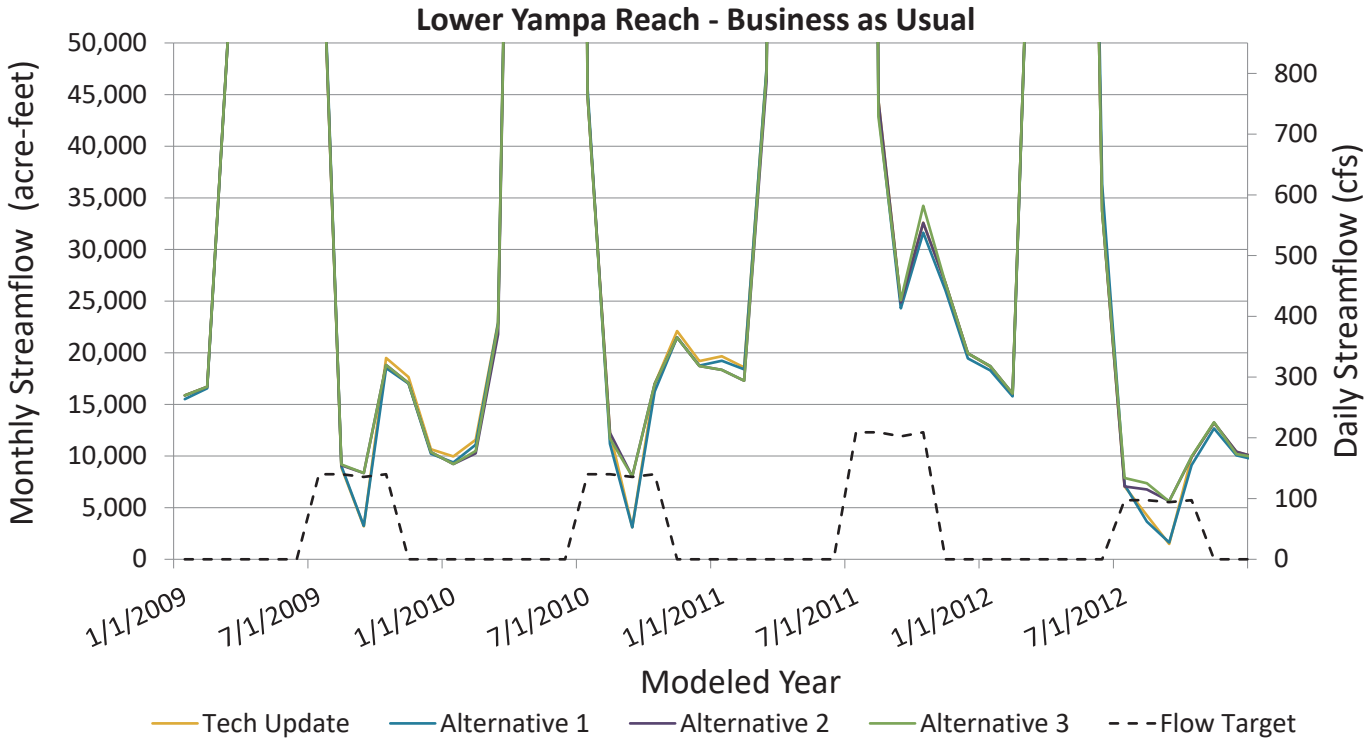


**Figure 17. Detailed Comparison of Monthly Streamflow Volume for the Lower Yampa Reach, Business as Usual**




Key observations from these results are:

- The streamflow volume for the Technical Update and Alternative 1 are similar. The improved agricultural efficiencies cause minor changes on the streamflow volumes. The streamflow is larger in May and June. This corresponds to a portion of the irrigation season that generally has sufficient water supplies. July shows slightly higher flows at the Lower Yampa Reach. Depending on the year, July may or may not have sufficient water supplies. The flows are smaller in August, September, October, November, December, January, and February. This corresponds to the period when return flow generated by flood irrigation are returning to the stream. The flows are about the same in March and April.
- The Recovery Program flow targets are only met during wet years. For the Technical Update and Alternative 1, the flow targets are not met during the average and dry years. For Alternatives 2 and 3, additional supplies from Elkhead Reservoir and Stagecoach Reservoir provide sufficient water to meet the flow targets.

