Basin Report Objectives

This report is designed to provide a local perspective on the Statewide Water Supply Initiative 2010 (SWSI 2010) report. This basin report was prepared in consultation with the local Basin Roundtable established by House Bill 05-1177 and some sections of the report were directly produced by basin roundtable members. As such, the report not only summarizes basin-specific data from SWSI 2010, but also seeks to document progress, problems, and a path forward from the basin's perspective. The State of Colorado fully supports the basin roundtable process, yet the substantive conclusions of this report are those of the basin roundtable and are not necessarily endorsed by the State of Colorado.

This report is intended to provide reconnaissance-level data that employs consistency in data collection and forecast methodology across the state while maximizing available data. The methods utilized in this approach are for the purpose of general statewide and basinwide planning and are not intended to replace the efforts of local entities for project-specific purposes.

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Rio Grande Basin

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Acronyms

AF	acre-feet
AFY	acre-feet per year
BLM	Bureau of Land Management
CBEF	Center for Business and Economic Forecasting
CDOW	Colorado Division of Wildlife
CDSS	Colorado Decision Support System
CDWR	Colorado Division of Water Resources
COL	Colorado Open Lands
CREP	Conservation Reserve Enhancement Program
CRWAS	Colorado River Water Availability Study
CU	consumptive use
CU&L	Consumptive Uses and Losses
CWCB	Colorado Water Conservation Board
DMRP	Drought Mitigation and Response Plan
DNR	Department of Natural Resources
DU	Ducks Unlimited
GIS	geographic information system
gpcd	gallons per capita per day
HB	House Bill
HUC	Hydrologic Unit Code
IBCC	Interbasin Compact Committee
IPP	identified projects and processes
ISF	instream flows
IWR	Irrigation Water Requirement
M&I	municipal and industrial
MLI	Manassa Land and Irrigation Company
NCNA	Nonconsumptive Needs Assessment
NEPA	National Environmental Policy Act
NGOs	nongovernmental organizations
NHD	National Hydrography Dataset
NRCS	Natural Resources Conservation Service
RiGHT	Rio Grande Headwaters Land Trust
SB	Senate Bill
SDO	State Demographer's Office
SMR	Santa Maria Reservoir
SRGAP	Southwest Regional Gap Analysis Project
SSI	self-supplied industrial
SWSI	Statewide Water Supply Initiative
TNC	The Nature Conservancy
USDA	U.S. Department of Agriculture
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WSL CU	Water Supply Limited Consumptive Use
WSRA	Water Supply Reserve Account

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Section 1
Introduction

1.1 Rio Grande Basin Roundtable

The Rio Grande Basin Roundtable makes an effort to have an educational element as part of each meeting. Initially these topics included information that was felt to be significant for all basin roundtable members to have a basic understanding of water issues affecting the Rio Grande Basin. These topics included the over appropriation of the basin, Colorado Water Law, the doctrine of prior-appropriation, the U.S. Bureau of Reclamation's Closed Basin Project, the effect the Rio Grande Compact has on overall water management in the basin, and Groundwater Management Sub-district's attempts to achieve sustainable use of groundwater. More recent educational topics have included the Super Ditch of the Lower Arkansas Basin, micro-hydro electrical generating plant technology and the permitting of such facilities, and the results of the application of water conservation measures in communities.

The basin roundtable has continued to develop their consumptive and nonconsumptive needs assessments. Through its Consumptive Use Subcommittee the Rio Grande Basin has performed its Consumptive Use Needs Assessments The major issues in the basin include agricultural use and related groundwater shortages, increasing municipal and industrial (M&I) demands, solar energy development, and oil and gas development. A total shortfall by 2050 of 180,000 acre-feet (AF) is documented, of which 160,000 AF is the agricultural groundwater shortage to be addressed by pending State Engineer's well rules and regulations, and fallowing land via the Groundwater Sub-districts. Issues and needs noted by the Consumptive Use Subcommittee will be documented in the forthcoming Statewide Water Supply Initiative (SWSI) updates. The basin has completed and approved Phase I of its Nonconsumptive Needs Assessment through the creation of a map with attribute counts at the watershed level. Nearly all watersheds within the basin had at least one environmental or recreational attribute present.

The Water Supply Reserve Account (WSRA) funds have allowed important water projects to proceed that would not otherwise have happened. The basin has been successful in obtaining $4 million for these water related projects. Each project was carefully scrutinized to ensure they met the threshold criteria, and proposals were reviewed by a subcommittee of the basin roundtable. The projects have included groundwater studies relating to sustainability issues in the basin, evaluation of rehabilitation needs and increased capacity of reservoirs, rehabilitation of a reservoir, improvements to the infrastructure of irrigation companies, water and natural resource conservation through conservation easements on lands adjoining the Rio Grande, riparian stabilization, and instream flows.

The basin roundtable has had little interaction with adjacent roundtables, primarily because the basin is over appropriated and focused on efforts to establish and maintain sustainability of the groundwater aquifers. This is anticipated to require 80,000 acres of irrigated agricultural lands coming out of production. The economic effects to the communities of the basin are still unknown.

1.2 Overview of the Water for the 21st Century Act

In 2005, the Colorado General Assembly passed the Colorado Water for the 21st Century Act (House Bill [HB] 05-1177). This legislation set up a framework that provides a permanent forum for broad-based water discussions, and it created two new structures—1) the Interbasin Compact Committee (IBCC), a statewide committee that addresses issues between basins; and 2) the basin roundtables, which were established in each of the state's eight major river basins plus the Denver Metro area. The purpose of the basin roundtables is to facilitate discussions on water issues and encourage locally driven collaborative solutions. The broad-based, collaborative nature of this process is reflected in the basin roundtable membership.

To help the basin roundtables accomplish their major responsibility of developing basinwide needs assessments, they have relied on groundwork completed during the SWSI Phase 1 study. To further develop their needs assessments, support water activities in each of the basins, and implement identified water projects and methods, it was clear that the basin roundtables needed staff support as well as technical and financial assistance. Using resources provided through HB 06-1400, the Colorado Water Conservation Board (CWCB) provides staff support and technical assistance to the basin roundtables and the IBCC for the ongoing implementation of the Colorado Water for the 21st Century Act. The basin roundtables were also provided financial resources through Senate Bill (SB) 06-179, which established the WSRA. The WSRA appropriates money to the CWCB to help implement the consumptive and nonconsumptive water supply projects and methods identified by the basin roundtables. These bills and other relevant legislation are summarized below. The purpose of this report is to summarize the results of the Rio Grande Basin Roundtable's needs assessment that have been completed to date.

SB03-110 authorized SWSI 1, which implemented a collaborative approach to water resources issues by establishing SWSI roundtables. SWSI 1 focused on using a common technical basis for identifying and quantifying water needs and issues.

HB05-1177 or The Colorado Water for the 21st Century Act provides a permanent forum for broad-based water discussions. It creates two new structures: 1) the IBCC, and 2) the basin roundtables. There are nine basin roundtables based on Colorado's eight major river basins and the Denver Metro area.

SB06-179 created the WSRA. Throughout SWSI and Colorado Water for the 21st Century Act processes, there has been a clear recognition that financial assistance is needed to address the water challenges in our state. This legislation funds the WSRA, which directs the State Treasurer to annually transfer $10 million from the Operational Account of the Severance Tax Trust Fund to the WSRA. These monies are available to the basin roundtables to fund water activities.

HB06-1385 created the CWCB's Intrastate Water Management and Development Section, which implements SWSI, the WSRA, develops reconnaissance level water supply alternatives, and tracks and supports water supply projects and planning processes. This section is now called the Water Supply Planning Section.

HB06-1400 appropriated money to the CWCB to fund staffing of the Water for the 21st Century Act process and monies for a contractor to technical assistance the basin roundtables.

SB09-106 authorized the funding of the WSRA in perpetuity.

Basin roundtables are legislatively required to be made up of a diverse set of stakeholders, including representatives from counties, municipalities, water conservancy districts, the environmental and recreational communities, agriculture, and industry. The responsibilities of the basin roundtables can be grouped into three categories—procedural, substantive, and public involvement. Each basin roundtable adopted bylaws that include the basin roundtable's goals, objectives, and operating procedures. These bylaws reflect the specific needs of the basin roundtable and reflect the uniqueness of each basin. Each basin roundtable developed procedures and selected two members of the IBCC.

The most extensive substantive responsibility assigned to each basin roundtable is to develop a basinwide water needs assessment. This is performed in cooperation with local governments, area water providers, and other stakeholders. The Colorado Water for the 21st Century Act states "Using data from the Statewide Water Supply Initiative and other appropriate sources and in cooperation with the ongoing Statewide Water Supply Initiative, develop:

- An assessment of consumptive water needs (municipal, industrial, and agricultural)
- An assessment of nonconsumptive water needs (environmental and recreational)
- An assessment of available water supplies (surface and groundwater) and an analysis of any unappropriated waters
- Proposed projects or methods to meet any identified water needs and achieve water supply sustainability over time"

Equally important to selecting members of the IBCC and developing a basinwide water needs assessment, the basin roundtables serve as a forum for public involvement. The basin roundtable activities are required by law to be open, public meetings. The basin roundtable process creates an expanded foundation for public involvement.

This SWSI 2010 Report was largely based on basin roundtables' water needs assessments. This report is a summary of the Rio Grande Basin Roundtable's needs assessment results that were utilized in the SWSI 2010 Report and that were chosen by the basin roundtable to be included in this Rio Grande Basin Roundtable Needs Assessment Report.

1.3 Overview of the SWSI 2010 Report

The last decade brought many changes to the State of Colorado's water supply outlook. Despite the recent economic recession, the state has experienced significant population growth, and Colorado's population is expected to nearly double within the next 40 years. Colorado needs to provide an adequate water supply for its citizens and the environment, yet Colorado is transitioning from an era of undeveloped resources to an era of managing a more developed resource. Meeting the state's municipal, industrial, agricultural, environmental, and recreational water needs will involve implementing a mix of local water projects and processes, conservation, reuse, agricultural transfers, and the development of new water supplies, all of which should be pursued concurrently. Ultimately, the future of Colorado—both its vibrancy and its beauty—is dependent on how our water resources are sustained, used, and developed.

To help understand and address these trends, the CWCB undertook a number of important initiatives. The CWCB is statutorily charged to conserve, protect, manage, and develop Colorado's water resources for current and future generations. In advancing this mission, the CWCB helps ensure that water is utilized to meet the needs of Colorado's citizens while protecting the environment.

In the last few years, state leaders and resource management agencies have increasingly focused on helping ensure that Colorado has an adequate water supply for its citizens, agriculture, and the environment. In 2003, the Colorado General Assembly recognized the critical need to understand and better prepare for our long-term water needs and authorized the CWCB to implement SWSI. SWSI 1, approved by the CWCB Board in 2004, was a comprehensive identification of Colorado's current and future water needs, and it examined a variety of approaches Colorado could take to meet those needs. SWSI 1 implemented a collaborative approach to water resource issues by establishing "basin roundtables"—diverse groups of individuals representing water interests who provide input on water issues.

This was followed by SWSI 2, which established four technical roundtables—Conservation, Alternative Agricultural Water Transfers, Environmental and Recreational Needs, and Addressing the Water Supply Gap. The overall goal of SWSI 2 was to develop a range of potential solutions that would help water providers, policymakers, and stakeholders gain a deeper understanding of the relative role that water efficiency, agricultural transfers, and new water development can play in meeting future needs and the trade-offs associated with these solutions.

In 2005, the legislature reaffirmed the need to prepare for a future in which water resources are increasingly limited by passing the Colorado Water for the 21st Century Act. This legislation institutionalized nine basin roundtables and created a voluntary, collaborative process to help the state address its water challenges. This process is based on the premise that Coloradoans can work together to address the water needs within the state.

Figure 1-1 illustrates the nine basin roundtables, which were organized to represent Colorado's eight major river basins and a separate basin roundtable for the Denver Metro area. The Yampa-White, Colorado, Gunnison, and Southwest Basin Roundtables are all based on tributaries to the Colorado River. The North Platte, Metro, and South Platte Basin Roundtables represent watersheds tributary to the Platte River. The Arkansas and Rio Grande Basin Roundtables are the headwaters of these river systems.

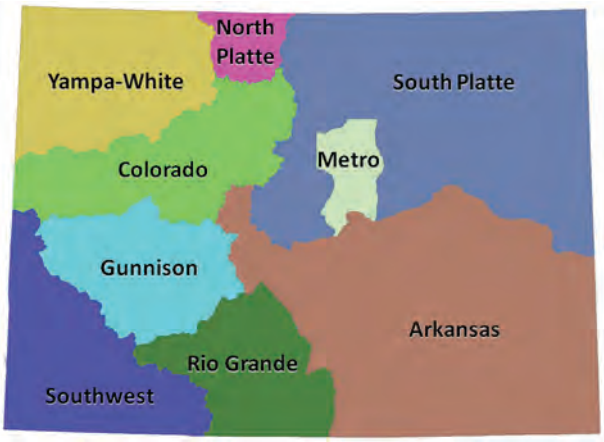


Figure 1-1 Colorado's nine basin roundtables provide a voluntary and collaborative process to help the state address its water challenges

In addition to the nine basin roundtables, the Colorado Water for the 21st Century Act established the 27-member IBCC to facilitate conversations between basins and to address statewide issues. The IBCC established its charter in 2006, which was soon ratified by Colorado's General Assembly. The charter outlines the roles of the IBCC—to provide a "framework that creates incentives for successful deliberations, agreements, and their implementation." To help advance this role, the IBCC embarked on a visioning process, through which the IBCC, CWCB, and basin roundtables agreed to evaluate water demand and supply strategies that could help address Colorado's water supply future.

1.4 SWSI 2010 Report Recommendations

With the completion of SWSI 2010, CWCB has updated its analysis of the state's water supply needs and recommends Colorado's water community enter an implementation phase to determine and pursue solutions to meeting the state's consumptive and nonconsumptive water supply needs. This will be accomplished through the following recommendations.

These recommendations do not necessarily represent a statewide consensus. The CWCB has deliberated on the information contained in SWSI 2010 and has put forth its view of how to move forward.

1. Actively encourage projects to address multiple purposes, including municipal, industrial, environmental, recreational, agricultural, risk management, and compact compliance needs.

2. Identify and utilize existing and new funding opportunities to assist in implementing projects and methods to meet Colorado's consumptive and nonconsumptive water supply needs.

3. Continue to lead the dialogue and foster cooperation among water interests in every basin and between basins for the purpose of implementing solutions to Colorado's water supply challenges.

4. Support water project proponents and opponents in resolving conflict and addressing concerns associated with implementing identified projects and processes (IPPs) that will reduce the M&I water supply gap. Identify IPPs that could be implemented by 2020.

5. Support meeting Colorado's nonconsumptive water needs by working with Colorado's water stakeholders to help:

   - Promote recovery and sustainability of endangered, threatened, and imperiled species in a manner that allows the state to fully use its compact and decreed entitlements.
   - Protect or enhance environmental and recreational values that benefit local and statewide economies.
   - Encourage multi-purpose projects that benefit both water users and native species.
   - Pursue projects and other strategies, including CWCB's Instream Flow Program, that benefit consumptive water users, the riparian and aquatic environments, and stream recreation.
   - Recognize the importance of environmental and recreational benefits derived from agricultural water use, storage reservoirs, and other consumptive water uses and water management.

6. Help meet Colorado's agricultural water supply needs by incorporating agricultural water needs into the development of water supply portfolios and supporting the implementation of multi-purpose agricultural water supply projects.

7. In order to determine the appropriate combination of strategies (IPPs, conservation, reuse, agricultural transfers, and the development of new water supplies) and portfolios to meet the water supply needs, CWCB will identify what it considers is achievable for each portfolio element and how those portfolio elements could be implemented.

8. Evaluate multi-purpose projects or packages of projects to develop new water supplies for use on the West Slope and the Front Range.

9. Develop and support risk management strategies so that Colorado can fully use its compact and decree entitlements to best balance Colorado's diverse water needs.

10. Support, encourage, and incentivize water providers in planning for and implementing M&I active conservation best management practices and other demand management strategies.

11. Work with water providers to identify opportunities where additional water could be made available by increased regional cooperation, storage, exchanges, and other creative opportunities.

12. Continue the evaluation of Colorado's water supply availability in all basins to help provide water users with viable analysis tools.

13. Help safeguard Colorado's water supply during times of drought by incorporating drought mitigation and response in statewide and local water supply planning.

14. Support local water supply planning.

15. The CWCB, in consultation with other state agencies, shall develop and implement a plan to educate and promote stewardship of water resources that recognizes water's critical role in supporting the quality of life and economic prosperity of all Coloradoans.

16. Establish a 6-year planning cycle for assessing Colorado's long-term consumptive and nonconsumptive water needs and support the implementation of projects and methods to meet those needs.

1.5 Rio Grande Basin Roundtable Needs Assessment Report Overview

This report presents the information utilized in the SWSI 2010 Report and needs assessment information developed by the basin roundtable that is specific to the Rio Grande Basin. Following is a description of the contents of this Basin Needs Assessment Report:

- **Section 2** is a summary of the **Rio Grande Basin Nonconsumptive Needs Assessment** that have been completed to date. The roundtable has completed an extensive inventory of its environmental and recreational attributes and has summarized this information in focus area mapping.

- **Section 3** provides an overview of **Rio Grande Basin Nonconsumptive Projects and Methods** that have been gathered by the CWCB and a summary of this information as requested by the basin roundtable.

- **Section 4** summarizes the basin's M&I and agricultural water demands into a basinwide look at the **Rio Grande Basin's Consumptive Needs Assessment**. The consumptive demands utilize a planning horizon of 2050.

- In **Section 5**, projects and methods to meet consumptive needs are considered. As part of the summary, the **Projects and Methods to Meet Rio Grande Basin M&I Needs** are described at a county level.

- The CWCB recently developed the draft Colorado River Water Availability Study (CRWAS). In **Section 6, Water Availability** is considered statewide including a summary of the analyses considered in CRWAS as well as water availability information developed by the Basin Roundtables as part of their basinwide needs assessments and during SWSI 1.

- **Section 7** is a summary of the **Rio Grande Basin Roundtable's Strategies to Address Consumptive and Nonconsumptive Needs** as well as the basin roundtable's recommended next steps.

Section 2
Rio Grande Basin Nonconsumptive Needs Assessment

2.1 Overview of Nonconsumptive Needs Assessments

As discussed in Section 1, the basin roundtables are required to complete Nonconsumptive Needs Assessments (NCNAs). This effort has included an extensive inventory, analysis, and synthesized mapping effort that built upon the Statewide Water Supply Initiative (SWSI) 2 environmental and recreational attribute mapping as a common technical platform for the basin roundtables. **Figure 2-1** shows the process that was utilized by the Colorado Water Conservation Board (CWCB) and basin roundtables in completing their NCNAs. The basin roundtables have utilized environmental and recreational mapping to identify where the nonconsumptive focus areas are in their basins. The basin roundtables' nonconsumptive focus areas and further study efforts are intended to facilitate the identification of projects and methods to address environmental and recreational water needs. The Rio Grande Basin nonconsumptive identified projects and methods are summarized in Section 3 of this report.

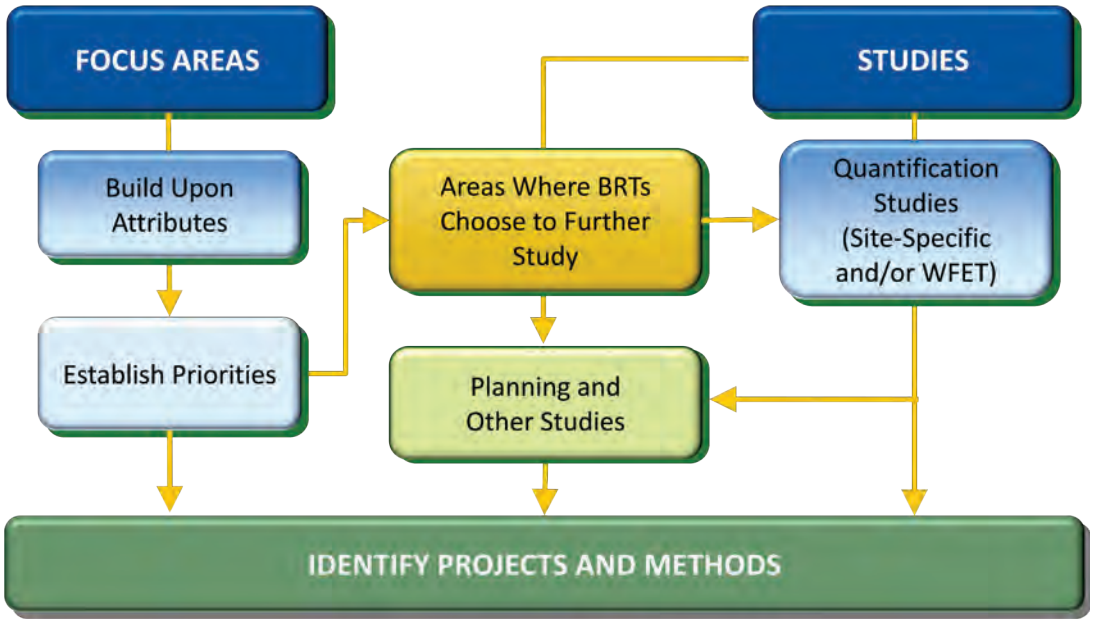


Figure 2-1 Nonconsumptive Needs Assessment Methodology

The focus area maps developed by each basin roundtable are based on a common set of environmental and recreational attributes and represent where Colorado's important water-based environmental and recreational attributes are located. The maps are reflective of stakeholder input for the focus areas and also reflect stream reaches and subwatersheds with higher concentrations of environmental and recreational qualities. These maps were generated to provide information to the basin roundtables on important environmental and recreational areas in their basins but were not intended to dictate future actions. It should be noted, and as will be shown in this section, that this effort has not identified all streams as important. The NCNAs are not intended to create a water right for the environment and will not diminish, impair, or cause injury to existing absolute or conditional water rights. The CWCB and basin roundtables developed the environmental and recreational focus area mapping for the following purposes:

- The maps are intended to serve as a useful guide for water supply planning so that future conflicts over environmental and recreational needs can be avoided.
- The maps can assist in identifying environmental and recreational water needs status, such as where needs are being met, where additional future study may need to take place, or where implementation projects in the basin are needed.
- The maps can help basins plan for the water needs of species of special concern so that they do not become federally-listed as endangered or threatened in the future.
- The maps can provide opportunity for collaborative efforts for future multi-objective projects.

2.2 Focus Area Mapping Methodology

Underlying the work done by the basin roundtables is a common technical platform, which builds off SWSI 2, as described above. This common technical platform approach recognizes the need for each basin roundtable to utilize the technical work in the most effective manner for the stakeholders and concerns within the basin. For example, some basins that were focused on wetlands or bird habitat issues used a watershed approach, while others focused on instream habitat.