**Table 6. White River Model Alternative Results**

| Management Strategy | White River Results |
|---|---|
| **ALTERNATIVE 1A**<br>20 percent of flood irrigated acreage is converted to sprinkler irrigation, no change in headgate demand. | **AGRICULTURE** - In general, agricultural users have relatively small gaps. Under Alternative 1a, the average annual gap and average annual consumptive use gaps are improved for Business as Usual, Weak Economy, Cooperative Growth, and Hot Growth. The gaps increase slightly under Adaptive Innovation.<br><br>**MUNICIPAL** - For Business as Usual, Weak Economy, and Cooperative Growth there are no gaps in the municipal water provider supplies. The largest gap is in the Adaptive Innovation, with the second largest under Hot Growth. The gap does not change under Alternative 1a. This is expected because the agricultural headgate demands have not changed, and there are only minor changes in agricultural consumptive use; therefore, water supply for other users is not impacted.<br><br>**INDUSTRIAL** - Future industrial uses have gaps in the five planning scenarios. Similar to municipal users, the industrial gap does not change under Alternative 1a. |
| **ALTERNATIVE 1B**<br>20 percent of flood-irrigated acreage is converted to sprinkler irrigation, and headgate demand is reduced due to increased efficiency. | **AGRICULTURE** - The average annual demand decreases due to the increase in agricultural irrigation efficiency. In four of the planning scenarios, the average annual gap and the average annual consumptive use gap decrease slightly. The exception is Adaptive Innovation, which assumes that agriculture will become more efficient and crop irrigation water requirements will decrease due to innovations in crop hybrids. Converting 20 percent of flood-irrigated acreage to sprinkler irrigation achieves very similar average annual headgate demands. The average annual gap and average annual consumptive use gap increase slightly in Alternative 1b.<br><br>**MUNICIPAL** - For Business as Usual and Weak Economy, there are no gaps in the municipal water provider supplies. Under Cooperative Growth, Alternative 1b results in a very small gap. This is caused by a change in the return flow patterns due to the increase in agricultural efficiencies.<br><br>The maximum gap is under Hot Growth. Similar to Cooperative Growth, this is caused by a change in return flow timing due to the increase in agricultural efficiencies.<br><br>**INDUSTRIAL** - Future industrial uses have gaps in the five planning scenarios. The industrial gap in maximum year does not change under Alternative 1b. |
| **ALTERNATIVE 2** | There is no “Alternative 2” for the White River. The existing reservoirs in the White River have small storage capacities and and cannot be considered for additional uses at this time. |

**Table 6. White River Model Alternative Results (continued)**

| Management Strategy | White River Results |
|---|---|
| **ALTERNATIVE 3**<br>20 percent of flood-irrigated acreage is converted to sprinkler irrigation, and headgate demand is reduced due to increased efficiency. | **AGRICULTURE** - Alternative 3 does not show a change to agricultural demands or gaps. This is because the increased reservoir storage at Lake Avery and the new Wolf Creek Reservoir storage are not made available to agriculture. It was assumed that the new storage would directly serve future M&I demands or augment future M&I demands.<br><br>**MUNICIPAL** - For Business as Usual, Weak Economy, and Cooperative Growth, there are no gaps in the municipal water provider supplies. Without access to reservoir storage, municipal users have a gap in Adaptive Innovation and Hot Growth. Under Adaptive Innovation, Alterative 3 shows no gap. The municipal and domestic providers have access to augmentation supplies from the Lake Avery enlargement and Wolf Creek Reservoir. Rangely can also receive supplemental supply from Wolf Creek Reservoir. The relatively modest increase in storage is capable of fully meeting the municipal demands, despite climate change.<br><br>Under Hot Growth, the new reservoir storage is able to reduce the gap but not completely eliminate it. If the population growth and climate change assumptions in Hot Growth occur, the YWG Basin will need additional strategies to fully meet the municipal demands.<br><br>**INDUSTRIAL** - Future industrial uses have a large amount of uncertainty. The uncertainty around energy development is shown in the wide range of demands. At the low end, Weak Economy assumes combined future demands of 5,270 AFY. At the high end, Hot Growth assumes combined future demands of 37,600 AFY. The industrial sector has the larger percent gaps than agriculture and municipal.<br><br>Alternative 3 shows that a modest increase in storage (2,644 AF in Lake Avery and 7,000 AF in Wolf Creek Reservoir) can significantly reduce the gaps for four of the five planning scenarios. Under Hot Growth, the large future demands have large gaps that are improved by storage but are not solved. If the industrial demands and climate change assumptions in Hot Growth occur, the YWG Basin will need additional strategies to fully meet the industrial demands. |

## White River Selected Reservoir Results

The figures below highlight trends in the reservoir storage results. Figure 18 presents Lake Avery simulated storage contents for Business as Usual. The graphs show that the Technical Update Alternative 1a and Alternative 1b have almost identical results for the reservoir. This is because there are no changes to reservoir operations in Alternative 1a and 1b. For Alternative 3 (green line), the reservoir has been enlarged, which causes the increase in reservoir storage to about 10,000 AF. Lake Avery is releasing up to 1,500 AF from the existing pool in one-third of the years to supplement streamflow upstream of Meeker. This results in storage levels that are lower than the other alternatives in dry years, such as 1977, 2002, and 2012. Additionally, the reservoir enlargement is releasing to augment downstream consumptive users and supplement streamflow. The reservoir is not used every year. It is only used during dry periods. In some dry years, the reservoir is able to refill in the following year. During multi-year droughts, such as 1977/1978, and the early 2000s, the reservoir is not always able to refill.

Figure 19 shows the simulated storage contents for Wolf Creek Reservoir. The reservoir is only included in Alternative 3. The graph compares the results from the five planning scenarios. The "saw tooth" pattern that is seen for all five planning scenarios is caused by evaporation. The reservoir fills during the peak run off and loses water due to evaporation the rest of summer and fall. Under terms of the water rights decree, releases to Rangely and other augmentation needs are limited to 7,000 AFY. Under Business as Usual and Hot Growth, the reservoir frequently makes releases. Under Hot Growth, the reservoir is releasing 7,000 AF almost every year. When the YWG Basin experiences back-to-back dry years, the reservoir is unable to refill in the second dry year. This can be seen in 1977/1978, 1990/1991, 1994/1995, 2002/2003, and 2012/2013.