Overall, the basin roundtables used three methods to identify their focus areas as shown in **Figure 2-2**. After the basin roundtables gathered additional data layers beyond existing SWSI 2 geographic information system (GIS) data layers, they each developed a summary map that highlighted environmental and recreational focus areas for their basin. The Rio Grande Basin Roundtable utilized Method 1, which employed GIS software to summarize information at a watershed level (U.S. Geological Survey [USGS] 12-digit Hydrologic Unit Code [HUC] watershed). The basin roundtable had many data layers

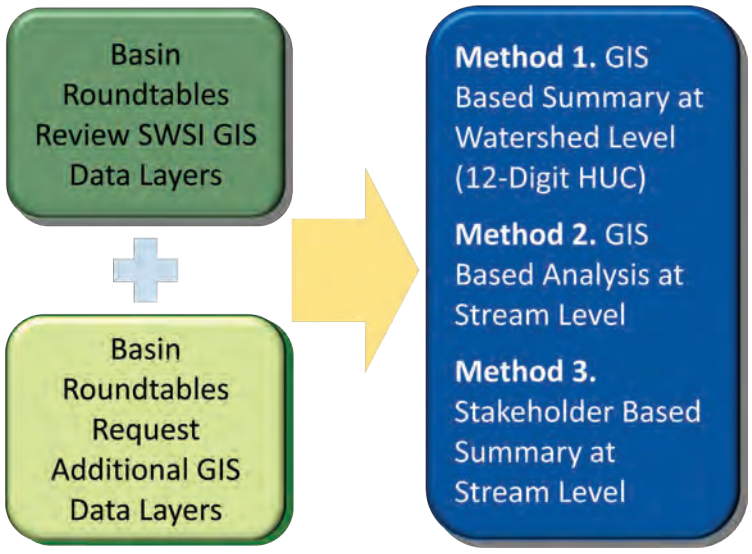


Figure 2-2 Basin Roundtable Focus Area Mapping Methodology

that they summarized into "categories," such as threatened and endangered species, riparian communities, and recreational boating areas. Using GIS software, the number of categories in each watershed was counted, and using varying color scales, GIS watersheds with a higher number of categories were highlighted in a darker color.

GIS software was used to organize the data layers for environmental and recreational attributes associated with nonconsumptive water needs for each basin. The term "data layer" refers to geographic data that represents a specific type of feature or attribute (e.g., wetlands or species habitat) and can also be referred to as a shapefile. Multiple data layers, organized collectively, are referred to as a dataset. The environmental and recreational data layers for each basin were selected using the SWSI 2 GIS data layers as a starting point. The basin roundtables reviewed the available data layers compiled during SWSI 2 and then suggested and contributed additional data layers as deemed appropriate for each basin. The SWSI 2010 Report's Appendix C contains the *Nonconsumptive Needs Assessment Focus Mapping Final Report* that provides the detailed methodology utilized by each basin roundtable in developing their focus area map.

2.2.1 SWSI 2 GIS Data Layers

The Environmental and Recreational Technical Roundtable that was formed under SWSI 2 developed a list of select environmental and recreational GIS data layers that could potentially be used by decisionmakers to determine areas of focus for environmental and recreational water needs. The complete list of SWSI 2 GIS data layers is shown in **Table 2-1**.

Table 2-1 SWSI 2 Environmental and Recreational Data Layers

Arkansas Darter	Gold Medal Trout Streams
Audubon Important Bird Areas	Greenback Cutthroat Trout
Bluehead Sucker	Greenback Cutthroat Trout
Bonytail Chub	Humpback Chub
Boreal Toad Critical Habitat	Rafting and Kayak Reaches
Colorado Department of Public Health and Environment Water Quality Control Division 303(D) Listed Segments	Rare Riparian Wetland Vascular Plants
Colorado Pikeminnow	Razorback Sucker
Colorado River Cutthroat Trout	Recreational In-Channel Diversions
CWCB Instream Flow Rights	Rio Grande Cutthroat Trout
CWCB Natural Lake Levels	Rio Grande Sucker
CWCB Water Rights Where Water Availability had a Role in Appropriation	Roundtail Chub
Flannelmouth Sucker	Significant Riparian/Wetland Communities
Gold Medal Trout Lakes	

In addition to the SWSI 2 environmental and recreational GIS data layers, the basin roundtables requested the attainment and development of other important environmental and recreational GIS data layers. Some of the additional GIS data were received directly from state and federal agencies, nongovernmental organizations and municipalities, or downloaded from their official websites. Other additional GIS data were digitized from available information, lists, or maps provided by basin roundtables, specialists (biologists, recreation guides), and other stakeholders. **Table 2-2** contains a list of additional environmental and recreational data layers that were collected based on basin input.

Table 2-2 Additional Statewide Environmental and Recreational Data Layers Based on Basin Roundtable Input

Additional Fishing	National Wetlands Inventory
Additional Greenback Cutthroat Trout Waters	Northern Leopard Frog Locations
Additional Paddling/Rafting/Kayaking/Flatwater Boating	Northern Redbelly Dace
Additional Rio Grande Sucker and Chub Streams	Osprey Nestsites and Foraging Areas
Bald Eagle Winter Concentration	Piping Plover
Bald Eagle Active Nestsites	Plains Minnow
Bald Eagle Summer Forage	Plains Orangethroat Darter
Bald Eagle Winter Forage	Preble's Meadow Jumping Mouse
Brassy Minnow	River Otter Confirmed Sightings
Colorado Birding Trails	River Otter Overall Range
Colorado Outstanding Waters	Rocky Mountain Biological Laboratory (scientific and educational reaches)
Common Garter Snake	Sandhill Crane Staging Areas
Common Shiner	Southwestern Willow Flycatcher
Ducks Unlimited Project Areas	Stonecat
Educational Segments	Waterfowl Hunting Areas
Eligible/Suitable Wild and Scenic	Wild and Scenic Study Rivers
Grand Mesa, Uncompahgre, and Gunnison Wilderness Waters/Areas	Wildlife Viewing
High Recreation Areas	Yellow Mud Turtle
Least Tern	

2.2.2 Categorization of Data Layers

Once the basin roundtables identified the focus environmental and recreational data layers in their basins, the data layers were grouped into subcategories representing a collective environmental or recreational category. This method had two advantages—1) it moderated redundancy among comparable, geographically overlapping individual data layers, and 2) it allowed for a more comprehensible presentation of the GIS data. For example, Colorado pikeminnow, razorback sucker, humpback chub, and bonytail chub and federal critical habitat individual data layers were all grouped under the subcategory "Federally Endangered Fish," which was included in the overarching environmental category. The Rio Grande Basin's subcategories are shown as an example below in **Figure 2-3**.

2.2.3 GIS Analysis of Data Layers

The Rio Grande Basin chose to use 12-digit HUC watersheds as the basis for their GIS tool development. The HUC is a hierarchical, numeric code that uniquely identifies hydrologic units. Hydrologic units are subdivisions of watersheds nested from largest to smallest areas and are used to organize hydrologic data. HUCs are identifiers as assigned to basin polygons by the USGS. The USGS creates the digital data for HUCs, which are available for download through the USGS website. Twelve-digit HUCs are the smallest subdivision of hydrologic data available to date in Colorado, with an average of 33 square miles.

For the Rio Grande Basin Roundtables, each environmental and recreational data layer was categorized as described in Section 2.2.2. Using GIS software, the categories of data layers were intersected with the 12-digit HUCs to create HUC-based environmental and recreational category areas. These HUC-based environmental and recreational category areas were then overlaid on one another using GIS software to create a density or number of environmental and recreational categories in a given 12-digit HUC.

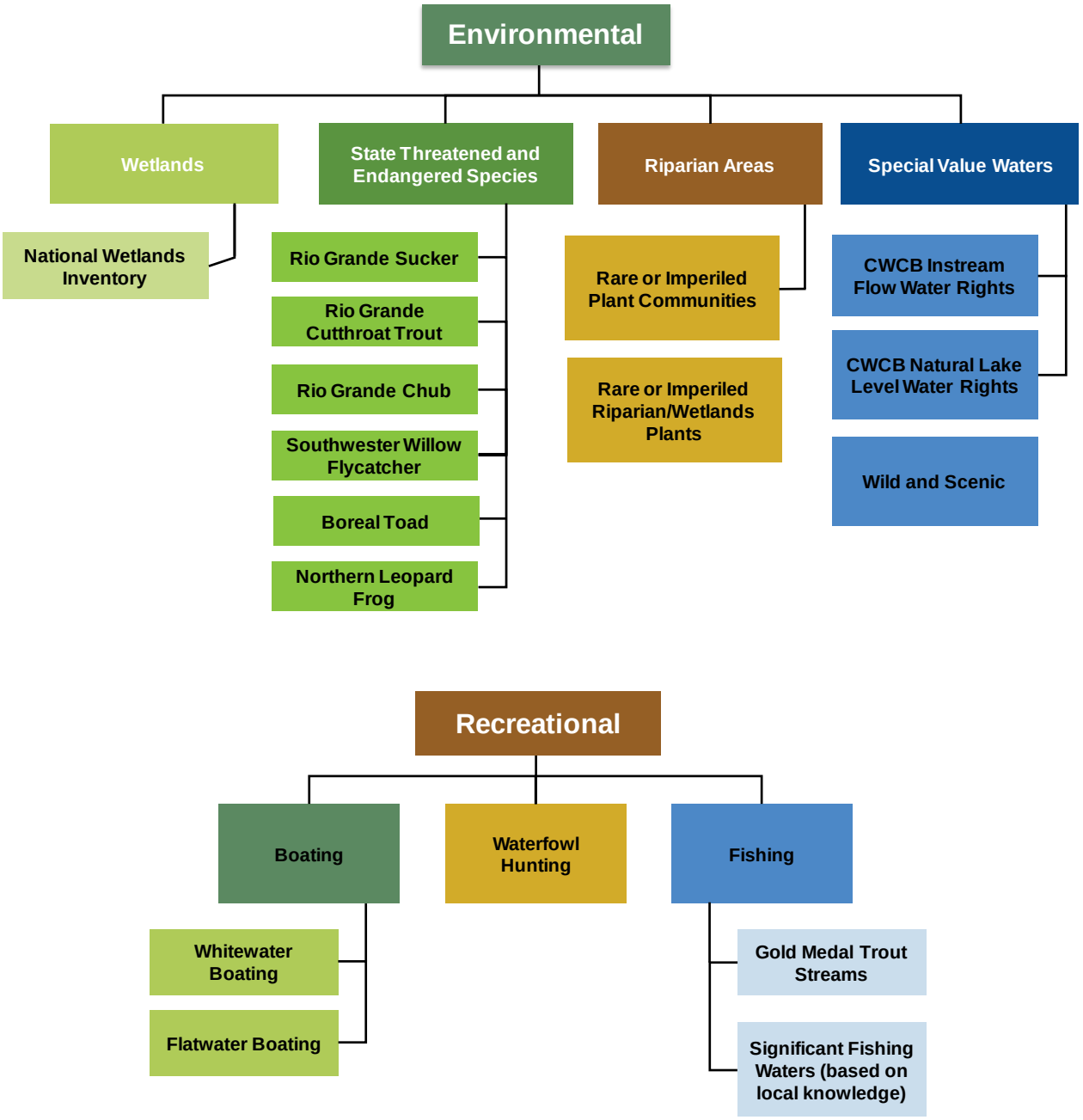
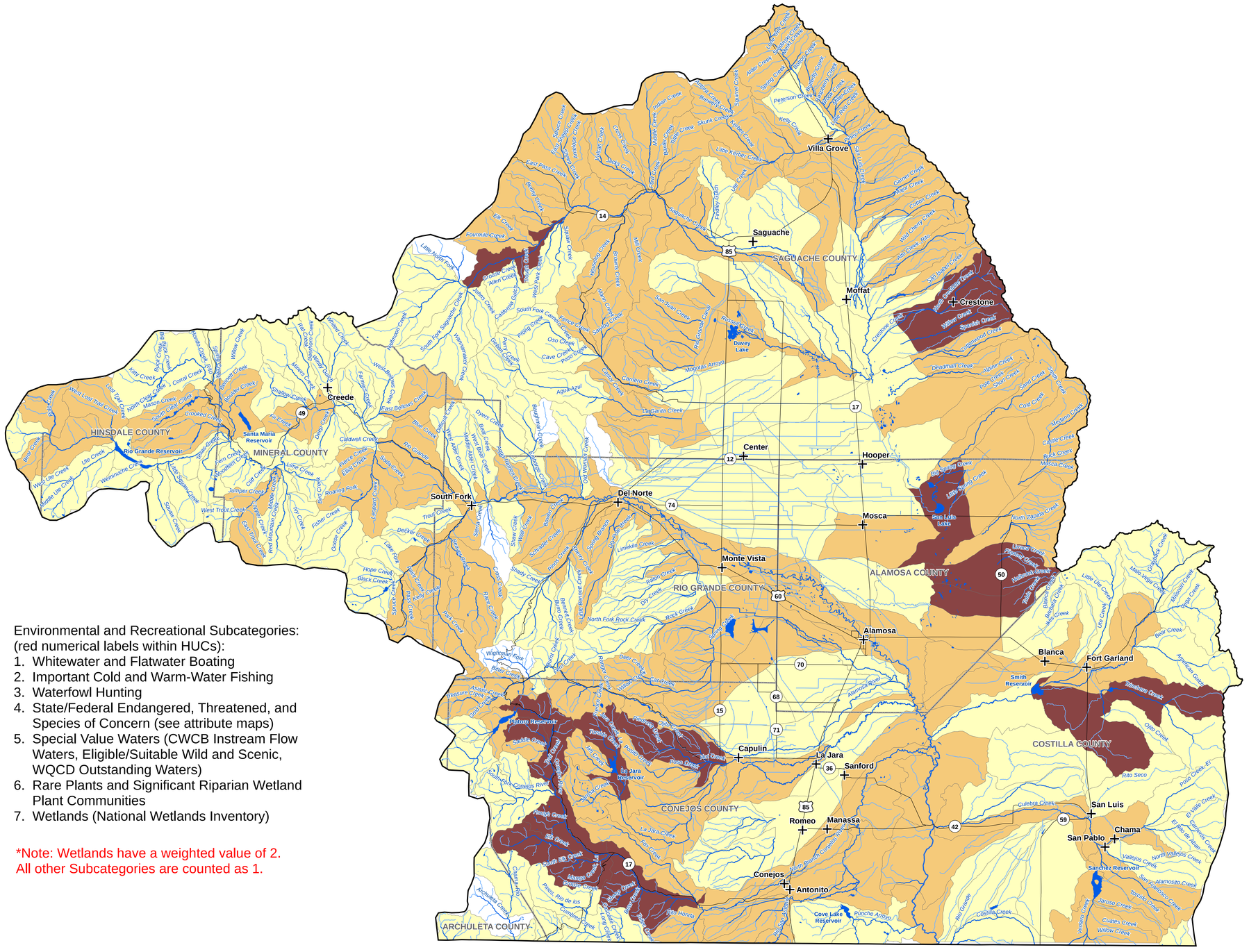


Figure 2-3 Rio Grande Basin Environmental and Recreational Subcategories

2.3 Nonconsumptive Focus Area Mapping Results

Using the methodologies and techniques outlined above, the Rio Grande Basin developed a unique map showing focus areas with nonconsumptive environmental and recreational water needs. The basin map was created as a Geospatial PDF file, or GeoPDF, to allow the user the ability to "click" areas of the map and view characteristics of that portion of the map such as what attribute subcategories are present for a given HUC or stream segment. In addition, the presence of specific attributes (e.g., Rio Grande sucker, trout, kayaking, etc.) is also summarized as well as information designated by the basin roundtable through creation of tables associated with their map. **Figure 2-4** can be used as a GeoPDF in the electronic version of this report. To utilize the map interactively, select the tools dropdown list, then select the analysis tools arrow and then click on the "object data tool." Using this tool, triple click a reach for additional information that will appear on the left side. Figure 2-4 shows the environmental and recreational focus mapping for the Rio Grande Basin. The Rio Grande Basin used seven environmental and recreational subcategories for its mapping efforts. Nearly all HUCs within the Rio Grande Basin had at least one environmental or recreational subcategory present. The areas of the Rio Grande Basin with the highest concentration of priority subcategories are located near Crestone, south of Fort Garland, northeast of Alamosa, along Hot Springs Creek in the northwest portion of the basin, and in a number of HUCs in western Conejos County.



Environmental and Recreational Subcategories:
(red numerical labels within HUCs):

1. Whitewater and Flatwater Boating
2. Important Cold and Warm-Water Fishing
3. Waterfowl Hunting
4. State/Federal Endangered, Threatened, and Species of Concern (see attribute maps)
5. Special Value Waters (CWCB Instream Flow Waters, Eligible/Suitable Wild and Scenic, WQCD Outstanding Waters)
6. Rare Plants and Significant Riparian Wetland Plant Communities
7. Wetlands (National Wetlands Inventory)

*Note: Wetlands have a weighted value of 2.
All other Subcategories are counted as 1.

Legend

Weighted Environmental and Recreational Subcategory Count by HUC

- 1 - 3
- 4 - 5
- 6 - 8
- Roads
- Rivers and Streams
- Lakes and Reservoirs
- Cities and Towns
- County Boundary

N
W E
S

0 4 8 16 24
Miles

1 inch = 4 miles

Figure 2-4
Rio Grande Basin
Nonconsumptive Needs Assessment
Environmental and Recreational
Subcategory Count per 12-Digit HUC

COLORADO WATER CONSERVATION BOARD
STATE OF COLORADO
1876
1937

CDM

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Section 3
Rio Grande Basin Nonconsumptive Projects and Methods

3.1 Nonconsumptive Projects and Methods Overview

Section 2 of this report summarizes the nonconsumptive needs in the Rio Grande Basin. As discussed in Section 1, the Water for the 21st Century Act requires the basin roundtables to identify projects and methods to meet their consumptive and nonconsumptive needs. For consumptive projects and methods, the Colorado Water Conservation Board (CWCB) worked with water providers and the basin roundtables to update the Statewide Water Supply Initiative (SWSI) 1 identified projects and processes (IPPs) from a planning horizon of 2030 to 2050. This effort is summarized in Section 5 of this report. For nonconsumptive needs, the CWCB has conducted an analogous outreach effort with the environmental and recreational community and the basin roundtables to identify nonconsumptive projects and methods similar to the municipal and industrial (M&I) consumptive IPPs. CWCB digitized the project information into a geographical information system (GIS) and compared this information with the nonconsumptive focus areas summarized in Section 2. With this information, CWCB was able to preliminarily identify nonconsumptive focus areas with and without projects and methods. It is important to note that if a focus area does not have an associated project and method it does not mean that the area needs protective projects and methods. It is also important to note that CWCB did not judge the sufficiency of the projects and methods in each reach; rather, as with the M&I IPPs, CWCB did not judge the merits of the nonconsumptive projects and methods being pursued by local organizations. This information gathered was intended to assist the basin roundtables in addressing the following questions:

1. Are there existing protections/efforts for environmental and recreational focus areas?
2. Are there areas without protections that need further study?
3. What strategies are needed to support nonconsumptive priority areas?
4. Are there areas where new flow or water level quantification is appropriate?
5. Are there areas where a project, whether structural (e.g., river restoration) or nonstructural, can be identified and implemented?
6. Are there areas where no action is needed at this time?

Section 3.2 highlights the importance of private land conservation in the San Luis Valley. Section 3.3 describes the methodology used to gather nonconsumptive projects and methods across the state. Section 3.4 summarizes the methodology used to analyze the project and method information and presents results for the Rio Grande Basin.

3.2 The Role of Private Land Conservation in the San Luis Valley

The local Rio Grande Headwaters Land Trust (RiGHT) serves the entire six county area of the San Luis Valley that comprises the Rio Grande Basin. Founded in 1999, RiGHT tracks private land conservation as achieved by a number of partners working in the area. The following is an overview of the status of protected lands in the basin as of May 2011.

3.2.1 San Luis Valley Overall Land Protection

RiGHT's research indicates that there are currently over 250,000 acres of land protected by conservation organizations in the San Luis Valley. This includes one of the largest easements in the U.S. of 80,000 acres on the Trinchera Ranch, held by Colorado Open Lands (COL) and nearly 50,000 acres of The Nature Conservancy's (TNC) Medano-Zapata Ranch is protected with the Colorado Wildlife Heritage Foundation. In addition, approximately 75 individual landowners have protected their properties with permanent conservation easements, resulting in significant landscape-scale protection in the San Luis Valley and in most cases, securing the water rights to the land to sustain agriculture and wildlife habitat.

The Nonconsumptive Needs Analysis for the Rio Grande Basin captures many of these projects in its maps, but typically conserved private lands are not identified by parcels, to protect the privacy of the landowners. It is important to know that these private land conservation efforts are in continual development with new projects and achievements accomplished yearly.

The following list of projects addresses direct protection of private lands, but does not include all the other conservation and restoration work underway in the San Luis Valley through various programs such as the Natural Resources Conservation Service's (NRCS) many programs, the U.S. Fish and Wildlife Service (USFWS) Partners for Fish and Wildlife, and complementary projects being implemented by and on the Great Sand Dunes National Park, three National Wildlife Refuges, U.S. Forest Service (USFS) and Bureau of Land Management (BLM) lands, Colorado Division of Wildlife's (CDOW's) State Wildlife Areas and the Colorado Division of Water Resources. In the San Luis Valley, there is extensive collaboration on planning, projects, and education between these state and federal agencies and various wildlife, wetlands, water and restoration groups, organizations, and private landowners.

3.2.2 Specific Land and Water Protection Initiatives in the San Luis Valley

Rio Grande Initiative - Spearheaded by RiGHT, the Rio Grande Initiative was developed to protect critical private lands and senior water rights along Colorado's 175-mile reach of the river's corridor. Through RiGHT's collaboration with TNC and Ducks Unlimited (DU), the Rio Grande Initiative has more than doubled the pace of conservation on the Rio Grande in the last 4 years, from the prior 20 years. To date, nearly 20,000 acres of private land has been protected on the Rio Grande, 14,000 of those since 2007. These voluntary conservation easements have resulted in the protection of prime agricultural land and senior water rights along the Rio Grande corridor, much of which also serves as crucial wildlife habitat. This represents the hard work of RiGHT, TNC, DU, the NRCS, Colorado Cattlemen's Agricultural Land Trust, and many local, state, and national partners and supporters. RiGHT and TNC's portion of the Rio Grande Initiative has achieved $26 million worth of conservation value ($15 million in funding and $11 million in landowner donations). This includes $1.5 million awarded by the CWCB from the Water Supply Reserve Account (WSRA) funds in 2008, with an additional $70,000 awarded in 2011 for a pending project, both supported by the Rio Grande Basin Roundtable.

Mike Sullivan, DWR, was Division 3 Engineer at the time of this award and wrote in his letter of support, "The protection of the hydraulic characteristics of the alluvial corridor of the Rio Grande is important to providing for a functional river system. This protection includes continued operation of the irrigation systems along the river; systems which were in place when the Rio Grande Compact was negotiated and are thus a part of the underlying physical framework and assumptions of the Compact."

Governor Bill Ritter, who announced in 2007 that the Rio Grande Initiative had been designated a Legacy Project by the Great Outdoors Colorado Board and awarded $7.4 million, said "The Rio Grande River is truly one of our state's most important natural treasures. Its waters sustain productive farms and ranches that were founded before Colorado became a state, and wildlife thrive along its impressive length. All Coloradans should be heartened to know that in these difficult economic times, creative people came together to protect the land, water, and wildlife that are the heart and soul of one of our iconic landscapes."