**Figure 18. Comparison of Lake Avery Simulated Storage Contents for Business as Usual and the Alternatives**

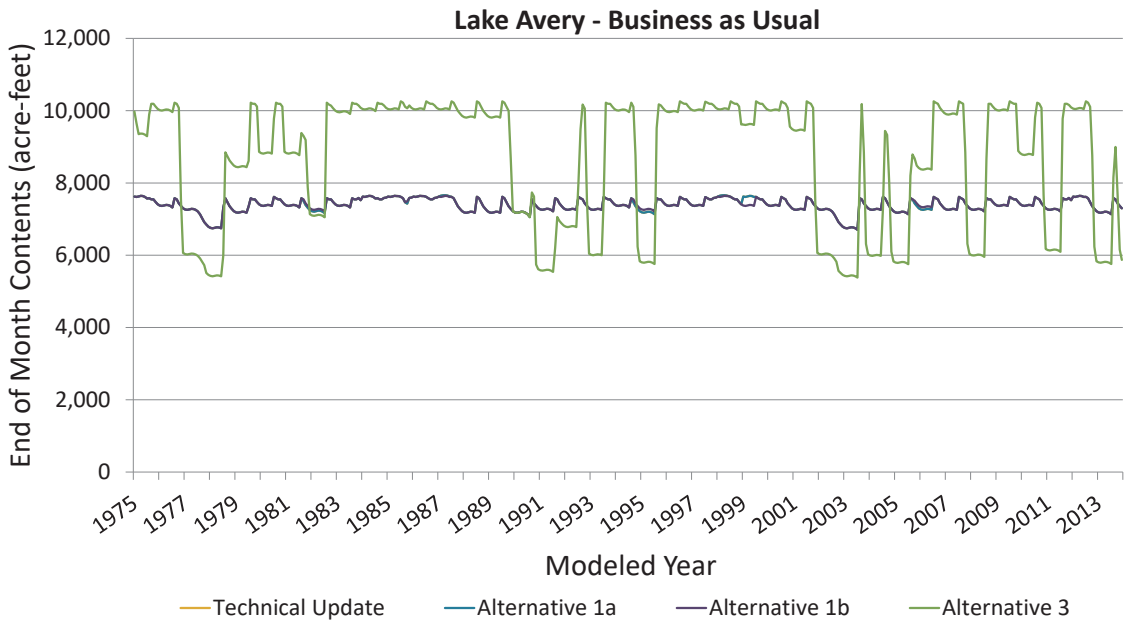
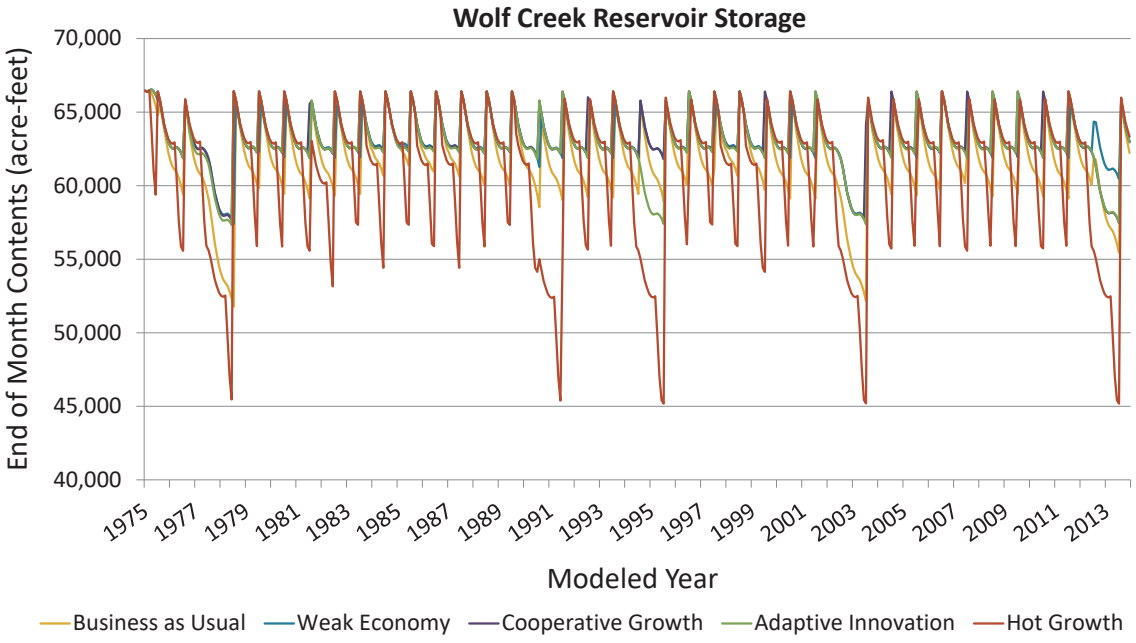



**Figure 19. Comparison of Wolf Creek Reservoir Simulated Storage Contents for Alternative 3 and the five planning scenarios**



## White River Selected Streamflow Results

Monthly streamflow volumes are shown for the White River Near Watson gage location. Results are only shown for Business as Usual because the impacts of the three alternatives are similar across the planning scenarios. The streamflow results are primarily driven by hydrology. Figure 20 and Figure 21 present results for 2010 through 2013. These years are selected to show a range of hydrological conditions. 2010 is an average year, 2011 is a wet year, 2012 is a very dry year, and 2013 is a moderately dry year. Figure 20 shows the full range of streamflow. Figure 21 focuses on the low-flow levels.

The White River at Watson gage is located in Utah, just beyond the Colorado-Utah state line. This gage is being used by the Recovery Program to develop recommended flow targets as part of the on-going White River Management Plan and PBO efforts. At time of publication, the flow targets are still in "interim" form and are not ready to use in the BIP update. The gage location is downstream of all activities in the state of Colorado; therefore, the streamflow shows the impacts of consumptive use, reservoir releases, and change in return flow amounts and timing.

**Figure 20. Comparison of Monthly Streamflow Volume for the White River Near Watson, Business as Usual**

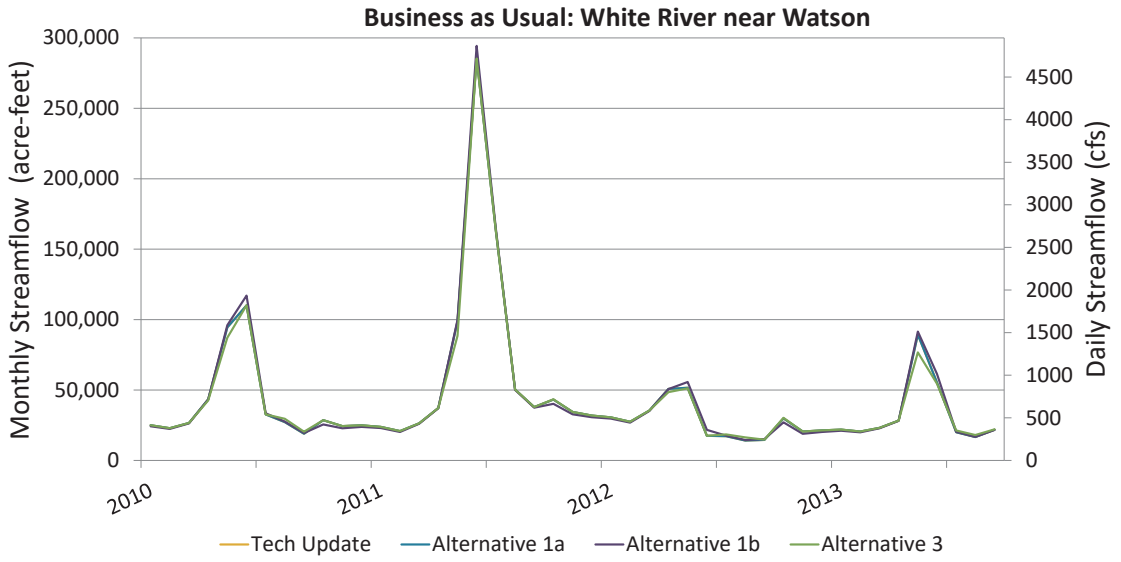
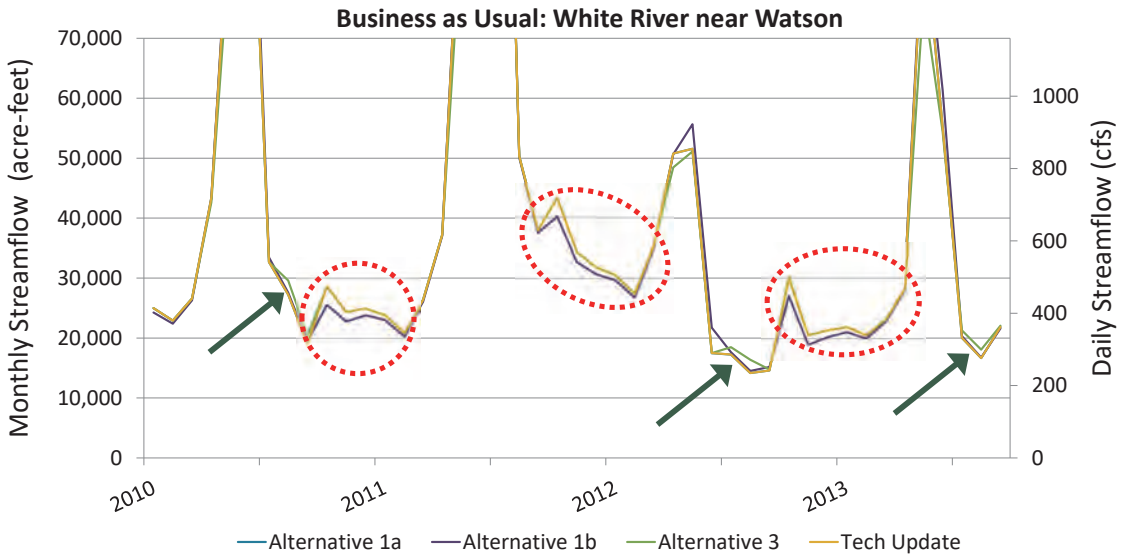