Saguache Creek – The Saguache Creek Corridor protection effort, led by Colorado Cattlemen's Agricultural Land Trust, has protected extensive lands along the creek, keeping many of the working ranches along that scenic corridor intact, along with securing the water rights there.

Rock Creek Heritage Area Project - South of Monte Vista, this project protected more than 8,000 acres of working ranches and senior water rights between the BLM and USFS uplands and the Monte Vista National Wildlife Refuge. Project partners include DU, American Farmland Trust, RiGHT, and the USFWS.

Southern Sangres Roundtable – There is a new and ongoing roundtable to plan for and hopefully achieve meaningful conservation along with trails and recreational opportunities in Costilla County. Colorado Open Lands and the Rio Grande Headwaters Land Trust are active participants in this effort with the county.

Northern San Luis Valley Conservation Roundtable – This new group meets quarterly to discuss conservation and natural resources challenges, explore opportunities, and support progress in the north area of the San Luis Valley leading towards Poncha Pass. Nancy Butler, Executive Director of RIGHT, is the Chair of this group.

For more information, contact the Rio Grande Headwaters Land Trust at info@riograndelandtrust.org, 719-657-0800 or visit www.riograndelandtrust.org.

3.3 Nonconsumptive Projects and Methods Methodology

In January 2010, CWCB developed a survey to collect information on where there are existing or planned nonconsumptive projects, methods, and studies. Studies were included since they may recommend or inform the implementation of projects or methods that will provide protection or enhancement of environmental and recreational attributes. This survey was distributed through CWCB's basin roundtable and e-mail database. On February 10, 2010, CWCB conducted a workshop in Silverthorne, Colorado to discuss the Phase II efforts and to collect information on nonconsumptive projects, methods, and studies from the workshop attendees. At the workshop, information on 116 stream segments and 209 projects, methods, or studies was provided to CWCB. In addition, CWCB also gathered information on individuals and organizations to follow up with the data collection effort. Since the February 2010 meeting, an additional 57 meetings have occurred to gather data on additional projects, methods, and studies. **Table 3-1** below summarizes the number of individuals or organizations contacted since the February 2010 meeting; the number of follow-up meetings held; and the number of projects, methods, and studies identified to date for each basin. Table 3-1 details the number of projects, methods, and studies that are in the focus areas and the number of projects outside of the focus areas. In total, 648 projects were identified from the outreach effort. Examples of the types of projects collected during this outreach effort include:

- Habitat restoration projects such as bank stabilization projects or instream habitat restoration such as pool and riffle development. Another example of habitat restoration area projects that focus on the maintaining connectivity for fish passage such as fish ladders.
- Flow protection projects such as voluntary flow agreements, instream flow (ISF) donations, or voluntary re-operation of reservoirs for releases for environmental or recreational needs.

Table 3-1 Summary of Meetings to Collect Nonconsumptive Project and Methods Information

Basin Roundtable	No. of Individuals or Organizations Contacted	No. of Meetings	No. Projects and Methods in Focus Areas	No. Projects and Methods Outside Focus Areas	Total No. Projects and Methods
Arkansas	7	5	40	0	40
Colorado	21	12	168	35	203
Gunnison	9	4	44	15	59
Metro	See South Platte	See South Platte	See South Platte	See South Platte	See South Platte
North Platte	1	1	41	7	48
Rio Grande	**10**	**5**	**59**	**0**	**59**
South Platte	17	14	54	53	107
Southwest	17	12	84	10	94
Yampa-White	9	4	22	16	38
TOTAL	91	57	512	136	648

In addition, there is a great deal of information gathered from divisions within the Colorado Department of Natural Resources (DNR) that have been integrated into the projects and methods database. For instance, **Table 3-2** summarizes CWCB's ISFs for each basin roundtable. Decreed ISFs have been confirmed by the water court. Pending ISFs have been approved by the CWCB Board and are going through the water court process. Recommended ISFs include those areas submitted to CWCB as a recommendation, but not yet approved by the CWCB Board at this time.

Table 3-2 Summary of CWCB Instream Flows and Natural Lake Levels

Basin Roundtable	Natural Lakes	ISF Decreed	Pending ISF	Recommended ISF
Arkansas	86	171	11	8
Colorado	150	404	12	6
Gunnison	82	259	15	2
Metro	0	24	0	0
North Platte	31	45	1	3
Rio Grande	**49**	**141**	**0**	**0**
South Platte	31	208	2	2
Southwest	50	151	4	6
Yampa-White	150	175	7	5
TOTAL	**494**	**1,578**	**52**	**32**

The CWCB's Watershed Protection and Flood Mitigation section oversees the agency's watershed restoration efforts. In addition, many of the WSRA grants fully or partially address nonconsumptive needs. **Table 3-3** shows the funding programs implemented by CWCB and project type associated with each program. The table shows the status of the projects; pending in this case means that either the contract has not yet been signed, but has CWCB approval, or that applicants have applied, but are not yet approved by the CWCB.

Table 3-3 Summary of CWCB's Watershed Restoration and Nonconsumptive WSRA Projects

Funding Source	Type	Complete	On-going	Pending	Total
Colorado Healthy Rivers Fund	Report	19	9	3	31
Colorado Healthy Rivers Fund	Restoration Project	15	7	6	28
Colorado Watershed Restoration Program	Report	1	3	0	4
Colorado Watershed Restoration Program	Restoration Project	2	9	1	12
Fish and Wildlife Resources Fund	Restoration Project	2	2	0	4
Multi-Objective Watershed Protection Plan	Report	5	0	1	6
Multi-Objective Watershed Protection Plan	Restoration Project	6	0	4	10
WSRA Nonconsumptive Related Grants	Report	8	15	3	26
WSRA Nonconsumptive Related Grants	Restoration Project	13	12	4	29
TOTAL		**71**	**57**	**22**	**150**
Total Restoration Projects	**Restoration Project**	**38**	**30**	**15**	**83**
Total Reports	**Report**	**33**	**27**	**7**	**67**
TOTAL CWCB Dollars Spent/Encumbered		$14,499,625			
TOTAL Estimated Match Dollars		$34,323,697			
TOTAL Approximate Expenditures		**$ 48,823,322**			

In addition to the CWCB's efforts, the CDOW is mandated by statute to manage the state's fishery and wildlife resources for the benefit of the citizens and visitors to the State of Colorado. The CDOW Aquatic Section takes the lead for fishery management for the agency, and to this end has mapped every waterbody, stream, or river segment in Colorado and associated a water management classification relating back to fishery objectives for that waterbody. The CDOW has participated in the basin roundtable processes throughout in order to provide data and information on basin fisheries, indicate fishery management priorities, and also to communicate where the most significant threats are currently located. CDOW recognizes that human uses of water will often conflict directly or indirectly with the ability to manage fisheries to meet these objectives. CDOW anticipates that as water resources are more intensively managed in the future, that pre-emptive coordination between water developers and conservation interests can minimize and in some cases improve their ability to meet fishery objectives in Colorado.

Finally, CWCB included the Southwest Regional Gap Analysis Project (SRGAP), coordinated by U.S. Geological Survey (USGS) into the projects and methods database. The SRGAP created detailed, seamless GIS data layers of land cover, all native terrestrial vertebrate species, land stewardship, and management status values. The management status values quantify the relationship between land management and biodiversity throughout the State of Colorado. Four management status values are as described below (USGS 2010):

- Status 4 lands are where there are no known public or private institutional mandates or legally recognized easements or deed restrictions held by the managing entity to prevent conversion of natural habitat types to anthropogenic habitat types. The area generally allows conversion to unnatural land cover throughout.
- Status 3 lands comprise areas having permanent protection from conversion of natural land cover for the majority of the area, but subject to extractive uses of either a broad, low-intensity type (e.g., logging) or localized intense type (e.g., mining). It also confers protection to federally-listed endangered and threatened species throughout the area.
- Status 2 lands are areas having permanent protection from conversion of natural land cover and a mandated management plan in operation to maintain a primarily natural state, but which may receive uses or management practices that degrade the quality of existing natural communities, including suppression of natural disturbance.

- Status 1 lands include areas having permanent protection from conversion of natural land cover and a mandated management plan in operation to maintain a natural state within which disturbance events (of natural type, frequency, intensity, and legacy) are allowed to proceed without interference or are mimicked through management.

For this effort, CWCB include areas with a status between 1 and 2.5 as a project and method in the nonconsumptive projects database.

3.4 Nonconsumptive Projects and Methods GIS Mapping and Analysis Methodology and Results

The project and method information collected by CWCB, as described in Section 3.2, was spatially digitized in GIS. Each project was digitized separately using an existing stream database called National Hydrography Dataset (NHD) 12-digit segments. The average length of a NHD segment is 1.5 miles. Depending on the length of the project, multiple NHD segments could represent one project. Also, depending on the project location, multiple projects could exist on the same NHD segment. A unique Project Identification and Segment Identification were given to all surveyed and interviewed projects within the Nonconsumptive Needs Assessment database. In addition, the WSRA grant project locations were digitized in a similar fashion. The CWCB ISFs and natural lake levels, CWCB restoration projects, and the USGS SRGAP information had previously been summarized using GIS; therefore, this data did not have to be digitized. The USGS SRGAP information was analyzed further to calculate a weighted management status value for each NHD segment. This value was calculated in GIS for each NHD 12-digit HUC by a weighted average of each land management status within the HUC.

Following are the assumptions used in digitizing the nonconsumptive projects and methods:

- No NHD segment was edited (i.e., if the project was smaller than an NHD segment, the whole NHD segment was used to represent the project location).
- Projects were digitized based on hand-drawn locations and/or brief descriptions. This information is still under review by the basin roundtables.

Following are the types of information included in the GIS geodatabase for each project:

- Project or Method Name
- Project or Method Type (i.e., study, flow protection, or restoration project)
- Project or Method Location
- Comments
- Project or Method Status (i.e., ongoing, planned, or completed)
- Project or Method Identification Number
- Project or Method Contact Name
- Project or Method Contact Identification Number

Figure 3-1 is a summary of the projects and methods developed to date by CWCB and represents the spatial information for all nonconsumptive projects and methods that are planned, ongoing, or completed in the Rio Grande Basin. This map contains all nonconsumptive projects and methods including—1) CWCB interviews and workshops, 2) CWCB watershed restoration projects, 3) WSRA grants, 4) ISFs, 5) USGS SRGAP information, and 6) CDOW projects. This map includes projects and methods inside the designated focus areas to spatially display the full extent of any project collected by CWCB. This information is also summarized in **Table 3-4** at the end of this section. This table summarizes the project name, location, type, and status. In addition, it summarizes the attributes located within the project boundary and also summarizes information about the type of protections the project provides as defined below.

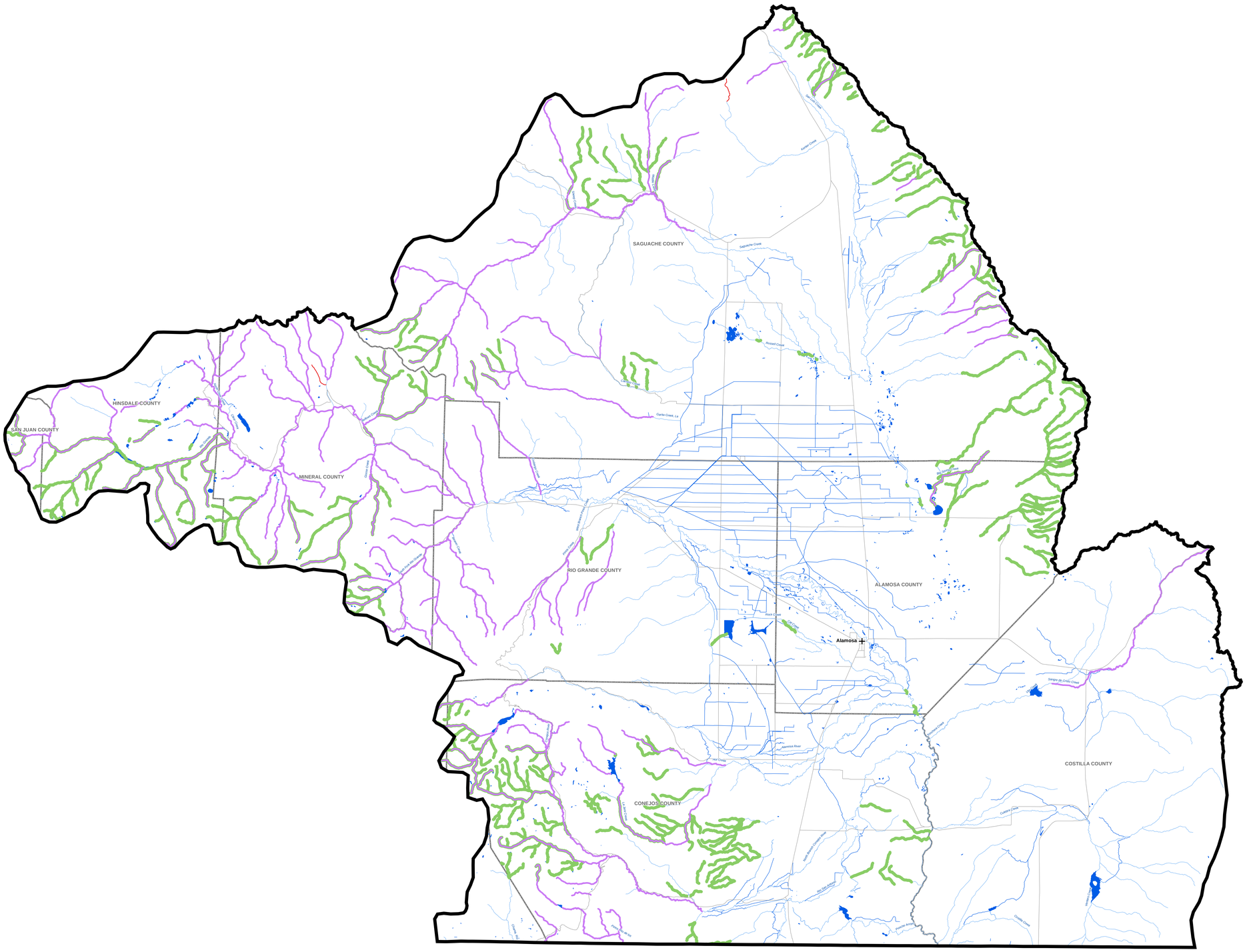
In addition to identifying the spatial extent and status of the identified projects and methods, CWCB also examined what type of protection the project or method may provide to a given environmental or recreational attribute. CWCB has classified the projects as having direct or indirect protections based on a given environmental or recreational attribute. The definitions used for direct and indirect protections are as follows:

- **Direct Protection** – Projects and methods with components designed intentionally to improve a specific attribute. For example, ISFs have direct protection of fish attributes. Additionally, restoration of a stream channel would also provide direct protections for aquatic species.
- **Indirect Protection** – Projects and methods with components that were not designed to directly improve the specific attribute but may still provide protection. For example, flow protection for a fish species may also indirectly protect riparian vegetation that is located in the area of the flow protection. Another example includes protective land stewardship or a wetland or bank stabilization effort that could indirectly protect aquatic species.

The projects and methods identified through interviews were individually evaluated and compared to the environmental and recreational attributes gathered by the basin roundtables during their focus area mapping effort. This information is included in Table 3-4. CWCB examined the various attributes summarized by the roundtables in their focus area mapping efforts (Section 2) and indentified if these areas have projects and methods that provide direct or indirect protections. The interviewed projects and methods, ISFs, and stewardship information were assigned direct or indirect protections based on roundtable attribute. In the Rio Grande Basin, the basin roundtable identified 6,600 miles of water bodies as focus areas. For these focus areas, 30 percent have an associated project or method. **Table 3-5** summarizes the project and method protections identified for the Rio Grande Basin. In the attribute column, the environmental and recreational attributes collected by the basin roundtable are summarized. The recreation attribute category includes attributes from whitewater and flatwater boating. Important Riparian and Wetland Areas category includes significant riparian areas, rare plant communities and national wetlands inventory data. The remaining attributes are specific species and were not categorized.

Table 3-5 Summary of Protections for the Rio Grande Basin Environmental and Recreational Attributes

Attribute Category	Percent of Attribute Length with Direct Protections	Percent of Attribute Length with Indirect Protections	Percent of Attribute Length with Direct and Indirect Protections	Total Percent of Attribute Length with Protections
Important Riparian and Wetland	5%	10%	6%	21%
Recreation	1%	0%	0%	1%
Rio Grande Chub	11%	14%	4%	29%
Rio Grande Cutthroat Trout	17%	9%	2%	28%
Rio Grande Sucker	14%	20%	6%	40%

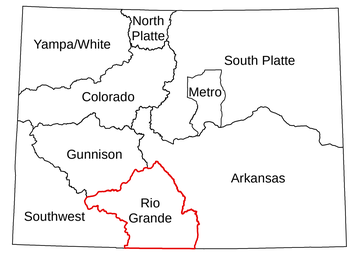


Legend

- River and Stream
- Lake and Reservoir
- City and Town
- Road
- County Boundary
- Basin

Projects

- CDOW
- CWCB
- ISF
- Stewardship
- WSRA



Colorado Basins

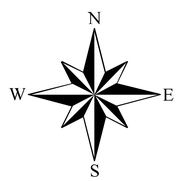


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Figure 3-1
Rio Grande Basin
Nonconsumptive Needs Assessment
Focus Areas with
Projects and Methods

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Table 3-4 Rio Grande Basin Nonconsumptive Identified Projects and Processes Summary

Project Location	Project Name	Project Type	Project Status	BRT Attributes Identified	Project Protections
Beaver Creek	Culvert replacement	Project	Planned	CWCB ISF water rights, CWCB natural lake level water rights, Flatwater Boating, Significant Riparian/Wetland Plants, Signification Fishing Waters	Other Fishing Streams and Lakes-D
Alamosa River	Alamosa River ISF Restoration	Flow Protection	Ongoing	Colorado Outstanding Waters, CWCB ISF water rights, CWCB natural lake level water rights, National Wetlands Inventory, Northern Leopard Frog , Rio Grande Chub, Rio Grande Cutthroat Trout, Significant Riparian/Wetland Communities, Significant Riparian/Wetland Plants, Wetlands, Whitewater Boating	Colorado Outstanding Waters-D, CWCB ISF Water Rights-D, CWCB Natural Lake Level Water Rights-D, Important Wetlands-I, National Wetlands Inventory-I, Rare Plants-I, Rio Grande Chub -D, Rio Grande Cutthroat Trout-D, Significant Plant Communities-I
Alamosa River	Alamosa River Upgrades	Flow Protection	Planned	Colorado Outstanding Waters, CWCB ISF water rights, CWCB natural lake level water rights, National Wetlands Inventory, Northern Leopard Frog , Rio Grande Chub, Rio Grande Cutthroat Trout, Significant Riparian/Wetland Communities, Significant Riparian/Wetland Plants, Wetlands, Whitewater Boating	
Alamosa River	Stream restoration	Project	Completed	CWCB natural lake level water rights, National Wetlands Inventory, Rio Grande Chub, Rio Grande Cutthroat Trout, Significant Riparian/Wetland Plants, Wetlands	Rio Grande Chub -D, Rio Grande Cutthroat Trout-D
Alamosa River (from Terrace Reservoir to County Rd 10)	Alamosa River ISF	Flow Protection	On-going	National Wetlands Inventory, Rio Grande Chub, Significant Riparian/Wetland Plants, Wetlands	Rio Grande Chub -D
Benino Creek	Culvert replacements	Project	Completed	CWCB ISF water rights, Significant Riparian/Wetland Plants, Signification Fishing Waters	Other Fishing Streams and Lakes-D, Rio Grande Cutthroat Trout-D, Rio Grande Sucker -D
Shallow Creek	Shallow Creek Stream Restoration & Structures	Project	Completed	CWCB ISF water rights, Signification Fishing Waters	Other Fishing Streams and Lakes-D
Approximately 2.2 miles upstream of confluence of French Creek and Blue River	French Gulch Superfund Program	Water Quality Protection	Completed	Aquatic_Ec, Boreal Toad, Colorado River Cutthroat Trout , CWCB ISF water rights, Riparian/Wetlands, Significant Riparian/Wetland Communities, Significant Riparian/Wetland Plants, Signification Fishing Waters	Boreal Toad -I, Federally Listed Critical Habitat-I, Other Fishing Streams and Lakes-D, Rare Plants-I, Significant Plant Communities-I
Prong Creek	Culvert replacements	Project	Completed	CWCB ISF water rights, Rio Grande Cutthroat Trout, Rio Grande Sucker, Significant Riparian/Wetland Communities, Significant Riparian/Wetland Plants	Other Fishing Streams and Lakes-D, Rio Grande Cutthroat Trout-D, Rio Grande Sucker -D
Rio Grande from Alamosa Wildlife National Refuge to Colorado state line	Rio Grande Natural Area Riparian Restoration	Project	Planned	Gold Metal Trout Streams, Greater Sandhill Crane, National Wetlands Inventory, Northern Leopard Frog , Peregrine, Rio Grande Chub, Rio Grande Sucker, Significant Riparian/Wetland Communities, Significant Riparian/Wetland Plants, Signification Fishing Waters, Southwestern Willow Flycatcher, Waterfowl Hunting / Viewing, Wetlands, Whitewater Boating	Flatwater Boating -I, Important Wetlands-D, National Wetlands Inventory-D, Other Fishing Streams and Lakes-I, Rio Grande Chub -I, Rio Grande Sucker -I, Sandhill Crane-D, Southwestern Willow Flycatcher-D, Waterfowl Hunting / Viewing-D
Rio Grande Main stem (Fern Creek to Cliff Lake)	"Rio Grande Main stem (Fern Creek to Cliff Lake) Tree planting, and Fishery structures"	Project	Completed	CWCB ISF water rights, Signification Fishing Waters, Whitewater Boating	Other Fishing Streams and Lakes-D
Rio Grande Main stem (Fern Creek to Cliff Lake)	Rio Grande Main stem (Fern Creek to Cliff Lake) Stream Rechanneling	Project	Completed	CWCB ISF water rights, Signification Fishing Waters, Whitewater Boating	
Rio Grande Reservoir	Rio Grande Reservoir Rehabilitation	Flow Protection	Planned	Colorado Outstanding Waters, CWCB ISF water rights, Flatwater Boating, Signification Fishing Waters, Whitewater Boating	Colorado Outstanding Waters-D, CWCB ISF Water Rights-D, Other Fishing Streams and Lakes-D
Rio Grande upstream of Alamosa	Rio Grande Restoration Project	Project	Ongoing	Greater Sandhill Crane, National Wetlands Inventory, Northern Leopard Frog , Peregrine, Rio Grande Chub, Significant Riparian/Wetland Communities, Significant Riparian/Wetland Plants, Southwestern Willow Flycatcher, Waterfowl Hunting / Viewing, Wetlands	Important Wetlands-D, National Wetlands Inventory-D, Rare Plants-D, Rio Grande Chub -D, Rio Grande Sucker -D, Sandhill Crane-D, Significant Plant Communities-D, Southwestern Willow Flycatcher-D, Waterfowl Hunting / Viewing-D
Rio Grande upstream of Alamosa	Rio Grande Restoration Project	Project	Planned	Greater Sandhill Crane, National Wetlands Inventory, Northern Leopard Frog , Peregrine, Rio Grande Chub, Significant Riparian/Wetland Communities, Significant Riparian/Wetland Plants, Southwestern Willow Flycatcher, Waterfowl Hunting / Viewing, Wetlands	Important Wetlands-D, National Wetlands Inventory-D, Rare Plants-D, Rio Grande Chub -D, Rio Grande Sucker -D, Sandhill Crane-D, Significant Plant Communities-D, Southwestern Willow Flycatcher-D, Waterfowl Hunting / Viewing-D
North Fork Carnero Creek	Road Relocation	Project	Completed	CWCB ISF water rights, National Wetlands Inventory, Rio Grande Cutthroat Trout, Rio Grande Sucker, Wetlands	Important Wetlands-I, National Wetlands Inventory-I, Rio Grande Cutthroat Trout-I, Rio Grande Sucker -I