**Figure 21. Detailed Comparison of Monthly Streamflow Volume for the White River Near Watson, Business as Usual**



Key observations are:

1. The streamflow volume for the Tech Update and Alternative 1a are the same.
2. For Alternative 1b, the streamflow volume is slightly higher during peak runoff. The increase in agricultural irrigation efficiency due to the conversion of 20 percent of the flood-irrigated acreage to sprinkler causes the headgate demand to decrease. This water is left in the river and is seen at this gage location.
3. As shown in the red circles on Figure 21, the streamflow volume is slightly lower in the fall and winter. This is caused by a decrease in return flow volume. The higher efficiency sprinklers generate less return flow water than flood irrigation.
4. For Alternative 3, the streamflow volume is slightly lower during the runoff, as the enlarged Lake Avery and the new Wolf Creek Reservoir divert water into storage.
5. As shown in the green arrows, during the late irrigation season in 2010, 2012, and 2013, the streamflow is higher due to water released from storage.

## 2 IMPLEMENT PROJECTS

The YWG BRT reviewed its existing Project Database during the BIP update and added numerous projects. The projects are important to YWG Basin stakeholders and will help meet future water needs across all sectors of water use. A high-level summary of the YWG Basin's Project Database is included in Section 7. The projects in the list are characterized below to further illustrate the nature of projects that the YWG BRT is focused on implementing in the near and long terms.

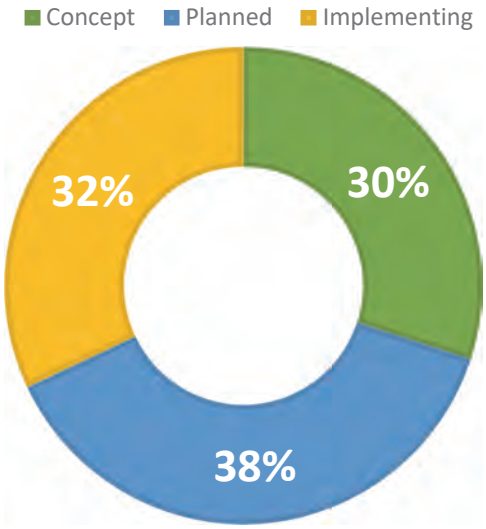



**Figure 22. Active Projects by Stage of Development**

Of the 90 total projects proposed for the YWG Basin, 77 are considered to be "active" projects as they are in the implementing, planned, or conceptual stage of development. Figure 22 shows the percent of projects with a status of "Concept", "Planned" or "Implementing." This figure shows:

- The Basin is actively implementing about 32 percent of the projects in the database. Stakeholders in the YWG Basin are actively working on projects that help advance the eight basin goals.
- About 38 percent of the projects have a status of planned. These projects are clearly defined by a project proponent. Many of these projects are either seeking permits or funding before they can be implemented.



- About 30 percent of the projects are concepts. These projects are in the early stages of development. This division of project status shows that the YWG Basin has a healthy division of projects that are underway, projects that are preparing for implementation, and projects that are just beginning to be explored.

Figure 23 shows the different types of projects that are documented in the Project Database. The categories refer to the primary beneficiary of the IPP or the primary challenge that is addressed by projects, as follows:

- **Agriculture** – Projects related to rehabilitating agricultural diversion structures, measuring agricultural diversions, addressing shortages, and return flow studies
- **Colorado River** – Projects related to Colorado Big River issues, such as Demand Management
- **Education** – Projects related to public education, outreach, and participation
- **Measurement** – Projects related to installing new streamflow gages, automated reservoir measurements, or weather stations
- **M&I** – Projects related to M&I supply projects, water treatment plan improvements, or conservation
- **Recreation** – Projects related to new in-river recreational infrastructure or improving river access
- **Reservoirs** – Projects related to building new storage projects, rehabilitating existing reservoirs and ponds, and reservoir management options
- **Watershed** – Projects related to watershed/forest/rangeland health, water quality, instream flows, land use planning, and PBOs.