Table 3-4 Rio Grande Basin Nonconsumptive Identified Projects and Processes Summary (continued)

Project Location	Project Name	Project Type	Project Status	BRT Attributes Identified	Project Protections
San Luis Creek	San Luis Conservation Initiative	Project	On-going	CWCB ISF water rights, National Wetlands Inventory, Northern Leopard Frog , Rio Grande Chub, Rio Grande Sucker, Significant Riparian/Wetland Communities, Significant Riparian/Wetland Plants, Wetlands	Important Wetlands-D, National Wetlands Inventory-D, Rare Plants-D, Rio Grande Chub -I, Rio Grande Sucker -I, Significant Plant Communities-D
North Fork Carnero Creek	Migration Barriers	Project	Completed	CWCB ISF water rights, National Wetlands Inventory, Rio Grande Cutthroat Trout, Rio Grande Sucker, Wetlands	Rio Grande Cutthroat Trout-D, Rio Grande Sucker -D
Sheep Creek - Trib to Saguache Creek	Sheep Creek Rock Dams	Project	Completed	CWCB ISF water rights, National Wetlands Inventory, Rio Grande Cutthroat Trout, Significant Riparian/Wetland Plants, Wetlands	Other Fishing Streams and Lakes-D, Rio Grande Cutthroat Trout-D
South Fork of Rio Grande	Gravel Pond Wetlands project	Project	Completed	CWCB ISF water rights, Significant Riparian/Wetland Plants, Signification Fishing Waters, Whitewater Boating	Important Wetlands-D, National Wetlands Inventory-D
South Fork of Rio Grande	Stream restoration	Project	Completed	CWCB ISF water rights, Significant Riparian/Wetland Plants, Signification Fishing Waters, Whitewater Boating	Other Fishing Streams and Lakes-D
South Fork of Rio Grande at Park Creek Campground	South Fork of Rio Grande Park Creek Campground	Project	Completed	CWCB ISF water rights, Significant Riparian/Wetland Plants, Signification Fishing Waters, Whitewater Boating	Other Fishing Streams and Lakes-D
Trout Creek above Creede Structures project	Trout Creek above Creede	Project	Completed	Boreal Toad, Colorado Outstanding Waters, CWCB ISF water rights, Significant Riparian/Wetland Plants, Signification Fishing Waters	Other Fishing Streams and Lakes-D
Valley View Hot Springs	Conservation easement with TNC including 2 miles of stream flow restoration on creek (unnamed)	Flow Protection	Completed	CWCB ISF water rights, National Wetlands Inventory, Rio Grande Chub, Significant Riparian/Wetland Communities, Wetlands	CWCB ISF Water Rights-D, Important Wetlands-D, National Wetlands Inventory-D, Rio Grande Chub -D, Significant Plant Communities-D
Willow Creek	Willow Creek Restoration Committee Mine Tailings	Water Quality Protection	Completed	CWCB ISF water rights, Significant Riparian/Wetland Communities, Signification Fishing Waters, Whitewater Boating	Other Fishing Streams and Lakes-I
Saguache Creek	Multiple conservation easements on ranches that tie water to the land.	Flow Protection	Completed	CWCB ISF water rights, National Wetlands Inventory, Rio Grande Chub, Signification Fishing Waters, Wetlands	CWCB ISF Water Rights-D, Important Wetlands-D, National Wetlands Inventory-D, Other Fishing Streams and Lakes-I, Rio Grande Chub -D
La Garita	Stream crossing restoration work	Project	Planned	CWCB ISF water rights, Significant Riparian/Wetland Plants, Signification Fishing Waters	Other Fishing Streams and Lakes-D
Big Springs Creek	Culvert replacements/Migration Barriers	Project	Completed	CWCB ISF water rights, Flatwater Boating, National Wetlands Inventory, Northern Leopard Frog , Rio Grande Sucker, Significant Riparian/Wetland Communities, Significant Riparian/Wetland Plants, Signification Fishing Waters, Waterfowl Hunting / Viewing, Wetlands	Other Fishing Streams and Lakes-D, Rio Grande Cutthroat Trout-D, Rio Grande Sucker -D
Cave Creek	Culvert removal	Project	Completed	CWCB ISF water rights, Rio Grande Cutthroat Trout, Rio Grande Sucker, Significant Riparian/Wetland Communities, Significant Riparian/Wetland Plants	Other Fishing Streams and Lakes-D, Rio Grande Cutthroat Trout-D, Rio Grande Sucker -D
Conejos Creek	Fish habitat improvement	Project	Planned	Colorado Outstanding Waters, CWCB ISF water rights, CWCB natural lake level water rights, Eligible Wild and Scenic, National Wetlands Inventory, Peregrine, Significant Riparian/Wetland Plants, Signification Fishing Waters, Wetlands	Other Fishing Streams and Lakes-D
Conejos River	Stream restoration	Project	Completed	Colorado Outstanding Waters, CWCB ISF water rights, CWCB natural lake level water rights, Eligible Wild and Scenic, National Wetlands Inventory, Peregrine, Rio Grande Cutthroat Trout, Rio Grande Sucker, Significant Riparian/Wetland Communities, Significant Riparian/Wetland Plants, Signification Fishing Waters, Wetlands, Whitewater Boating	Other Fishing Streams and Lakes-D, Rio Grande Cutthroat Trout-D, Rio Grande Sucker -D
Groundhog Creek	Culvert replacements	Project	Completed	CWCB ISF water rights, Significant Riparian/Wetland Plants, Signification Fishing Waters	Other Fishing Streams and Lakes-D, Rio Grande Cutthroat Trout-D, Rio Grande Sucker -D
Hot Creek	Hot Creek restoration project	Project	Completed	CWCB ISF water rights, National Wetlands Inventory, Rio Grande Chub, Significant Riparian/Wetland Communities, Wetlands	Rio Grande Chub -D
Kerber Creek	Kerber Creek Restoration	Project	Ongoing/Completed	National Wetlands Inventory, Rio Grande Chub, Significant Riparian/Wetland Plants, Wetlands	Rio Grande Chub-D
Park Creek	Road obliteration-closure	Project	Completed	CWCB ISF water rights, Rio Grande Chub, Significant Riparian/Wetland Communities, Significant Riparian/Wetland Plants, Signification Fishing Waters	Other Fishing Streams and Lakes-I, Rare Plants-I, Rio Grande Chub-I, Significant Plant Communities-I
La Garita	Stream crossing restoration work	Project	Planned	CWCB ISF water fights, National Wetlands Inventory, Peregrine, Signification Fishing Waters, Southwestern Willow Flycatcher, Wetlands	Other Fishing Streams and Lakes-D
Lake Fork Conejos	Migration Barriers	Project	Completed	CWCB ISF water rights, CWCB natural lake level water rights, Flatwater Boating, National Wetlands Inventory, Rio Grande Cutthroat Trout, Rio Grande Sucker, Significant Riparian/Wetland Plants, Signification Fishing Waters, Wetlands, Whitewater Boating	Other Fishing Streams and Lakes-D, Rio Grande Cutthroat Trout-D, Rio Grande Sucker-D

Table 3-4 Rio Grande Basin Nonconsumptive Identified Projects and Processes Summary (continued)

Project Location	Project Name	Project Type	Project Status	BRT Attributes Identified	Project Protections
Lower Crestone Creek	Fish studies by USFWS and CDOW	Information	Planned	CWCB ISF water rights, CWCB natural lake level water rights, National Wetlands Inventory, Rio Grande Chub, Rio Grande Sucker, Significant Riparian/Wetland Plants, Signification Fishing Waters, Wetlands	
Lower Crestone Creek	USFWS/CDOW water diversion/water control structures to maintain water levels	Flow Protection	Ongoing	CWCB ISF water rights, CWCB natural lake level water rights, National Wetlands Inventory, Rio Grande Chub, Rio Grande Sucker, Significant Riparian/Wetland Plants, Signification Fishing Waters, Wetlands	Important Wetlands-I, National Wetlands Inventory-I, Other Fishing Streams and Lakes-D, Rare Plants-I, Rio Grande Chub-D, Rio Grande Sucker-D, Significant Plant Communities-I, Waterfowl Hunting/Viewing-I
Middle Fork Camero Creek	Culvert replacements	Project	Completed	National Wetlands Inventory, Rio Grande Cutthroat Trout, Rio Grande Sucker, Significant Riparian/Wetland Plants, Wetlands	Other Fishing Streams and Lakes-D, Rio Grande Cutthroat Trout-D, Rio Grande Sucker-D
Mill Creek	Million Reservoir Diversion Improvements	Project	Completed	CWCB ISF water rights	
Mineral County above Creede to Rio Grande	Willow Creek Restoration Committee Channel Restoration	Project	Planned	CWCB ISF water rights, Significant Riparian/Wetland Communities, Signification Fishing Waters, Whitewater Boating	Other Fishing Streams and Lakes-D
Mishak Lakes Wetland Complex	"Conservation easements and fee title covering about 3,000 acres"	Flow Protection	Completed	National Wetlands Inventory, Northern Leopard Frog, Significant Riparian/Wetland Communities, Significant Riparian/Wetland Plants, Waterfowl Hunting/Viewing, Wetlands	Important Wetlands-D, National Wetlands Inventory-D, Rare Plants-D, Significant Plant Communities-D, Waterfowl Hunting/Viewing-D
Mishak Lakes Wetland Complex	Hydrologic assessment (Sanderson et al 2008) simulated natural hydrologic regime	Information	Completed	National Wetlands Inventory, Northern Leopard Frog, Significant Riparian/Wetland Communities, Significant Riparian/Wetlands Plants, Waterfowl Hunting/Viewing, Wetlands	
North Fork Camero Creek	Culvert replacements	Project	Completed	CWCB ISF water rights, National Wetlands Inventory, Rio Grande Cutthroat Trout, Rio Grande Sucker, Wetlands	Other Fishing Streams and Lakes-D, Rio Grande Cutthroat Trout-D, Rio Grande Sucker-D
La Garita	Barrier installation and non-native removal habitat restoration project	Project	Ongoing	CWCB ISF water rights, National Wetlands Inventory, Peregrine, Rio Grande Cutthroat Trout, Significant Riparian/Wetland Plants, Signification Fishing Waters, Southwestern Willow Flycatcher, Wetlands	Rio Grande Cutthroat Trout-D
0	Dredging of conservation pools	Project	Proposed	Colorado Outstanding Waters, CWCB ISF water rights, Flatwater Boating, Gold Metal Trout Streams, Greater Sandhill Crane, National Wetlands Inventory, Northern Leopard Frog, Peregrine, Rio Grande Chub, Rio Grande Sucker, Significant Riparian/Wetland Communities, Significant Riparian/Wetland Plants, Signification Fishing Waters, Southwestern Willow Flycatcher, Waterfowl Hunting/Viewing, Wetlands, Whitewater Rafting	CWCB ISF Water Rights-D, Flatwater Boating-D, Important Wetlands-DI, National Wetlands Inventory-I, Other Fishing Streams and Lakes-D, Rare Plants-I, Rio Grande Cutthroat Trout-D, Rio Grande Sucker-D, Significant Plant Communities-I, Waterfowl Hunting/Viewing-I, Whitewater Boating OR Rafting-I
0	Fully utilize transmountain return flows 0 Rio Grande	Information	Planned	Colorado Outstanding Waters, CWCB ISF water rights, Flatwater Boating, Gold Metal Trout Streams, Greater Sandhill Crane, National Wetlands Inventory, Northern Leopard Frog, Peregrine, Rio Grande Chub, Rio Grande Sucker, Significant Riparian/Wetland Communities, Significant Riparian/Wetland Plants, Signification Fishing Waters, Southwestern Willow Flycatcher, Waterfowl Hunting/Viewing, Wetlands, Whitewater Boating	
0	Platoro Reservoir minimum flow modification	Flow Protection	Proposed	Colorado Outstanding Waters, CWCB ISF water rights, Eligible Wild and Scenic, Flatwater Boating, National Wetlands Inventory, Rio Grande Cutthroat Trout, Rio Grande Sucker, Significant Riparian/Wetland Communities, Significant Riparian/Wetland Plants, Signification Fishing Waters, Wetlands, Whitewater Boating	Colorado Outstanding Waters-D, CWCB ISF Water Rights-D, Eligible Wild and Scenic-D, Important Wetlands-DI, National Wetlands Inventory-DI, Other Fishing Streams and Lakes-D, Rare Plants-DI, Rio Grande Cutthroat Trout-D, Rio Grande Sucker-D, Significant Plant Communities-DI, Whitewater Boating OR Rafting-I

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Section 4
Rio Grande Basin Consumptive Needs Assessment

4.1 Overview of Consumptive Needs Assessment Process

Water in Colorado is managed to meet the needs of Colorado's citizens, agriculture, and environment. Colorado's economy, quality of life, recreational opportunities, and the environment are all dependent on water. The broad diversity of water uses in Colorado is indicative of the many ways in which we are affected by the water that is available to us and our environment, and how we choose to use it. Severe and continuing drought conditions throughout the state in the early 2000s in conjunction with rapid economic growth and concern over interstate compact obligations have brought focus to the constraints on our state's water resources and the challenges associated with meeting multiple objectives and needs.

The objectives of the consumptive needs part of this Rio Grande Basin Needs Assessment Report is to:

- Update population projections and extend them to 2050
- Update municipal and industrial (M&I) per capita estimates including passive conservation
- Extend the Statewide Water Supply Initiative (SWSI) 1 consumptive water use projections to 2050 for the M&I sector
- Update the self-supplied industrial (SSI) sector forecast to 2050
- Update the current tally of irrigated acres throughout Colorado and forecast irrigated acres in 2050
- Update current agricultural demands and shortages
- Update the consumptive demand forecast to 2050 for the agricultural sector

The analyses summarized in this section use a water forecast horizon of 2050 for a number of reasons. The Colorado Water Conservation Board (CWCB) determined that the forecast horizon for the water demand projections needed to be extended to the year 2050 to better represent the long-term water needs that the state will face.

The following sections provide an overview of the methods used in determining reconnaissance level consumptive water use projections for 2050, and the results of those analyses. Sections 4.2.1 and 4.2.2 describe the methods and results of projecting M&I demands, including population forecasting, estimation of per capita water use, and the application of passive conservation measures. The methods used to estimate SSI demands, and the results thereof, are presented in Section 4.2.3. Section 4.2.4 summarizes the statewide results of the M&I and SSI demand projections. Section 4.3 summarizes the same for agricultural demands. Detailed descriptions of these methodologies and results are available in Appendices H and I of the SWSI 2010 Report.

4.2 M&I and SSI Consumptive Needs

Standard methods were used for projecting future M&I and SSI water demands in the Rio Grande Basin. The objectives were to develop a reconnaissance level water use forecast that employs consistency in data collection and forecast methodology across the state and maximizes available data. The methods utilized in this approach are for the purpose of general statewide and basinwide planning and are not intended to replace demand projections prepared by local entities for project-specific purposes.

The M&I water demands forecast takes on a "driver multiplied by rate of use" approach. This is a commonly accepted forecast methodology that accounts for changes in water demand resulting from changes in the driver. County and statewide population projections are the most accepted predictor of future growth for the state. Therefore, the driver for the M&I water demands forecast is population and the rate of use is gallons per capita per day (gpcd).

4.2.1 Future Population Projections

Population projections were estimated using the forecasting process and models utilized by the Colorado State Demographer's Office (SDO). Because of the uncertainty in projecting economic conditions and employment levels in 2050, low, medium, and high scenario population projections were developed. A detailed analysis of the population projections is included in Appendix H of the SWSI 2010 Report.

4.2.1.1 2050 Population Projection Methodology

The first step in developing 2050 population projections was to identify a population forecasting methodology that could meet the needs of the 2050 water demand projections. To be suitable, the water demand projections would need to satisfy the following criteria:

- The forecasting methodology must be valid and widely acceptable, both by users of the results and demographic forecasting practitioners.
- The forecasting approach must be transparent and understandable to the extent possible.
- The projections must be replicable.
- In keeping with state-of-the-art practice employed by the SDO, the projections must be economically based and then linked to demographic factors in an integrated manner.
- The projections must be able to produce population forecasts for each county to the year 2050 under high, medium, and low economic development assumptions.

It was determined that the forecasting process and models utilized by the SDO, in conjunction with its consultant, the Center for Business and Economic Forecasting (CBEF), met all of those criteria. Therefore, the SDO forecasting process was adopted for the 2050 effort.

As of 2010, the SDO/CBEF projections are available through the year 2035. It was determined that the forecasting models, equations, and algorithms could be extended or adjusted as needed from 2035 to 2050. To adjust the models from 2035 to 2050 assumptions regarding national and international driving forces behind Colorado's basic economic sectors were developed.

Basic economic sectors include those activities that bring money and economic stimulus into a geographic area. Employment was projected for each of Colorado's basic economic sectors on the basis of the assumptions for the driving forces behind those basic sectors. With projections of basic employment, industry-specific employment multipliers were applied to arrive at total Colorado jobs.

Because of the uncertainty in projecting economic conditions and employment levels in 2050, low, medium, and high employment scenarios were developed for each key employment sector, leading to low, medium, and high population projections. Each of the scenarios reflects unique assumptions for the economy and for each employment sector. These assumptions are detailed in Appendix H of the SWSI 2010 Report. Additionally, populations for counties that lie within two or more basins were allocated to the respective basins based on estimates from known population centers within each basin.

4.2.1.2 2050 Population Projection Results

Between the years 2008 and 2050, the State of Colorado is projected to grow from approximately 5.1 million people to between 8.6 million and 10 million people. Under low economic development assumptions, state population is projected to grow to about 8.6 million people, or by about 71 percent. Under high economic development assumptions, including a 550,000 barrel per day oil shale industry, the state's population is projected to grow to just over 10 million people, or by 98 percent, as compared to Colorado's 2008 population. On average, statewide population projections from 2008 forward indicate an increase of about 1.4 million people every 15 years.

Table 4-1 shows how population growth will vary across the state during the next 40 years. Based on these projections, the Arkansas, Metro, and South Platte Basins will continue to have the largest population in the state. However, the West Slope will continue to grow at a faster rate than the Front Range of Colorado. **Figure 4-1** shows how population growth will vary throughout the Rio Grande Basin at the county level. The Rio Grande Basin is projected to increase from approximately 50,000 people in the year 2008 to 80,000 people by the year 2050; an increase of about 60 percent. Agriculture was the largest basic employment sector in the Rio Grande Basin in 2007 but is expected to be slightly behind household basic sectors by 2050. Also by 2050, the portions of mining, regional and national service, and tourism jobs compared to total jobs in the basin are expected to increase.

Table 4-1 Population Projections by River Basin

Basin	2008	2035	Percent Change 2008 to 2035	Percent Average Annual Growth Rate	2050			Percent Change 2008 to 2050	Percent Average Annual Growth Rate
					Low	Medium	High		
Arkansas	948,000	1,451,000	53	1.6	1,581,000	1,688,000	1,841,000	67-94	1.2-1.6
Colorado	307,000	558,000	82	2.2	661,000	725,000	832,000	115-171	1.8-2.4
Gunnison	105,000	184,000	75	2.1	206,000	220,000	240,000	96-129	1.6-2.0
Metro	2,513,000	3,622,000	44	1.4	4,018,000	4,144,000	4,534,000	60-80	1.1-1.4
North Platte	1,500	1,800	20	0.7	2,000	2,200	2,500	33-67	0.7-1.2
Rio Grande	**50,000**	**68,000**	**36**	**1.2**	**74,000**	**80,000**	**87,000**	**48-74**	**0.9-1.3**
South Platte	977,000	1,622,000	66	1.9	1,808,000	1,902,000	2,065,000	85-111	1.5-1.8
Southwest	105,000	185,000	76	2.1	204,000	224,000	249,000	94-137	1.6-2.1
Yampa-White	45,000	81,000	80	2.2	94,000	117,000	153,000	109-240	1.8-3.0
TOTAL	**5,051,500**	**7,772,800**	**54**	**1.6**	**8,648,000**	**9,102,200**	**10,000,000**	**71-98**	**1.3-1.6**

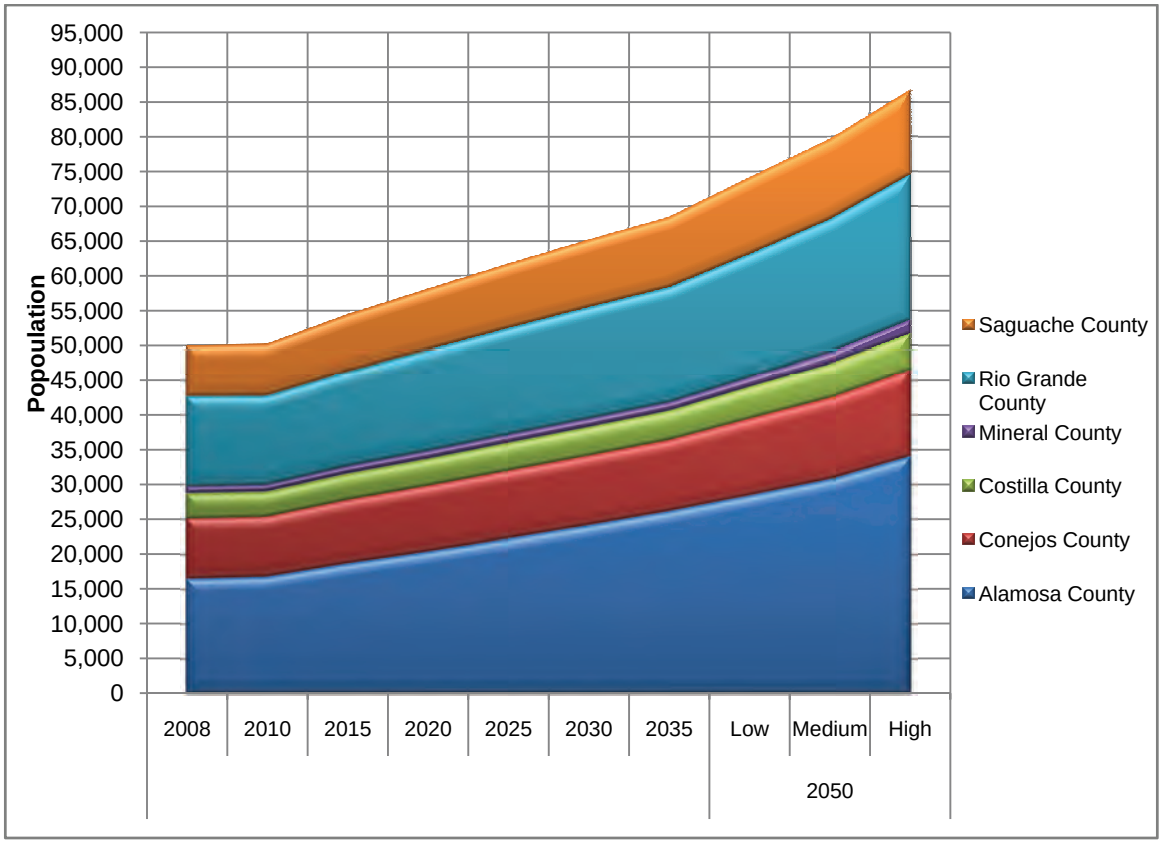

Figure 4-1 Rio Grande Basin Population Projections through 2050

4.2.2 Future M&I Water Demands

The M&I demand forecast is aimed at capturing the water needs of an increased population. M&I demands are the water uses typical of municipal systems, including residential, commercial, light industrial, nonagricultural related irrigation, nonrevenue water, and firefighting. For the current effort, the M&I demand forecast also captures households across the basin that are self-supplied and thus not connected to a public water supply system. **Table 4-2** contains the definitions of the M&I demand terms used throughout this report.

Table 4-2 Definition of M&I Demand Terms

Demand Terminology	Definition
M&I Demand	All the water uses of typical municipal systems, including residential, commercial, industrial, irrigation, and firefighting
SSI Demand	Large industrial water uses that have their own water supplies or lease raw water from others
M&I Demand and SSI Demand	The sum of M&I and SSI demand

The updated demands presented in this document include both baseline demands (without passive conservation) and baseline demands minus passive conservation. It is important to note that the M&I demand forecasts do not include potential increases in demand due to climate change or potential decreases in demand due to active conservation programs.

4.2.2.1 2050 M&I Water Demands Methodology

The methodology used for the M&I water demands forecast in this update is nearly identical to the methodology employed in SWSI 1. The method is based on a sample of water providers throughout the state as described in this section. The estimated per capita water use rates for each county were multiplied by the projected population of each county to estimate current and future municipal water demand (i.e., the residential, commercial, and industrial water use) of each county.

It is critical to note that the methods utilized in this approach are for the purpose of general basinwide and statewide planning and are not intended to replace demand projections prepared by local entities for project-specific purposes. County and statewide population projections are the most accepted predictor of future growth for the state. Therefore, it was determined the SWSI 1 methodology was most appropriate. The methodology employed is a commonly accepted forecast methodology for statewide water supply planning purposes, but is not appropriate for project-specific purposes or for direct comparisons between basins or counties.

Estimates of Per Capita M&I Water Use

The M&I water demands forecast is developed by multiplying the population projections outlined in Section 4.2.1 by a rate of use. The rate of use is systemwide gpcd. Numerous factors affect per capita water use rates, and through the course of SWSI 1 and the current SWSI 2010, differences in the water use components that are included or excluded from individual entities' per capita estimates clearly affected the resulting values. Per capita water use rates are in large part a function of:

- Number of households
- Persons per household
- Median household income
- Mean maximum temperature
- Total precipitation
- Total employment
- Ratio of irrigated public land areas (e.g., parks) to population in service area
- Mix of residential and commercial water use and types of commercial use
- Level of tourism and/or second homes
- Ratio of employment by sector (e.g., agriculture, commercial, industrial)
- Urban/rural nature of county

Provider water use and service population data were gathered from various sources and organized to create a database. The database built upon existing information from 254 water providers gathered for SWSI 1. Efforts were made to update the data for these providers as part of analyses completed in 2009 and 2010. The CWCB also worked with water providers and basin roundtables across the state through the first part of 2010 to collect additional data. Based on these efforts, updated per capita estimates were collected for 214 water providers covering 87 percent of the population in Colorado. A systemwide gpcd estimate was calculated for each participating local water provider by dividing the total water deliveries by the service area population.

Because 2050 population projects were developed at the county level, the systemwide gpcd values needed to be aggregated from the water provider level to the county level. A weighting process was applied to develop a county average systemwide gpcd based upon the portion of the county population serviced by each water provider. Once the county level M&I demand forecast was developed, basin level M&I water use rates were calculated for the nine basin roundtable areas. Basin M&I demands were aggregated from the county demands based on the portion of the county within the basin. For four counties (Cheyenne, Lake, Saguache, and San Juan), no provider-level data were obtained. For these counties, the weighted basin

average was assigned. The population estimates developed for this update and the gpcd values determined through data collection are multiplied to estimate county demands. The population estimates represent permanent populations of each county; thus the water use rates are based on total water use divided by the permanent population. The resulting gpcd water use rates incorporate water used by tourists, students, and other transient populations in that the water used by the transient population is indexed to the permanent population along with the water use of the permanent population. The resulting gpcd also incorporates commercial and light industrial water use supplied by the water provider. For statewide planning purposes, this is a consistent approach to account for water use by transient populations, commercial, and light industry. Comparisons of gpcds between counties and basins should not be made directly, since differences in the amount of industry, tourism, and outdoor water use varies significantly between geographic regions.

Passive Water Conservation Savings

The methodology for the M&I water demands projections outlined above develops baseline water demand estimates. In addition, CWCB has updated the passive conservation analysis, and these water savings are subtracted from the baseline estimates. This section provides an overview of passive water conservation savings, which chiefly relate to the water demand reductions associated with the impacts of state and federal policy measures and do not include active conservation measures and programs sponsored by water providers. A detailed description of this analysis is provided in the *SWSI Conservation Levels Analysis Report*.

Several pieces of key federal and state legislation were considered in the development of the passive conservation savings estimates, including the 1992 National Energy Policy Act, the 2002 California Energy Commission Water Efficiency Standards, and the 2007 California Assembly Bill 715.

For this analysis, passive water savings were calculated to occur as a result of retrofitting housing stock and businesses that exist prior to 2016 through the replacement of washing machines, toilets, and dishwashers. Future water demand reductions associated with passive savings were calculated for each year beginning in 1996, which was when benchmark toilet flushing volume data from Denver was available. The calculations used to estimate future demand reductions from passive conservation were developed for minimum and maximum scenarios based on the assumptions related to the retrofit of existing housing and commercial construction with high-efficiency toilets, clothes washers, and dishwashers.

The calculations based on these assumptions were used to estimate a range of future passive water savings in each county for each year starting in 2000 and continuing until 2050. The total range of savings expected from passive conservation through 2050 is 19 to 33 gpcd. The upper range of these savings were applied to the county level baseline estimates described above to assess what the 2050 demands would be on a low, medium, and high basis with passive conservation. As stated in the *SWSI Conservation Levels Analysis Report,* there are three major reasons for applying the high passive conservation savings:

1. Water and energy savings will become increasingly important to water customers as water and fuel costs rise. As water customers seek more efficiency in their homes and businesses, high efficiency fixtures and appliances will become increasingly efficient as technology improves and customers strive to reduce their variable costs related to water and energy.

2. The potential exists to realize substantial permanent water demand reductions in the future if appropriate regulations and ordinances are developed to address water use in existing and new construction.

3. The impact of commercial retrofits (e.g., restaurants, motels, ski area condominiums, centralized laundries, commercial laundries, bars, etc.), is not well captured in the passive savings analyses since information regarding numbers of and ages of individual types of commercial properties were not available.

4.2.2.2 2050 M&I Water Demands Results

Colorado's population is projected to nearly double by the year 2050. Because the major driver for water use is population growth, M&I water usage is also expected to nearly double, even with savings from passive conservation. Statewide municipal water demands are estimated to increase from 975,000 acre-feet per year (AFY) to 1.36 million AFY by 2035 requiring an additional 383,000 AFY of water to meet Colorado's municipal water needs in 2035.

Based on the population projections discussed in Section 4.2.1, total statewide 2050 M&I water demands with passive conservation could range from 1.5 to 1.8 million AFY. By 2050, Colorado will need between 538,000 and 812,000 AFY of additional water to meet M&I demands. Passive conservation savings will result in approximately 154,000 AFY reduction statewide or just over 8 percent decrease in M&I water demands by 2050 for the medium demand scenario.

Figure 4-2 and **Table 4-3** illustrates the M&I water demand projections with passive conservation savings for each of the counties in the Rio Grande Basin.

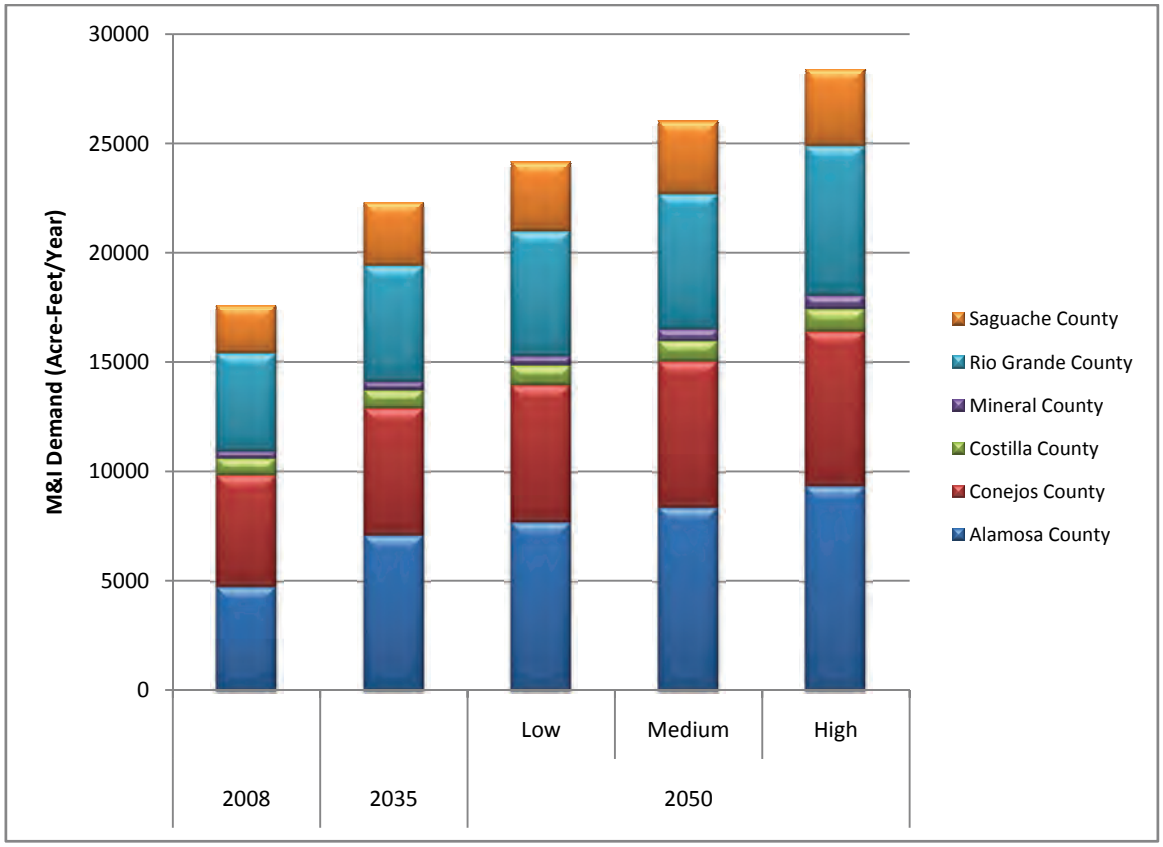

Figure 4-2 Rio Grande Basin M&I Water Demands

Table 4-3 M&I Forecast by River Basin

County	Water Demand (AF)	Baseline Water Demands (AFY)				Water Demands with Passive Conservation (AFY)			
	2008	2035	2050 Low	2050 Medium	2050 High	2035	2050 Low	2050 Medium	2050 High
Alamosa County	4,800	7,600	8,200	8,900	9,800	7,100	7,700	8,400	9,400
Conejos County	5,000	6,000	6,500	6,900	7,300	5,800	6,200	6,600	7,000
Costilla County	780	910	990	1,100	1,100	820	900	960	1,000
Mineral County	330	410	450	540	650	380	430	510	620
Rio Grande County	4,500	5,600	6,000	6,500	7,200	5,300	5,700	6,200	6,800
Saguache County	2,200	3,100	3,400	3,500	3,700	2,900	3,200	3,300	3,500
Total	**18,000**	**24,000**	**26,000**	**27,000**	**30,000**	**22,000**	**24,000**	**26,000**	**28,000**

4.2.3 SSI Water Demands

Standard methods were adapted for use in SWSI 1 for estimating future SSI water demands throughout Colorado. SSI water demands include water use by self-supplied and municipal provided large industries. The subsectors that are included in SSI are:

- Large industries, including mining, manufacturing, brewing, and food processing
- Water needed for snowmaking
- Thermoelectric power generation at coal and natural gas-fired facilities
- Energy development, including the extraction and production of natural gas, coal, uranium, and oil shale

These industries represent economic growth within the state and the availability of water resources is imperative to their growth. Because of the diversity of the SSI subsectors, this section is organized to summarize each subsector separately, including data collection efforts and results. Detailed discussions of data sources, methodologies, and results are provided in Appendix H of the SWSI 2010 Report.

4.2.3.1 Energy Development

The Rio Grande Basin Roundtable expects that within the next 40 to 50 years a solar energy development industry will occur in the Rio Grande Basin. Some of the technologies proposed are water intensive and recent estimates by the basin roundtable have identified a potential range of 1,200 to 2,000 AFY demand for solar energy development by 2050. **Table 4-4** shows the estimated energy development direct water demands for Alamosa County where water demands for energy production will be required by 2050. Water demands for energy development have the potential to increase over twelve times 2008 levels by 2050 for the high scenario.

Table 4-4 Estimated Energy Development Direct Water Demands (AFY)

			2050		
County	2008	2035	Low	Med	High
Alamosa	—	300	1,200	1,500	2,000

4.2.3.2 Rio Grande Basin SSI Summary

Figure 4-3 displays SSI water demands in the Rio Grande Basin.

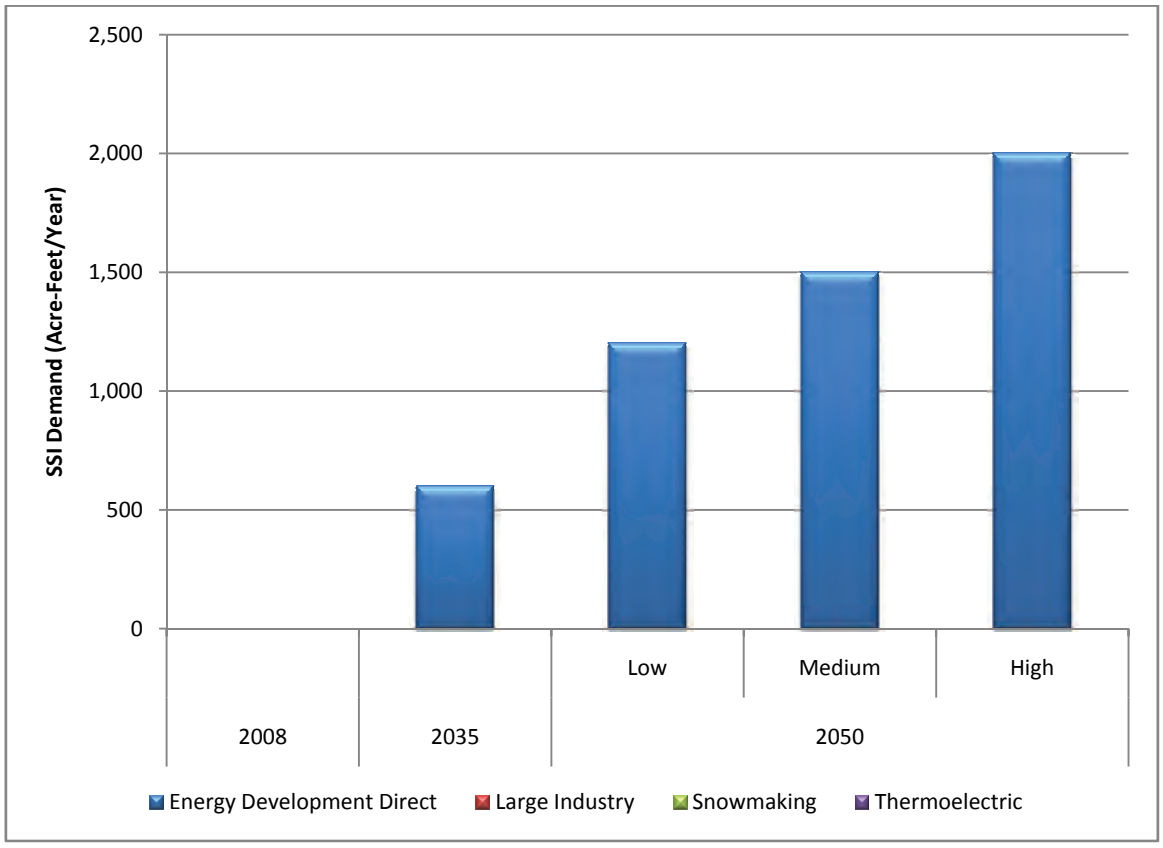

Figure 4-3 Rio Grande Basin SSI Water Demands

4.2.4 Statewide 2050 M&I and SSI Consumptive Needs Summary

Of the many factors affecting M&I water use, the projected increases in population clearly drive the increases in M&I use from 2000 to 2050. **Table 4-5** and **Figure 4-4** summarize the Rio Grande Basin's M&I and SSI water use for 2008 and projections including reductions as a result of passive conservation measures for 2035 and the 2050 low, medium, and high scenarios. Total statewide 2035 water demands are projected to be nearly 1.6 million AFY. 2050 water demands are projected to range from approximately 1.75 million AFY to nearly 2.1 million AFY. Figure 4-4 also shows that M&I water demands are estimated to exceed SSI demands for all of the future projections.

Table 4-5 Summary of M&I and SSI Demands for Rio Grande Basin (AFY)

Basin	Demand Type[1,2]	2008	2035	2050 Low	2050 Med	2050 High
Rio Grande	M&I	18,000	22,000	24,000	26,000	28,000
	SSI	—	600	1,200	1,500	2,000
	Total	18,000	22,600	25,200	27,500	30,000
Statewide	M&I	974,500	1,357,600	1,512,700	1,607,700	1,786,800
	SSI	187,760	235,990	235,890	261,490	322,090
	Total	1,162,260	1,593,590	1,748,590	1,869,190	2,108,890

[1] M&I demands for 2035 and 2050 include passive conservation savings.
[2] SSI demands include energy development, large industry, snowmaking, and thermoelectric.

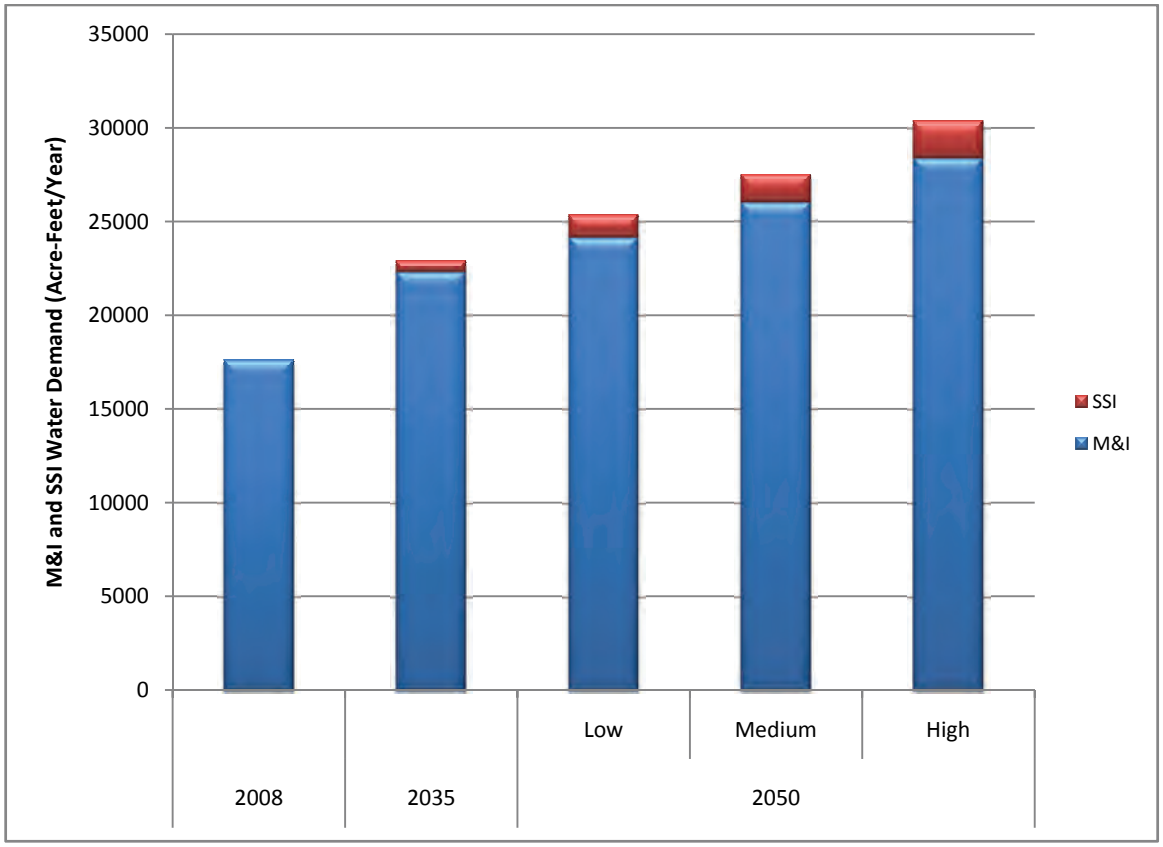

Figure 4-4 Rio Grande Basin M&I and SSI Water Demands

4.3 Agricultural Consumptive Needs

This section provides information about the methodologies utilized to develop a current tally of irrigated acres and summarizes how 2050 irrigated acres were estimated. In addition, this section provides an overview of existing and 2050 agricultural demands.

4.3.1 Agricultural Demand Methodology

This section describes the methods used to estimate the water needed to support Colorado's agriculture, both currently and in 2050. The estimates include consumptive use (CU) water only—rather than the generally larger volumes of water pumped or diverted—both for the irrigation of crops and for livestock production. CU includes the amount of diverted water that is used by plants through evapotranspiration processes, as well as water that is "lost" to soil evaporation or deep percolation into the groundwater aquifer. A portion of the total diverted amount returns to the stream through surface runoff or lagged groundwater return flows and therefore is not consumptively used.