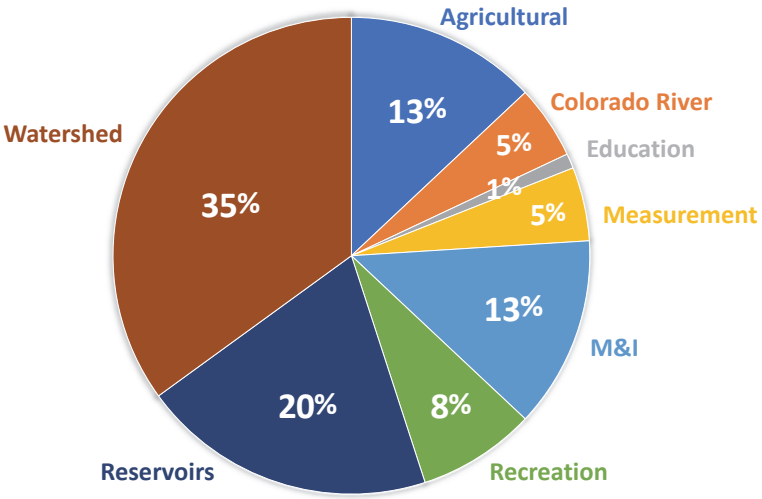



**Figure 23. Active Projects by Category**

Cost estimates were developed or provided for approximately 65 percent of the active projects. Based on available cost estimates, the total estimated cost to implement and/or construct the active projects in the YWG Basin is approximately $655 million.

Numerous potential projects in the YWG Basin will be impactful toward meeting the goals identified by the YWG BRT. Project prioritization will occur through the existing and ongoing planning studies. The Yampa IWMP and White River IWI are two planning documents that will address prioritization of water supply projects, and these studies support multi-benefit projects.

# Section 7. Future Basin Projects

The BRTs, along with other stakeholders, identified projects that will further progress toward achieving basin goals and meeting future water needs. The list of projects is managed in a database that was initially developed prior to the 2015 BIP and was updated in 2020 during the BIP update. The purpose of the Project Database is to keep a record of the projects considered by the roundtables through the BIP process, both in the past and into the future. Table 7 provides a snapshot summary of the Project Database at the conclusion of the current BIP update process.

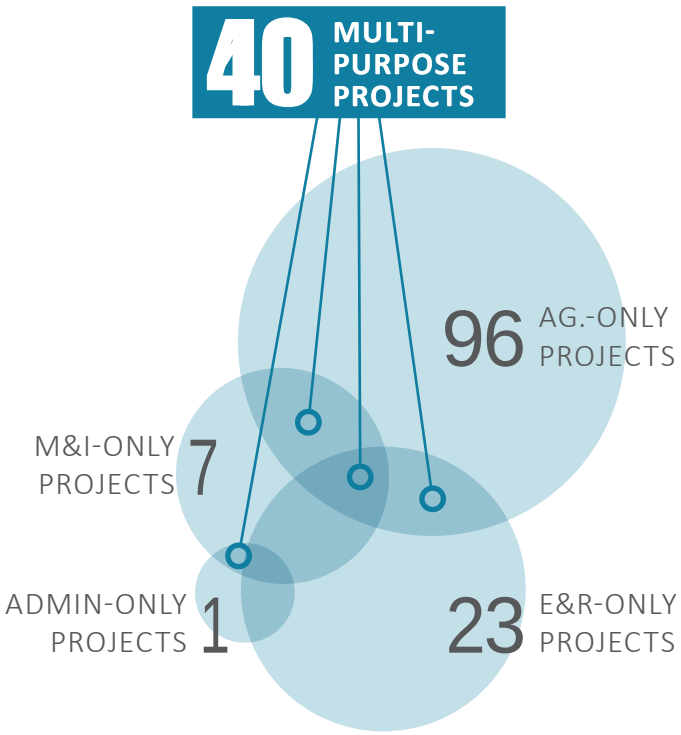
**Table 7. Snapshot Summary of YWG Basin Projects**

| | |
|---|---|
| Total Projects | 84 |
| New projects added in 2020 | 57 |
| Projects completed | 4 |
| Projects being implemented | 30 |
| Projects identified as meeting M&I needs | 35 |
| Projects identified as meeting Ag needs | 43 |
| Projects identified as meeting E&R needs | 52 |
| Tier 1 projects | 28 |
| Tier 2 projects | 12 |
| Tier 3 projects | 28 |
| Tier 4 projects | 5 |
| **TOTAL COST OF ALL PROJECTS** | **$655,000,000** |
| **PERCENTAGE OF PROJECTS WITH AN ESTIMATED COST** | **65%** |