Colorado's water needs for irrigation are characterized in this analysis by the Irrigation Water Requirement (IWR), Water Supply Limited Consumptive Use (WSL CU), and the difference between these two numbers. CU modeling was executed using a recent decade of climate and water supply information. The objective was not to simulate what occurred over the past 10 years, but to estimate IWR and WSL CU for today's agricultural conditions and a plausible sample of climate and hydrology, exemplified by the recent decade. Future irrigation demand was examined by assuming that historical climate conditions will

continue. The analysis assumed that agricultural demand is directly and linearly related to the number of acres irrigated.

In addition to the crop consumption described above, Colorado's agricultural demand includes three other types of CU that are associated with agricultural activity:

- Livestock CU
- Stockpond evaporation
- Losses incidental to delivering irrigation water

The Colorado Decision Support System (CDSS) program has developed processes for quantifying these uses in the context of developing basinwide water budgets, and water resources planning models. For this analysis, CDSS procedures were used to update the SWSI 1 estimates. The following subsections provide an overview of the methodologies used to estimate current and future irrigated acres and agricultural water demands and the results. A detailed description of these methodologies and results is in Appendix I of the SWSI 2010 Report.

4.3.1.1 Current Irrigated Acres Methodology

The CDSS program has produced irrigated lands mapping and crop CU models in the Rio Grande Basin. The maps are available as spatial databases, and include crop types, irrigation practices, and association with diversion structures or wells. The structure identifier associated with the irrigated land indicates the location of the headgate that serves the land. Irrigated acres are assigned to the water district where the diversion is located, which may not be where the irrigated acreage lies. Dates of the irrigated lands information varied with the basins including the number of years information was collected.

4.3.1.2 2050 Irrigated Acres Methodology

Using the most current irrigated acres for each basin as defined in the previous section as a baseline, estimates of 2050 irrigated acres were based on the following factors:

- Urbanization of existing irrigated lands
- Agricultural to municipal water transfers
- Water management decisions
- Demographic factors
- Biofuels production
- Climate change
- Farm programs
- Subdivision of agricultural lands and lifestyle farms
- Yield and productivity
- Open space and conservation easements
- Economics of agriculture

The first three factors (urbanization of existing irrigated lands, agricultural to municipal water transfers, and water management decisions) were quantified based on future growth estimates, municipal water demand gaps that will be met by 2050, and interviews with water management agencies across the state. The remaining factors were qualitatively addressed based on information provided by the CWCB and the Colorado Department of Agriculture.

The urbanization of existing irrigated lands was established using 2050 population projections, estimation of future urban area size, and the current irrigated acres as described in the previous section. As discussed above, current irrigated acres in each administrative water district were determined from geographic information system data sources. However, certain types of data (e.g., future population forecasts) were

only available on a county basis. Therefore, future losses of irrigated acres were calculated first for each county, and then redistributed by water district. The methodology is described in detail in Appendix I of the SWSI 2010 Report.

The M&I gap analysis (described in Section 5) was used as the basis for the analysis of irrigated acreage changes associated with agricultural to municipal water transfers. For each of Colorado's major river basins the amount of the M&I gap was summarized in AFY on a low, medium, and high basis. Currently the Rio Grande Basin is over-appropriated and the agricultural sector is self-imposing constraints on itself to address the historical depletion of its aquifers, which may result in up to 80,000 acres being taken out of production to address this issue and bring the aquifer levels back to specific historical levels through groundwater management subdistricts. As the results of these efforts are realized, the number of acres being taken out of agricultural production may change. In the Rio Grande Basin, all future M&I needs will have to come from the agricultural sector because the basin is over-appropriated and irrigators are not always able to take or use their decreed water rights because of curtailments necessary on the Rio Grande and Conejos River to meet Colorado's obligations under the Rio Grande Compact. The percentages shown are a conservative estimate based on the assumption of 100 percent yield success rate for IPPs (see Section 5). The IPPs in the Rio Grande Basin will not specifically make more water available for M&I uses – any IPPs will make more water available to irrigators and reduce the amount of curtailment imposed to meet the Rio Grande Compact. Therefore, it does not take into account the projects or methods that may not be successful in meeting Colorado's future M&I demands; if IPPs are unsuccessful, it is likely that M&I water providers will turn to increased agricultural transfers to meet future demands. The following equation was used to estimate irrigated acres that would be needed for agricultural to municipal transfers to address M&I gaps:

Irrigated Acres Transferred = M&I Gap ÷ Transferrable Consumptive Use x (1 – Safety Factor)

A safety factor of 25 percent was applied to account for the additional amount of irrigated acres that may be needed to provide the transferred water on a firm yield basis.

CWCB interviewed entities within the South Platte, Rio Grande, and Republican River Basins to estimate what changes may occur in irrigated acres due to water management decisions affected by compact compliance or maintain groundwater levels. For the remaining factors (demographic factors, biofuels production, climate change, farm programs, subdivision of agricultural lands and lifestyle farms, yield and productivity, open space and conservation easements, economics of agriculture), CWCB identified trends that are expected to occur within each area over the next 40 years and then developed a qualitative assessment on whether each factor would cause a negative or positive impact on irrigated agriculture by 2050. A detailed description of this qualitative assessment is available in Appendix I of the SWSI 2010 Report.

4.3.1.3 Current Agricultural Demand Methodology

Current irrigation demand for water in Colorado can be defined as the average amount of water consumptively used by crops on land currently under irrigation. Typically, water supply is plentiful early in the irrigation year, crop CU is not limited and is equal to the crop IWR. It is recognized that the IWR is a theoretical number as no additional water is available in the Rio Grande Basin to attain this level of CU. In the Rio Grande Basin the IWR serves as a measure in the shortfall of irrigation water as a result of a combination of factors including an over-appropriated basin, water management practices dictated by meeting the Rio Grande Compact, and inadequate precipitation in the basin. Efforts to reduce the shortfall in surface irrigation water are addressed through the use of wells. As the irrigation season continues, the available water supply generally decreases, becoming less than the crops' uptake capacity, and CU is limited by supply. In order to quantify crop CU, one must have credible estimates or measurements of the crops'

average capacity to use irrigation water, referred to as IWR, as well as the average water supply. The minima of these two values over a series of time increments (typically months) is the WSL CU.

For this analysis, both average IWR and average WSL CU are reported. The latter may be considered to be the current agricultural demand resulting from limited supply; that is, the water required to sustain current level crop production. IWR provides perspective on the amount of water that would be used, if it was physically and legally available. It is an upper limit on consumption by current agriculture practices, and a reminder that the Rio Grande Basin and Colorado are dry with over-appropriated streams.

IWR estimation requires time series of climate information, particularly precipitation and temperature, over the study period; WSL CU estimation requires information about the time-varying water supply available to the crop. For this analysis, a recent 10-year study period was used in each basin, although the exact decade differed from basin to basin depending on available data. The 10-year period allowed for estimation of average conditions with respect to both climate and hydrology. IWR and WSL CU were calculated assuming that the most current estimate of number of irrigated acres, and most recent information on crop types, prevailed during each year of the study period. The results show demand for "today's" agricultural conditions in Colorado, based on a 10-year sample of climate and hydrology.

Where applicable, CDSS methodologies were applied to estimate non-irrigation agricultural consumptive demands (e.g., livestock and stockpond evaporation) as well. Livestock CU is estimated by multiplying the number of cattle, sheep, and hogs located within a basin by their corresponding per capita use. Stockpond evaporation is based on net evaporation rates and stock pond surface area estimates. Details differ among the basins, but in general, the method estimates net reservoir evaporation by subtracting average monthly effective precipitation from the estimated gross monthly free water surface evaporation.

Lastly, incidental losses may include, but are not limited to, vegetative CU that occurs along canals and in tailwater areas. The CDSS program, in preparing Consumptive Uses and Losses (CU&L) Reports for the state, has adopted 10 percent as the factor for computing incidental losses associated with irrigation CU. This number of 10 percent may be low when transportation losses are also considered. On the Rio Grande these losses alone may range between 10 percent and 20 percent. However, the value is in the middle of the range of factors (5 percent to 29 percent) used by the U.S. Bureau of Reclamation in their parallel CU&L accounting throughout the upper basin states.

4.3.1.4 2050 Agricultural Demand Methodology

Following the techniques described in Section 4.3.1.2, changes in numbers of acres irrigated have been developed for each water district. Since this study intentionally avoids identifying specific water rights or ditches for change of use, there is no basis for calculating the structure-specific CU by which a water district's irrigation demand will change. CU per irrigated acre varies from structure to structure, and depends on available supply, seniority of a water right, and system efficiency. The variability of these factors makes it impossible to predict future losses of irrigated land on a structure-by-structure basis. Consequently, simplifying assumptions were made such that irrigation demand was considered directly proportional to number of acres irrigated. To derive future irrigation demand, current irrigation demand for each water district was scaled by the ratio of future irrigated acreage to current irrigated acreage.

Similarly, non-irrigation demand was estimated as being in proportion to irrigated acres. The relationship between losses incidental to irrigation and number of acres irrigated is proportional. With respect to stockponds and stock watering, it is assumed that predicted changes in irrigated acreage will be accompanied by similar changes in stock raising activities. To derive future non-irrigation demand, current non-irrigation demand was scaled by the ratio of future irrigated acreage to current irrigated acreage.

4.3.2 Agricultural Demand Results

The following sections describe the results of the current and future agricultural demand analyses, which were performed based on the methodologies described above. These analyses included assessments of both irrigated acreage and associated agricultural consumptive water demands. Maps are included to identify the locations of existing irrigated lands across the state, as well as to show the range of irrigated acreage losses anticipated in each basin by 2050.

4.3.2.1 Current Irrigated Acres Results

Information developed for this effort was generated at the water district level. **Figure 4-5** on the following page shows the locations of Colorado's water districts and the spatial distribution of current irrigated acres in Colorado based on the methods presented previously.

Table 4-6 presents the number of irrigated acres in each river basin and the percentage of total that each basin represents. Colorado currently has 3,466,000 million acres of irrigated farmland across the state. The South Platte River Basin has the highest percentage of irrigated acres followed by the Rio Grande Basin and the Republican River Basin.

Table 4-6 Current Irrigated Acres by River Basin

Basin	Irrigated Acres	Percentage of Colorado's Irrigated Acres
Arkansas	428,000	12%
Colorado	268,000	8%
Gunnison	272,000	8%
North Platte	117,000	3%
Republican	550,000	16%
Rio Grande	**622,000**	**18%**
South Platte	831,000	24%
Southwest	259,000	7%
Yampa-White	119,000	3%
Statewide Total	**3,466,000**	**100%**

4.3.2.2 Future Irrigated Acres Results

Table 4-7 shows the results of future irrigated acres analysis. Future irrigated acres in Colorado may decrease by 115,000 to 155,000 acres due to urbanization alone, under low and high population growth scenarios, respectively. The basins with largest expected loss of irrigated acres due to urbanization are the South Platte, Colorado, and Gunnison Basins.

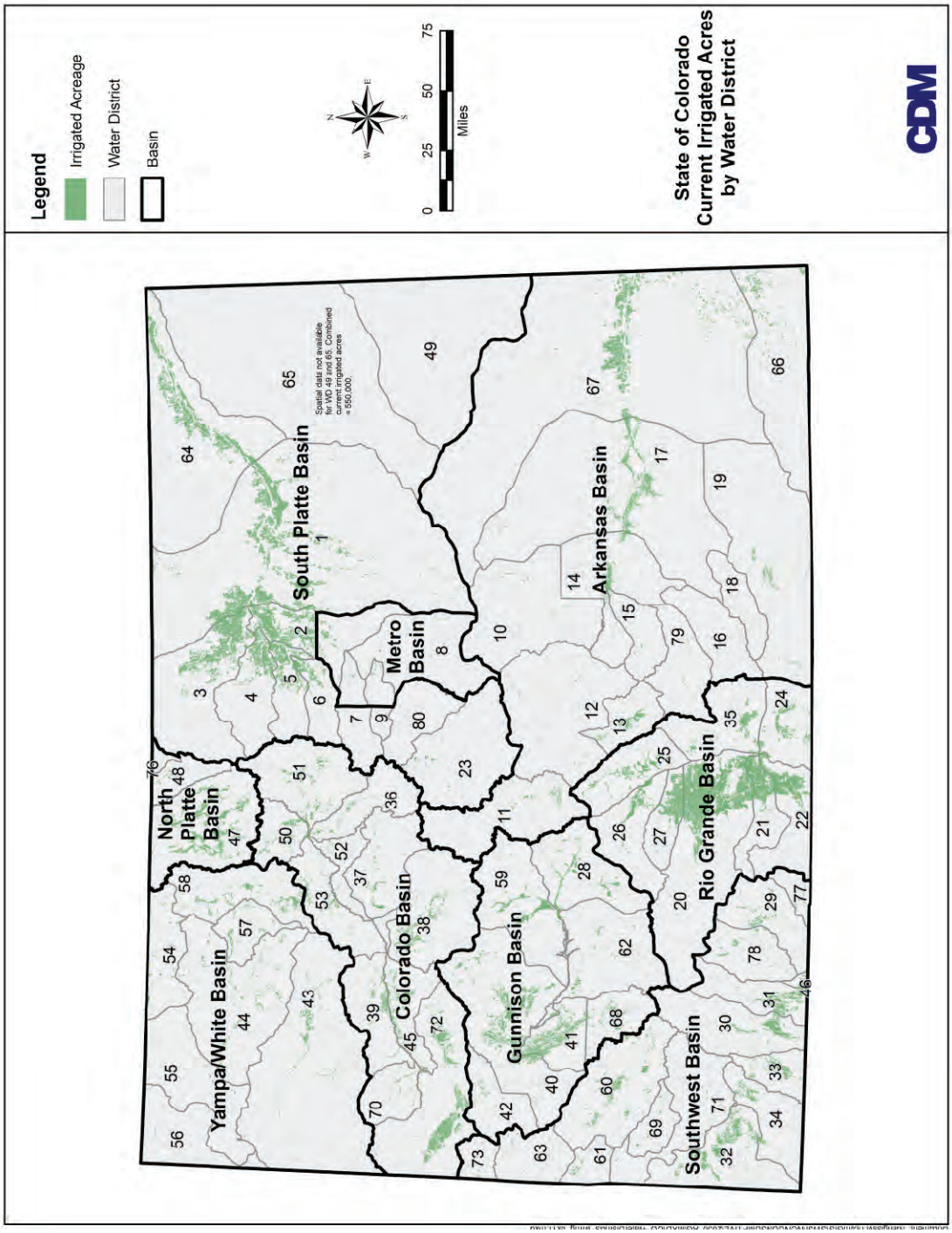

Figure 4-5 State of Colorado Current Irrigated Acres by Water District

Table4-7 Future Irrigated Acres by River Basin

Basin	Current Irrigated Acres	Decrease in Irrigated Acres Due to Urbanization		Decreases in Irrigated Acres Due to Other Reasons	Decreases in Irrigated Acres from Planned Agricultural to Municipal Transfers	Decreases in Irrigated Acres from Agricultural to Municipal Transfers to Address M&I Gap		Estimated 2050 Irrigated Acres	
		Low	High			Low	High	Low	High
Arkansas	428,000	2,000	3,000	—	7,000	26,000	63,000	355,000	393,000
Colorado	268,000	40,000	58,000	—	200	11,000	19,000	190,800	216,800
Gunnison	272,000	20,000	26,000	—	—	1,000	2,000	244,000	251,000
North Platte	117,000	—	—	—	—	—	—	117,000	117,000
Republican	550,000	300	600	109,000	—	—	—	440,400	440,700
Rio Grande	**622,000**	**800**	**1,000**	**80,000**	**—**	**2,000**	**3,000**	**538,000**	**539,200**
South Platte	831,000	47,000	58,000	14,000	19,000	100,000	176,000	564,000	651,000
Southwest	259,000	4,000	6,000	—	—	3,000	7,000	246,000	252,000
Yampa-White	119,000	1,000	2,000	—	—	3,000	64,000	53,000	115,000
Statewide Total	**3,466,000**	**115,100**	**154,600**	**203,000**	**26,200**	**146,000**	**334,000**	**2,748,200**	**2,975,700**

Table 4-7 also shows the potential loss of irrigated acres due to other reasons. The South Platte, Republican, and Rio Grande Basins are expected to lose irrigated acres due to a variety of factors, as follows:

- For the South Platte Basin, up to 14,000 irrigated acres have been taken out of production in the last 5 years because a shortage of augmentation water led to numerous wells being shut down in the central South Platte Basin in 2006. This reduction of irrigated acres is expected to be more or less permanent since the cost of acquiring augmentation water in the central South Platte River Basin is prohibitive for the agricultural community. This reduction in acreage is not reflected in the current irrigated acreage.

- In the Republican River Basin, a total of about 35,000 acres were removed from irrigation through conservation programs by 2009. An additional 64,000 acres are estimated to be removed from irrigation due to the declining saturated thickness of the Ogallala aquifer, and another 10,000 acres are to be dried up in District 65 in association with the construction of a pipeline for compact compliance reasons.

- In the Rio Grande Basin, the estimated decline in irrigated acres is a result of the basin addressing the issue of declining aquifer levels, and the unsustainability of current groundwater management practices. This is being addressed by the establishment of groundwater management subdistricts. As a part of the planned solution to the unsustainable groundwater management practices it is anticipated that agricultural crop land will have to be taken out of production. Initial estimates of the amount of land that will have to be taken out of production ranges up to 80,000 acres. This figure may change as the aquifers recover and on the success of other measures being taken. For the purpose of this analysis the 80,000 acres has been used. The actions being taken will not only protect the aquifers but also senior surface right holders and have the potential to assist Colorado in complying with the Rio Grande Compact by providing augmentation water to the Rio Grande and Conejos River to offset well depletions.

Although the agricultural community has recognized the need to decrease agricultural acreage as the means to retaining the subsurface water table balance, this might also be accomplished by a combination of practices: reduced acreage, improved irrigation methods, and/or farming different crops using less water. If the basin is to avoid significant overall negative economic and associated impacts as a result of the reduction in agricultural production, measures may have to be taken to establish a broader economic base. This may be difficult in today's economic climate.

Finally, Table 4-7 identifies approximately 26,000 acres that will be dried-up in the Arkansas, Colorado, and South Platte River Basins as a result of planned agricultural to municipal transfers. Additional transfers that may be required to meet M&I gaps are expected to decrease irrigated acreage from 160,000 acres to 334,000 acres statewide.

Overall, the future irrigation analysis shows that Colorado may lose about 500,000 to 700,000 acres of its irrigated lands by 2050 due to all factors combined. These acreages represent 15 to 20 percent of the current total irrigated lands. **Figure 4-6** shows the range of potential changes by basin. **Figure 4-7** shows the comparison between current irrigated acres and 2050 irrigated acres as both numbers of acres and percent change. Note that the basin with the highest percent change (Yampa-White, 34,000 acres, 29 percent) is not the same as the basin with the highest change in total acres (South Platte, 224,000 acres, 27 percent).

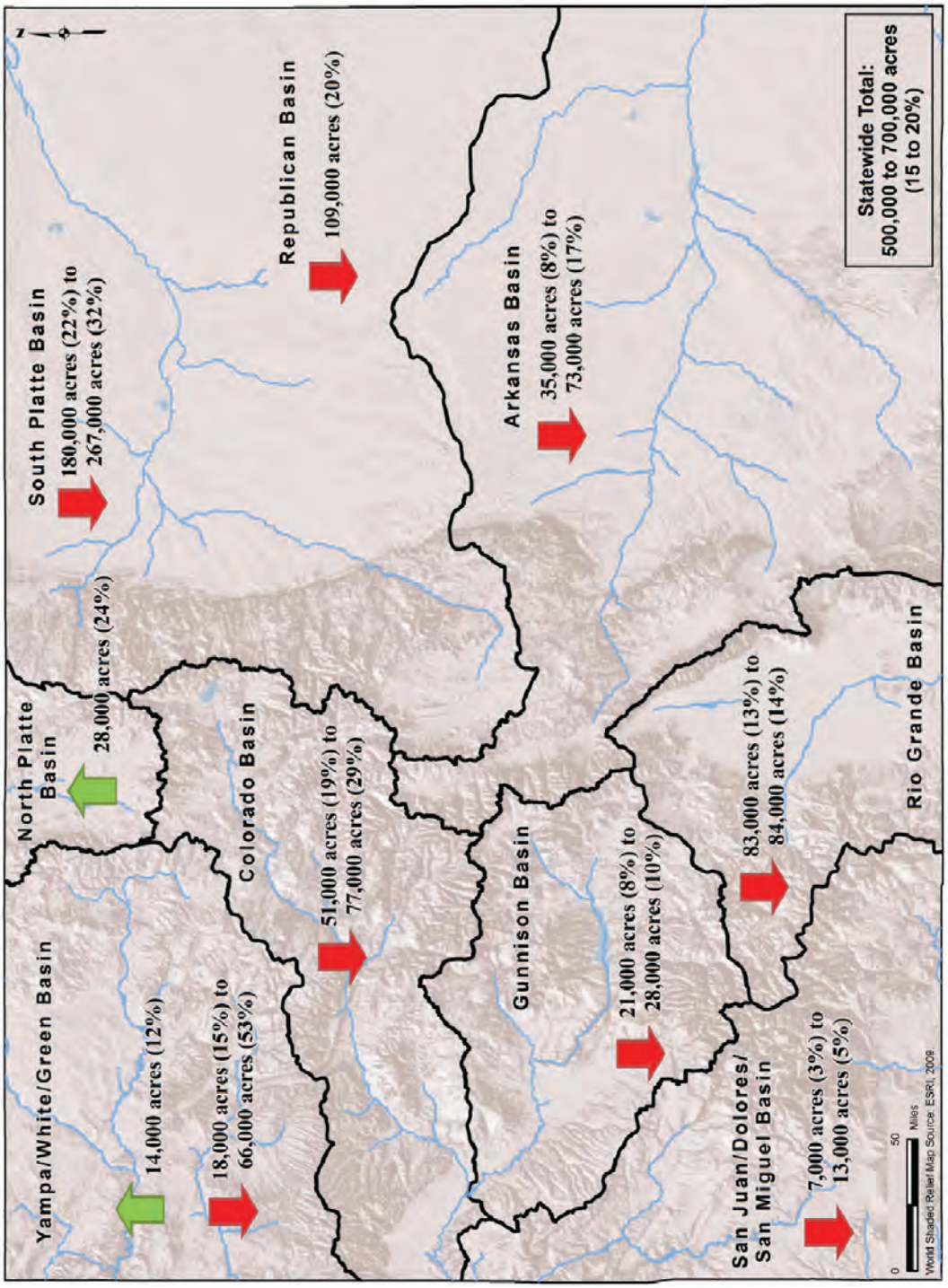

Figure 4-6 Potential Changes in Irrigated Acres by 2050

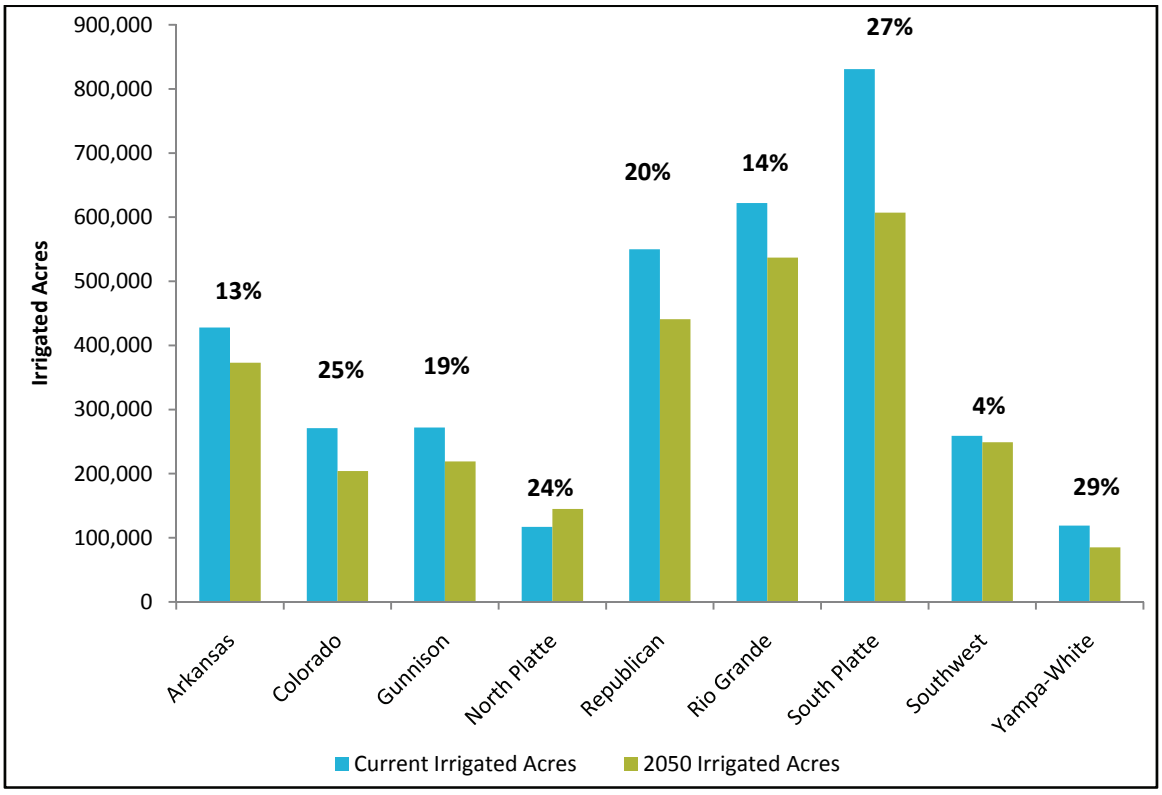

Figure 4-7 Comparison of Current and 2050 Irrigated Acres

4.3.2.3 Current Agricultural Demand Results

Table 4-8 summarizes results of the average annual current agricultural demand by basin. It shows irrigated acres IWR, WSL CU, and shortage (difference between IWR and WSL CU). Non-irrigation demand is also shown by basin. **Figures 4-8** and **4-9** show the current WSL CU and shortage amounts by basin. Basins with the highest agricultural water demand include the South Platte, Rio Grande, and Republican.