*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 exceed $655 million

*(for projects that have identified a project cost)*




## Project Tiering and Level of Readiness

A new feature of the Project Database for the BIP update is the assignment of "tiers" to projects (see description of tiers in the graphic). 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 Water Supply Reserve Fund (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**<br>*Ready to launch and has full data set* |
| TIER 2 | **Supported and Pursued**<br>*Almost ready to move forward and has a significant amount of data* |
| TIER 3 | **Supported and Developing**<br>*Project is developing but still needs to be fleshed out* |
| TIER 4 | **Considering**<br>*Project not yet moving forward but should be kept on the list* |

# Section 8. Education and Outreach

## Introduction and Overview

When the Colorado General Assembly established the BRTs and the IBCC in 2005, it provided for a Public Education, Participation and Outreach (PEPO) Workgroup. Each roundtable supports the PEPO effort by implementing an Education Action Plan (EAP), which it updates annually. To accomplish its basin's goals and successfully implement the BIP, the YWG BRT needs the support of the water community and general public; to that end, it seeks to educate the community about the impact of water on their lives, the water challenges facing the basin, and proposed solutions. Furthermore, the PEPO committee's goals include facilitating informed discussions on water issues, encouraging locally driven collaborative solutions, leveraging partnerships with other YWG basin organizations whose mission is to promote water education, and providing a mechanism by which public input and feedback can be relayed to the IBCC[2].

## Critical education/outreach issues

The YWG's 2021 EAP identifies the following as "critical" topics for upcoming education and outreach:

- Colorado Basin Issues
  - Compact Compliance
  - Powell/Mead structural deficit
  - Colorado River Drought Contingency Plan
- BIP (and Colorado Water Plan) update
- Yampa IWMP and White River IWI
- BRT collaborative process
- Water supply gaps and Colorado Water Plan
- Drought and how to adapt
- Watershed health

## PEPO Achievements

Community Agricultural Alliance (CAA) has been the YWG BRT PEPO Liaison since 2016. It was awarded a three-year WSRF grant in 2020 to continue in this role conducting education and outreach activities. On behalf of the BRT, CAA achieved the following with the support of PEPO funds and a WSRF grant:

- Placed YWG BRT meeting notices in regional newspapers
- Created YWG BRT website and Facebook page
- Developed YWG BRT logo
- Produced a series of six videos: Yampa River Hydrograph; Municipal and Industrial Water Use; Storage: Our Place in the Water Cycle; Agriculture in the basin; Recreation and Wildlife; and White Basin. These can be viewed at **https://yampawhitegreen.com/water_table_videos/**
- Developed and published 13 water education ads in regional newspapers from 2017 through 2020 that covered the YWG BRT process, the BIP, basin facts and model findings, water users, IWMP, and the Colorado Compact
- Developed 16 radio ads that ran on regional stations
- Developed or supported 24 water education events within the YWG Basin

The Yampatika Outdoor Awareness Association received grant funding to develop YWG Rivers K-12 Curriculum for the BRT. Curriculum highlighting the importance of water to agriculture, municipalities, recreation, businesses, community members, and the environment was developed in spring 2020. Yampatika is now determining how to implement that curriculum within the COVID-19 health requirements.

### PEPO Goals

**Goal 1**: Raise public awareness of YWG BRT activities

**Goal 2**: Raise public awareness of the YWG BIP and the CWP

**Goal 3**: Support IWMP development in the YWG Basin

**Goal 4**: Education Sub-committee will identify writers and topics; the liaison will submit these articles to regional news agencies

**Goal 5**: BIP and CWP updates

**Goal 6**: Other identified water education opportunities as identified by the YWG BRT and partners

**Goal 7**: Provide financial assistance to BRT members who wish to attend BIP/CWP-related conferences

**Goal 8**: YWG PEPO chair will participate in CWCB education-related meetings

**Goal 9**: The PEPO liaison will participate in CWCB education-related training

[2] 2021 YWG EAP