Table 4-8 Estimated Current Agricultural Demand by Basin

Basin	Irrigated Acres	Irrigation Water Requirement (AFY)	Water Supply-Limited Consumptive Use (AFY)	Shortage (AFY)	Non-Irrigation Demand (AFY)
Arkansas	428,000	995,000	542,000	453,000	56,000
Colorado	268,000	584,000	485,000	100,000	51,000
Gunnison	272,000	633,000	505,000	128,000	54,000
North Platte	117,000	202,000	113,000	89,000	12,000
Republican	550,000	802,000	602,000	200,000	67,000
Rio Grande	**622,000**	**1,283,000**	**855,000**	**428,000**	**45,000**
South Platte	831,000	1,496,000	1,117,000	379,000	115,000
Southwest	259,000	580,000	382,000	198,000	46,000
Yampa-White	119,000	235,000	181,000	54,000	24,000
Statewide Total	**3,466,000**	**6,819,000**	**4,791,000**	**2,028,000**	**470,000**

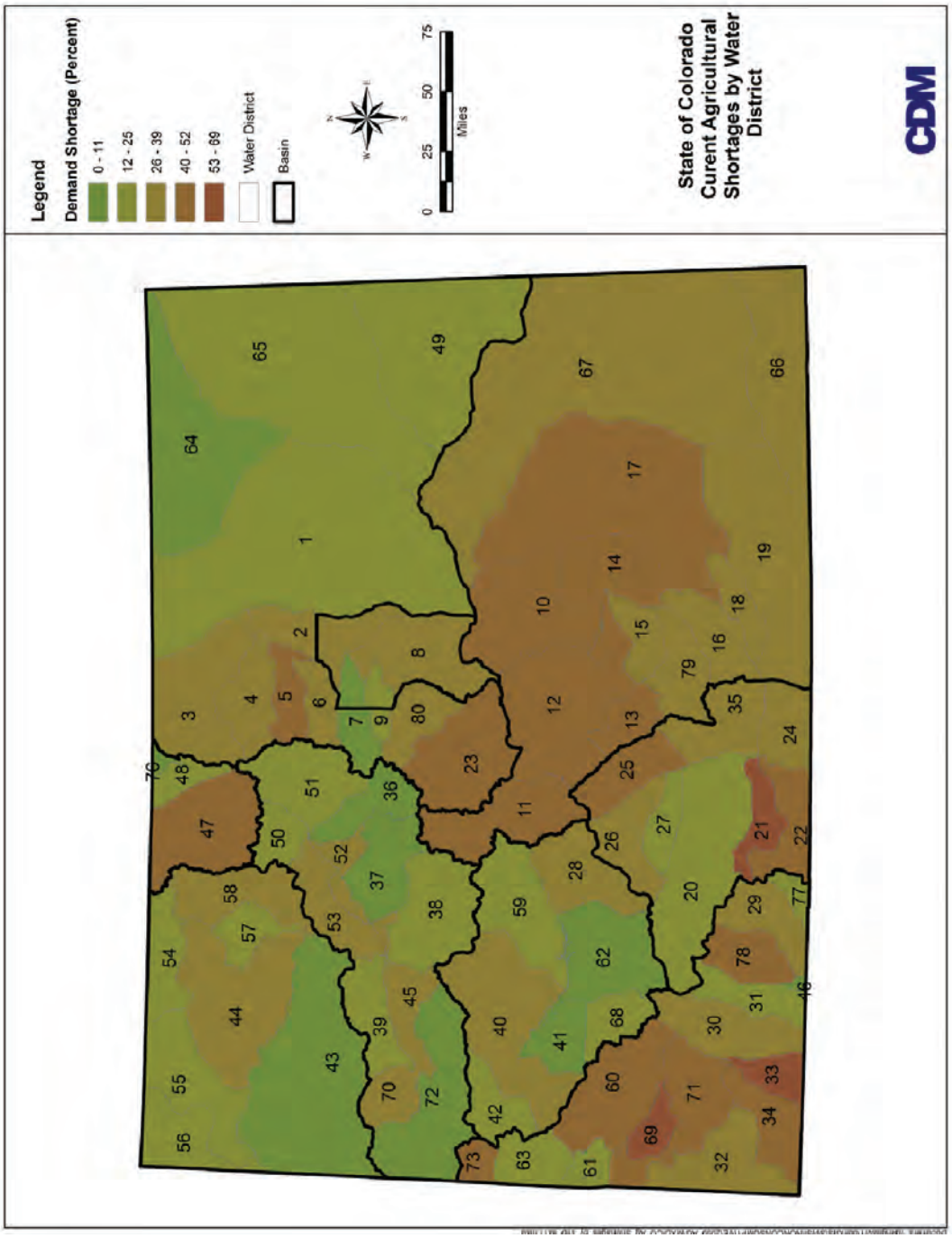

Figure 4-8 State of Colorado Current Agricultural Shortages by Water District

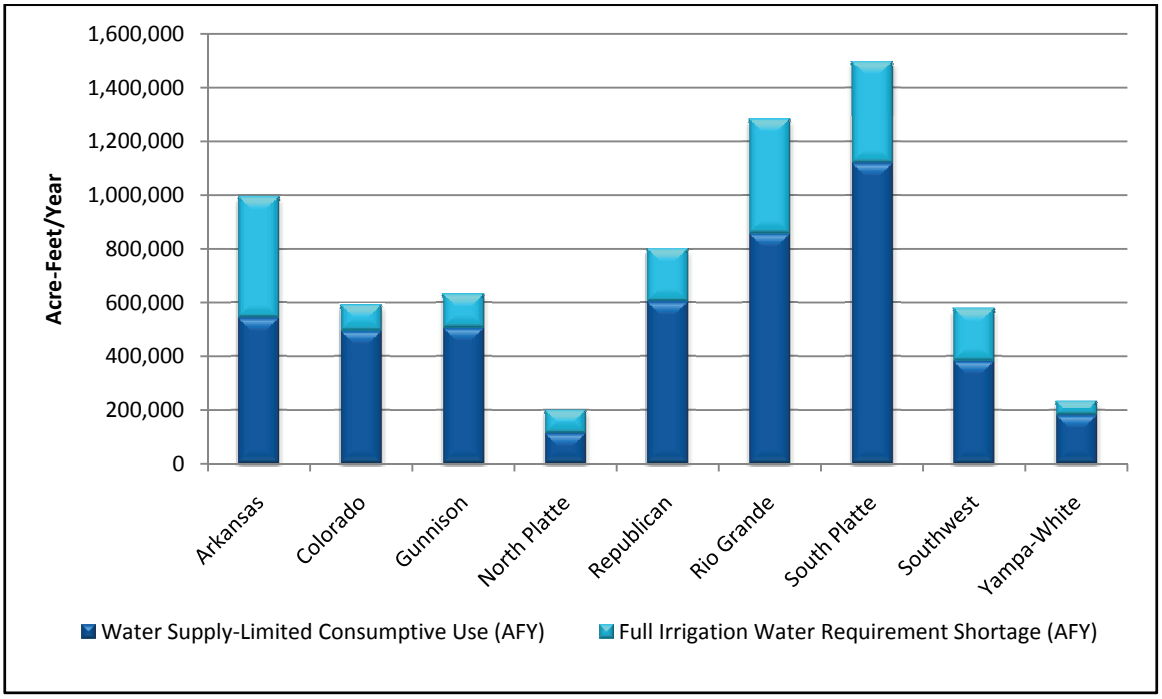

Figure 4-9 State of Colorado Current Agricultural Demands and Shortages

4.3.2.4 Future Agricultural Demand Results

Table 4-9 summarizes the estimated average annual agricultural demand by basin for the year 2050, assuming that historical climate and hydrology continue into the future. It shows irrigated acres, IWR, WSL CU, shortage, and non-irrigation demand. **Figure 4-10** shows the WSL CU and shortages by basin for the 2050 irrigated acres. Consistent with the projected decline in irrigated acres, declines in both irrigation and non-irrigation agricultural water demands are anticipated to occur in all basins except for the North Platte.

Table 4-9 Estimated 2050 Agricultural Demand by Basin

Basin	Irrigated Acres	Irrigation Water Requirement (AFY)	Water Supply-Limited Consumptive Use (AFY)	Shortage (AFY)	Non-Irrigation Demand (AFY)
Arkansas	373,000	862,000	476,000	386,000	49,000
Colorado	204,000	443,000	366,000	77,000	38,000
Gunnison	219,000	573,000	457,000	116,000	48,000
North Platte	145,000	250,000	140,000	110,000	14,000
Republican	441,000	640,000	480,000	160,000	5,000
Rio Grande	**537,000**	**1,108,000**	**739,000**	**369,000**	**38,000**
South Platte	607,000	1,094,000	820,000	274,000	84,000
Southwest	249,000	558,000	367,000	191,000	44,000
Yampa-White	85,000	209,000	170,000	39,000	17,000
Statewide Total	**2,860,000**	**5,737,000**	**4,015,000**	**1,722,000**	**337,000**

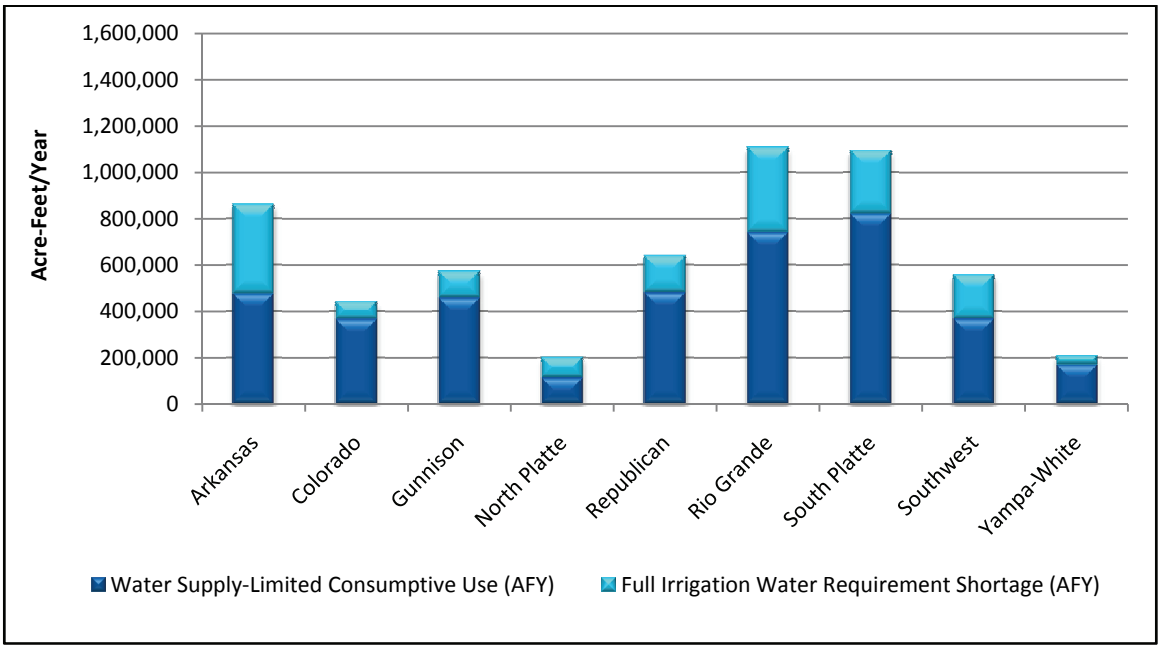

Figure 4-10 2050 Agricultural Demands and Shortages

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Section 5
Rio Grande Basin Consumptive Projects and Methods and the M&I Gap

5.1 Projects and Methods to Address the M&I Gap Overview

Section 4 of this report summarizes the consumptive water needs across the State of Colorado and the Rio Grande Basin. As discussed in Section 1, the Colorado Water for the 21st Century Act requires the basin roundtables to identify projects and methods to meet their consumptive needs.

Section 5.2 summarizes the major projects and methods identified to meet future municipal and industrial (M&I) consumptive needs; Section 5.3 documents the resulting assessment of M&I gaps.

In order to identify M&I projects and methods, the Colorado Water Conservation Board (CWCB) worked with water providers and the basin roundtables to update the Statewide Water Supply Initiative (SWSI) 1 identified projects and processes (IPPs). This information was used to estimate a low, medium, and high 2050 M&I gap corresponding to the M&I demand projections summarized in Section 4 and different IPP success rates. To be clear, an M&I "gap" in the context of this study is not indicative of a future water supply shortfall; rather, it is a future water supply need for which a project or method to meet that need is not presently identified.

It is important for the reader to recognize that the analyses documented in this section are intended for the purpose of "big picture" statewide planning. While data and other information were collected from individual water providers, the results presented herein are for the purpose of general statewide and basinwide planning and are not intended to be used for individual provider planning, site-specific analysis, or project-specific purposes.

5.2 Projects and Methods to Meet M&I Consumptive Needs

Water providers throughout Colorado are pursuing water supply projects and planning processes to help meet future water demands. These IPPs, if successfully implemented, have the ability to meet some, but not all of Colorado's 2050 M&I water needs. IPPs are defined as projects and methods local water providers are counting on to meet future water supply needs. Future M&I water supply needs that are not met by an IPP are considered an M&I water supply gap. The estimation of future M&I water supply gaps is dependent upon several factors, including current water use, forecasted future water use, and water provider predictions of new water supply that will be developed through IPPs.

Statewide, these analyses were performed on a countywide basis and aggregated by basin roundtable area. For the Front Range counties in the Arkansas, Metro, and South Platte Basins, the county results were aggregated to a regional subbasin level for presentation in this report and consistency with SWSI 1. The majority of population growth over the next 40 years is expected to occur in these basins.

5.2.1 Identified Projects and Processes Methodology

The first part of the M&I gap analysis is to calculate 2050 total new M&I water needs, which is described in Section 4. The second part of the 2050 M&I and SSI gap analysis is to calculate the anticipated yield from the water providers' 2050 IPPs, assuming 100 percent success rate. For counties with more than one surveyed water provider, all relevant information was compiled to create the most complete picture of projected water supplies in the county. This IPP yield is then subtracted from the 2050 net new water needs (i.e., demand increases above existing supplies) at the county level. Where the total water provider IPP yield in a county exceeded the projected county demand for the low, medium, or high scenarios, the extra water was assumed to not be available for redistribution to other counties unless otherwise noted.

Information on water providers' IPPs was obtained from the following sources:

- CWCB interviews and data collected from water providers throughout the state in 2009–2010
- Section 6 of the SWSI 1 report (published 2004, data based on projections to 2030)
- Basin roundtable updates (e.g., Arkansas 2008 report, June 2010 presentation by Applegate)

CWCB staff conducted outreach interviews in 2010 with most municipal water providers delivering 2,000 acre-feet per year (AFY) or more, including the top three water providers in each basin, where possible. Not every water provider responded; however, with significant basin roundtable assistance, many water providers submitted data in addition to the original list. This outreach was used to determine what projects and methods water providers are pursuing to meet their future needs along with confirmation of water demand data. In an effort to obtain more detailed data on providers' IPPs than was available for SWSI 1, interviewed entities were asked to delineate IPPs into the following categories:

- Agricultural water transfers
- Reuse of existing fully consumable supplies
- Growth into existing supplies
- Regional in-basin projects
- New transbasin projects
- Firming in-basin water rights
- Firming transbasin water rights

Passive and active conservation measures are not included in the categorized IPPs. Passive conservation is already factored into the 2050 M&I demand forecasts presented in Section 4.

The categorized IPP data presented in this section is based on information provided by the interviewed water providers on what their firm treated water deliveries will be for each category of IPP. While some IPPs include features that could be applied across more than one category, CWCB relied upon the water providers' data to assign the various projects and methods to the single most appropriate category. For example, although not explicitly quantified herein, it is likely that the true yield anticipated from agricultural water transfers is higher, but many water providers have captured agricultural transfers in IPPs falling in other categories such as regional in-basin projects or firming in-basin water rights. Some entities may also own agricultural water rights that are presently being leased back to agricultural water users; future M&I use of these supplies may be considered by some water providers to be growth into existing supplies. Based on these efforts IPP data were updated for 75 providers covering approximately

80 percent of the population in Colorado. Many of the quantified IPPs specified by the interviewed M&I water providers are identified in Appendix J of the SWSI 2010 Report.

The interview summary provided by CWCB identified and quantified many of the water providers' IPPs associated with each category. Where IPP information was derived from other sources, professional judgment was used to assign predicted yield to the most appropriate category. This approach was primarily applied to IPP data from the SWSI 1 report, which tallied IPPs by county or subbasin, but generally did not categorize yields from specified types of IPPs.

Because of the need for flexibility, reliability, and future uncertainty, many water providers design projects to meet needs based on planning numbers, which are often greater than current per capita water usage rates. Some specific reasons include—1) ensuring water supply if another system fails, 2) planning for drought or climate change, 3) an expected increase in commercial water use, or 4) concerns that one or more planned project will not be successfully implemented. Furthermore, many water rights limit the use of water to the specific water right holder, causing legal barriers to sharing water supplies. For these reasons, where the total potential volume of IPPs exceeded either the 2050 total water needs or the 2050 total water needs minus any provider-specified gaps, a pro-rata share reduction was applied to each IPP category relevant to that county or subbasin. For example, total quantified IPPs for the interviewed providers in a particular county exceed 50,000 AFY, but IPPs required to meet 2050 net new water needs range from 18,000 AFY to 30,000 AFY. A percentage of the total 50,000 AFY yield from IPPs is associated with each of the seven categories of IPPs, but since less IPP yield is actually needed to meet demands, the same category distribution percentages were applied to the lesser need. In other words, the amount of yield from each IPP category is reduced such that only the amount actually necessary to meet 2050 new water needs is applied.

Note, however, that this methodology and data presentation does not in any way preclude water providers from developing IPPs in excess of their 2050 needs. Rather, it is beyond the scope of this gap analysis to present data for individual water providers whose demand projections, planning horizon, and system reliability may differ from the regional analysis presented here. Any excess IPP volume quantified for a particular county is assumed to not be available to meet water supply gaps in other counties, unless specified otherwise. Likewise, there was no intention of implying intra-county sharing among water providers, unless specifically noted. By proportionally scaling back each entity's 2050 IPP yields when the sum of all entities' IPPs in a particular county exceed the forecasted 2050 net new water needs for that county—and explicitly accounting for provider-specified gaps—it is CWCB's intention to avoid implying that any one provider's excess yield would be used to meet the shortfall (i.e., gap) of another water provider.

5.2.2 Estimation of 2050 IPP Yield by Basin

A broad range of water management solutions with varying levels of supply are planned for each of the basins. The following sections summarize the yields of IPPs statewide and for each county or region in each basin at the 100 percent success rate. As described above, due to the number of counties and distinct areas in the Arkansas, Metro, and South Platte Basins, those basins are summarized by region, whereas each of the other basins is discussed at a county level. Because of the overall volume of demand and the size of the projected gaps in the South Platte and Arkansas Basins, those basins' IPPs lists are more populated than the other basins' lists.

Many water providers are pursuing multiple projects and will need to pursue all of these identified projects to meet their increased demand by the year 2050. This is due to the reality that each of the IPPs has associated risk and may not yield all of the anticipated water supply. Alternate IPP yield success rates (i.e., less than 100 percent) are addressed subsequently in Section 5.3.2. The results of calculations based on the

alternate IPP success rates are incorporated into the gap analysis presented in Section 5.3.3. Additionally, many of these IPPs will benefit multiple beneficiaries and therefore address a number of objectives concurrently. However, challenges exist in determining funding sources and acquiring water rights to support the multiple uses. In addition to quantified IPP yields, the tables for each basin also include a general summary of the major projects and other IPPs in each county or region.

5.2.2.1 Statewide

Statewide, the new water supplies needed for M&I and self-supplied industrial (SSI) use by the year 2050—above and beyond all existing supplies—are estimated to range from about 600,000 AFY to nearly 1 million AFY (see Section 4). This range reflects the uncertainty associated with forecasting water demands 40 years into the future, in particular SSI demands associated with energy development and other market-driven commodities. Based on extensive interviews with water providers, input from basin roundtable and Interbasin Compact Committee (IBCC) members, and a thorough review of other pertinent information, IPPs have been identified that will meet a significant portion of these future new demands.

Applying the general methodology for assessing IPPs described in Section 5.2.1, the IPPs were grouped into seven primary categories. **Table 5-1** identifies the anticipated range of yield from each category for each basin. For this and many of the subsequent tables, values are presented as a range, with the low and high yield values shown. Where the yield values do not change from low to high, a single value is shown rather than a range. Although the interviewed water providers generally provided demand and IPP data for a 2050 medium growth scenario, the ranges presented herein derive from the use of low, medium, and high population and demand levels for 2050 for the various analyses associated with SWSI 2010.

Table 5-1 Major Categories of Identified Projects and Processes by Basin (Yields at 100% Success Rate) [1]

Basin	Agricultural Transfer (AFY)	Reuse (AFY)	Growth into Existing Supplies (AFY)	Regional In-Basin Project (AFY)	New Transbasin Project (AFY)	Firming In-Basin Water Rights (AFY)	Firming Transbasin Rights (AFY)	Total IPPs at 100% Success Rate (AFY)
Arkansas	9,200 – 11,000	23,000 – 32,000	2,300 – 2,600	37,000	0	6,100 – 7,300	10,000 – 11,000	88,000 – 100,000
Colorado	2,900 – 8,000	500	14,000 – 28,000	13,000 – 15,000	0	11,000 – 19,000	0	42,000 – 70,000
Gunnison	400 – 500	0	1,100 – 1,700	11,000 – 15,000	0	900	0	14,000 – 18,000
Metro	20,000 – 33,000	14,000 – 21,000	55,000 – 86,000	34,000 – 39,000	13,000 – 23,000	900 – 1,400	3,500 – 4,800	140,000 – 210,000
North Platte	0	0	100 – 300	0	0	0	0	100 – 300
Rio Grande	**0**	**0**	**2,900 – 4,300**	**0**	**0**	**3,000 – 4,300**	**0**	**5,900 – 8,600**
South Platte	19,000 – 20,000	5,000 – 7,000	20,000 – 30,000	37,000 – 39,000	0	22,000 – 26,000	18,000 – 21,000	120,000 – 140,000
Southwest	0	0	5,200 – 7,300	9,000 – 13,000	0	0	0	14,000 – 21,000
Yampa-White	0	0	3,500 – 4,900	6,600 – 9,000	0	0	0	10,000 – 14,000
Total	**51,000 – 73,000**	**43,000 – 61,000**	**100,000 – 160,000**	**150,000 – 170,000**	**13,000 – 23,000**	**44,000 – 58,000**	**32,000 – 37,000**	**430,000 – 580,000**

[1] Aggregated basin total values rounded to two significant digits to reflect increased uncertainty at larger geographic scales.

As shown in Table 5-1, quantified IPPs at 100 percent yield success would provide approximately 430,000 AFY, or about 72 percent of the new demands under the low growth scenario. At the high end, again assuming 100 percent success rate, IPPs would total about 580,000 AFY and represent approximately 58 percent of the high demand increase. The largest categories of IPP yields by volume are projected to be regional in-basin projects (150,000 AFY to 170,000 AFY) and growth into existing supplies (100,000 AFY to 160,000 AFY). **Figure 5-1** depicts the data graphically; for the individual basins that follow, the corresponding figures can be found in Appendix J of the SWSI 2010 Report.

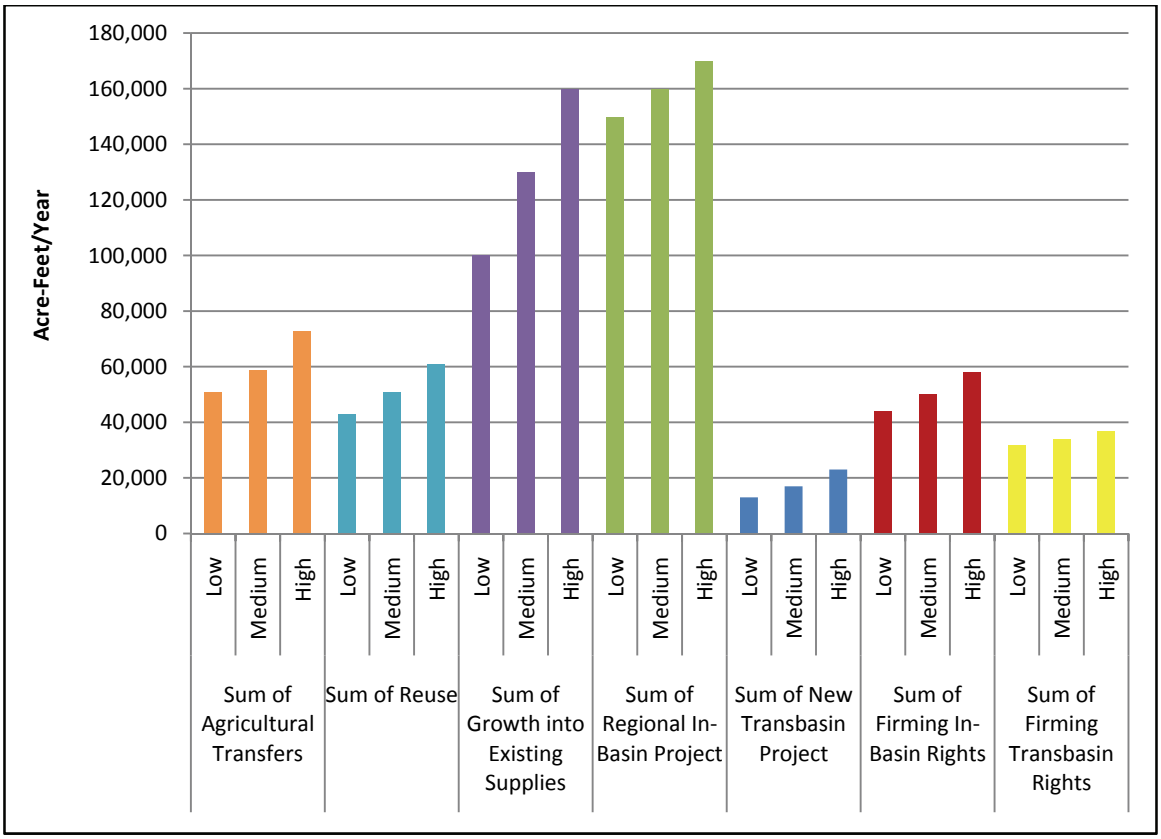

Figure 5-1 Statewide Summary of Yield for IPP Categories at 100% Success Rate

5.2.2.2 Rio Grande Basin

In the Rio Grande Basin, there is relatively minor growth projected for M&I needs by 2050. CWCB conducted interviews of the Cities of Alamosa and Monte Vista in Alamosa County. IPPs were not quantified in the interview summaries, but it was determined that adequate groundwater supplies are available to meet 2050 M&I needs. Specifically, it was estimated during SWSI 1 that sufficient groundwater is physically available for most anticipated M&I growth, but augmentation of groundwater pumping will be required. These additional M&I uses will have to be augmented either through the municipalities obtaining their own augmentation plans using existing surface water rights, or with the municipality contracting with one of the new groundwater subdistricts, or contracting with the San Luis Valley Water Conservancy District for augmentation water assuming it is available in the quantities required. Therefore, Alamosa County IPPs were set equal to 2050 net new M&I needs, with the understanding that there will not be any net increase in water availability because the Rio Grande Basin is over appropriated. New SSI demands are limited to proposed solar power generation facilities in Alamosa County and are anticipated to have demands in the range of 1,200 AFY to 2,000 AFY, and again, these uses will have to be augmented by existing water sources.

For all other Rio Grande counties, IPPs were based on SWSI 1 information. Conejos County and Mineral County were identified as having adequate water supplies to meet future needs beyond 2030; IPPs were therefore set equal to 2050 total water needs. No IPPs were identified for Costilla County. SWSI 1 quantified IPPs for Rio Grande County and Saguache County based on estimated yield from existing water rights, groundwater, and augmentation plans; the same values were applied as IPPs for the present gap analysis. As with Alamosa County, these additional M&I water uses from groundwater could be met by the municipalities obtaining their own augmentation plans or by contracting with one of the new groundwater subdistricts, or contracting with the San Luis Valley Water Conservancy District for augmentation water assuming it is available in the quantities required. The only source of the necessary augmentation water will be from the agricultural sector.

Anticipated yields from each category of IPPs at 100 percent success rate are summarized for the Rio Grande Basin in **Table 5-2**.

Table 5-2 Rio Grande Basin IPP Summary at 100% Success Rate

Region or County	Agricultural Transfer (AFY)	Reuse (AFY)	Growth into Existing Supplies (AFY)	Regional In-Basin Project (AFY)	New Transbasin Project (AFY)	Firming In-Basin Water Rights (AFY)	Firming Transbasin Rights (AFY)	Total IPPs at 100% Success Rate (AFY)
Alamosa County	0	0	1,400 – 2,300	0	0	1,500 – 2,300	0	2,900 – 4,600
Alamosa County IPPs • Existing water rights • Augmentation plans • Groundwater								
Conejos County	0	0	600 – 1,000	0	0	600 – 1,000	0	1,200 – 2,000
Conejos County IPPs • Existing water rights • Augmentation plans • Groundwater								
Costilla County	0	0	0	0	0	0	0	0
Costilla County IPPs • Existing water rights • Augmentation plans • Groundwater								
Mineral County	0	0	40 – 200	0	0	50 – 100	0	90 - 300
Mineral County IPPs • Existing water rights • Augmentation plans • Groundwater								
Rio Grande County	0	0	400	0	0	500	0	900
Rio Grande County IPPs • Existing water rights • Augmentation plans • Groundwater								
Saguache County	0	0	400	0	0	400	0	800
Saguache County IPPs • Existing water rights • Augmentation plans • Groundwater								
Total[1]	**0**	**0**	**2,900 – 4,300**	**0**	**0**	**3,000 – 4,300**	**0**	**5,900 – 8,600**

[1] Aggregated basin total values rounded to two significant digits to reflect increased uncertainty at larger geographic scales.

In addition to the IPPs discussed above, the Rio Grande Basin believes that there are structural IPPs that need to be completed to optimize future water supplies and their usage in the basin. The proposed IPPs relate to bringing the basin's privately owned reservoirs back to their designed capacity. The reduction in capacity is a result of a number of factors, including deterioration of the reservoirs structures and associated systems, and the fact they are privately held by entities without an adequate financial resources to address the outstanding issues.

The Rio Grande Reservoir is the only on-stream reservoir on the Rio Grande with a design capacity of 52,000 acre-feet (AF). There is significant seepage that occurs at high storage levels. In addition, the existing outlet works are not capable of releasing high inflows. The rehabilitation of the Rio Grande Reservoir would include addressing seepage issues, the inadequacy of the outlet works, and necessary upgrades of the spillway. Studies have been completed regarding what rehabilitation work is necessary and the associated costs. Ongoing studies are considering the opportunities to change historical water release patterns to improve the nonconsumptive benefits of river flows. Such consideration is possible because of the waters being stored by multiple owners, including the Colorado Division of Wildlife, a portion of the state's Rio Grande Compact flows, the San Luis Valley Water Conservancy District, and potential water owned by the groundwater subdistricts.

For the Santa Maria and Continental Reservoirs the capacity is limited partially due to the system that conveys water to the reservoirs and the system between the reservoirs to move water. These issues result in the reservoirs not being able to take advantage of their decreed storage rights when in priority. Studies are ongoing to determine what measures are necessary, and their associated costs to bring the reservoir system back to its design capacity of 72,000 AF.

On the Alamosa River, studies have identified mitigation measures necessary for the Terrace Reservoir to store its deigned capacity. These measures include upgrading of the spillway to pass the required storm event.

5.3 M&I Gap Analysis

The IPPs being pursued by local water providers represent significant quantities of water and the implementation of these local projects and plans is critical to meeting Colorado's future water supply needs. However, even with the implementation of the IPPs, there are still remaining M&I and SSI consumptive water supply gaps that will need to be satisfied. As stated previously, the calculated gaps do not necessarily represent a future water supply shortage, but the gaps do demonstrate where additional work is needed to identify projects and methods to meet those future needs. The following sections summarize the calculations and results of the 2050 M&I and SSI gap analysis. As described previously, this analysis includes 2050 low, medium, and high gap values to account for the inherent uncertainty in long-range population, demand, and water supply forecasting. Future M&I and SSI demands were assessed in Section 4 of this report.

Section 5.3.1 presents the M&I and SSI gap calculation methodology generally, followed by details on the variations that occur within the calculations for each basin. The calculations as described in Section 5.3.1 are based on the assumption of 100 percent success rate for the development of IPP yield. Section 5.3.2 describes alternate (i.e., less than 100 percent) IPP yield success rates for each basin as they are applied to estimate the 2050 medium and high gaps. Section 5.3.3 summarizes the results of the gap analysis at the statewide level and for the Rio Grande Basin.

The results of the gap analysis presented in this report are based on the estimated firm yield of IPPs. Furthermore, the demand values that are integral to the gap calculations are based on water providers' treated water deliveries and do not account for losses during raw water collection, treatment, and

distribution, which are highly variable depending on, among other things, water source, types of treatment processes, and age and condition of distribution system. Additionally, there are many future uncertainties such as the potential for climate change, drought, infrastructure failure, and other factors. Therefore, raw water needs are very likely to be greater than the gap values presented in this report.

Note that current and future agricultural consumptive demands and shortages were assessed in Section 4 of this report. Calculated irrigation shortages are based on available water supply being less than the ideal amount required for meeting the consumptive use requirements of a particular crop. Changes in these calculated results for 2050 relative to 2008 are generally driven by the anticipated loss of irrigated land to development and other factors. The discussions that follow apply only to the M&I and SSI consumptive gap analysis.

5.3.1 M&I Gap Analysis Methodology

For the purpose of this study, the M&I and SSI water supply gap is defined as follows:

M&I and SSI Water Supply Gap = 2050 Net New Water Needs – 2050 IPPs

where:

2050 Net New Water Needs = (2050 low/medium/high M&I baseline demands – high passive conservation - current M&I use) + (2050 low/medium/high SSI demands – current SSI use)

2050 IPPs = Water Provider Anticipated Yield from: Agricultural Transfers + Reuse + Growth into Exiting Supplies + Regional In-basin Projects + New Transbasin Projects + Firming In-basin Water Rights + Firming Transbasin Water Rights

If the available IPPs exceeded the 2050 water needs for a particular county, the IPPs were reset equal to the 2050 water needs. As stated previously herein, this calculation effectively scales back the yield of each IPP in a pro-rata fashion in order to present only the amount of yield necessary to meet water supply needs at the 2050 planning horizon. Sometimes this occurs for all three growth scenarios, sometimes for only low or low and medium. It is generally assumed that one county's surplus IPPs would not be reallocated to another county and that one provider's surplus would not be specifically allocated to meet another provider's gap. This approach was applied in all basins, unless specified otherwise.

The 2050 M&I and SSI gap is referred to in the results tables (see Section 5.3.3) as the "information/real" gap. The "real" gap is based on known numerical data from the *Demands to 2050 Report*, water provider interviews and data, SWSI 1, and other sources. Based on this information, 2050 M&I and SSI demand forecasts exceed the anticipated yields of water providers' IPPs and the result is a real, defined gap. An "information" gap arises due to a lack of numerical data to support more detailed gap quantification for some water providers or even counties and subbasins.

The preceding description represents the general approach to the M&I gap analyses, with the yields of IPPs based on the 100 percent success rate. However, the process was modified as necessary for each county and basin based on the available source data. The following sections outline variations to the methodology in each basin. These are general descriptions and do not necessarily capture every variation for every county; however, additional details about the calculations for each county or region are provided in Appendix J of the SWSI 2010 Report.

5.3.1.1 Rio Grande Basin

Following are the assumptions used to catalog the Rio Grande Basin's IPPs (at 100 percent success rate) and revise the gap calculations:

- The 2050 net new water needs were calculated based on the *Demands to 2050 Report* as described for the general approach.
- IPPs were quantified for the Rio Grande Basin as described in Section 5.2.2.2.
- The information/real gap for each Rio Grande Basin county was calculated as follows:
  - Alamosa County: IPPs cover the 2050 M&I water needs; the information/real gap was set equal to the 2050 new SSI water needs.
  - Conejos County and Mineral County: IPPs were set equal to 2050 total water needs and the information/real gaps were zero.
  - Costilla County: No IPPs were identified; the information/real gap was set equal to 2050 total water needs.
  - Rio Grande County and Saguache County: Quantified IPPs from SWSI Phase 1were applied, and the information/real gap for these two counties was calculated as 2050 net new water needs minus IPPs.

5.3.2 Gap Analysis with Alternate IPP Yield Scenarios

The assumptions and calculations described in Section 5.3.1 above evaluate the gap based on a 100 percent success rate for IPP yield development. While it is necessary to assess the full range of the 2050 M&I and SSI Gap, CWCB developed three potential scenarios to bracket the range of the M&I and SSI gap for low to high scenarios. For consistency in comparing M&I gaps across the state, these scenarios were used for the Rio Grande Basin. However, for the Rio Grande Basin there will have to be 100 percent success of the defined IPPs as all of the new M&I demand will be met through agricultural sources, and this either happens or the alternative is that there is no growth in M&I uses, which is unacceptable. Each scenario has a variable IPP yield success rate applied as a percentage of total IPP yield. For the low gap scenario, it was assumed that 100 percent of the IPPs (see Section 5.2.1) could be applied to the 2050 net new water needs.

For the medium and high gap estimates, the yield of the IPPs was assumed to be varied based on discussions from the IBCC, CWCB, and basin roundtables. For the medium gap scenario, it was assumed that the IPP yield would be reduced based on percent success rates discussed by IBCC in their scenario discussions for the alternative portfolio (see Section 7). IPP yield for the high gap scenario is assumed to be reduced based on the percent success rates as defined in the status quo portfolio that has been discussed by the IBCC. The percentage success rates for IPP yields for the medium and high scenarios are presented in **Table 5-3**.

Table 5-3 IPP Success Rates for the Medium and High Gap Scenarios

Basin	IBCC Alternative Portfolio IPP Yield Success Rates	IBCC Status Quo Portfolio IPP Yield Success Rates
Arkansas	90%	75%
Colorado	90%	90%
Gunnison	90%	90%
Metro	60%	50%
North Platte	90%	90%
Rio Grande	**90%**	**90%**
South Platte	60%	40%
Southwest	75%	75%
Yampa-White	90%	90%

The gap calculations based on alternate IPP yield success rates are best demonstrated by example. The Colorado Basin has an existing (2008) demand of 68,000 AFY and a 2050 low growth demand of about 132,000 AFY, representing an increase of nearly 65,000 AFY. IPPs associated with the Colorado Basin low growth scenario are 42,000 AFY (at 100 percent implementation), leaving a 2050 supply gap of 22,000 AFY under the low gap scenario. The Colorado Basin has a 2050 medium growth demand of 150,000 AFY, representing an increase of 82,000 AFY over the existing demand. Medium growth IPPs total 54,000 AFY at 100 percent yield, but based on Table 5-11, only 90 percent (49,000 AFY) of the yield is assumed to be successfully developed under the medium gap scenario. The result is a gap of about 33,000 AFY in 2050. High growth scenario demands are approximately 180,000 AFY, which is an increase of about 110,000 AFY over the existing scenario. High growth IPPs total 70,000 AFY at 100 percent yield, but under the high gap scenario, again only 90 percent (63,000 AFY) success is achieved. Thus, the Colorado Basin high gap is about 48,000 AFY.

A similar process is utilized for the other basins. For the medium and high statewide analyses, the success rates in Table 5-3 are applied to each basin prior to calculating the overall gaps on an aggregate basis.

5.3.3 2050 M&I and SSI Gap Analysis Results

The water supply gaps resulting from the assumptions and calculations defined in Section 5.3.1 and Section 5.3.2 are summarized in the following sections, first statewide, then for each basin by subbasin (region) or county. The full set of gap results implies nine total gap scenarios based on low, medium, and high M&I demands and three IPP yield scenarios (100 percent success rate, an alternative success rate, and a status quo success rate). For the purpose of discussion, however, the results are reduced to three scenarios in the tables presented in the following sections. These three scenarios encapsulate the full range of anticipated M&I and SSI water supply gaps in 2050, from the lowest low gap scenario (lowest demands with 100 percent IPP success rate) to the highest high gap scenario (high demands with status quo IPP success rates).

5.3.3.1 Statewide

Colorado faces a significant M&I water supply gap in 2050. Under the low gap scenario (low demands and 100 percent IPP success rate), the statewide gap is 190,000 AFY. Under the medium gap scenario (medium demands and an alternative IPP success rate), the statewide gap is about 390,000 AFY. Under the high gap scenario (high demands and status quo IPP success rate), the statewide gap is about 630,000 AFY. By 2050, Colorado's M&I gap could be between 32 percent and 66 percent of new M&I demands.

Table 5-4 provides a summary of each basin's increased M&I and SSI demands relative to current conditions (defined for this study as 2008), the amount of that increase met by the IPPs, and the results of the gap calculations. In general, the low IPPs plus the low remaining M&I and SSI gap equal the low increase in M&I and SSI demand, with some minor variability due to rounding at the county or regional level. The same is true for the medium and high values. The Arkansas and Metro Basins are exceptions to this rule due to the inclusion of additional gap volumes associated with the replacement of existing nonrenewable groundwater sources.

Table 5-4 Statewide M&I and SSI Gaps in 2050[1]

Basin	Increase in M&I and SSI Demand (AFY)			Estimated Yield of Identified Projects and Processes (AFY)			Estimated Remaining M&I and SSI Gap after Identified Projects and Processes (AFY)		
				100% IPP Success Rate	Alternative IPP Success Rates	Status Quo IPP Success Rates	Gap at 100% IPP Success Rate	Gap at Alternative IPP Success Rates	Gap at Status Quo IPP Success Rates
	Low	Med	High	Low	Med	High	Low	Med	High
Arkansas[2]	110,000	140,000	170,000	88,000	85,000	76,000	36,000	64,000	110,000
Colorado	65,000	82,000	110,000	42,000	49,000	63,000	22,000	33,000	48,000
Gunnison	16,000	19,000	23,000	14,000	14,000	16,000	2,800	5,100	6,500
Metro[3]	180,000	210,000	280,000	140,000	97,000	100,000	63,000	130,000	190,000
North Platte	100	200	300	100	200	300	0	20	30
Rio Grande	**7,700**	**9,900**	**13,000**	**5,900**	**6,400**	**7,700**	**1,800**	**3,600**	**5,100**
South Platte	160,000	180,000	230,000	120,000	78,000	58,000	36,000	110,000	170,000
Southwest	20,000	25,000	31,000	14,000	13,000	15,000	5,100	12,000	16,000
Yampa-White	34,000	48,000	95,000	10,000	11,000	13,000	23,000	37,000	83,000
Total	**590,000**	**710,000**	**950,000**	**430,000**	**350,000**	**350,000**	**190,000**	**390,000**	**630,000**

[1] Aggregated basin total values rounded to two significant digits to reflect increased uncertainty at larger geographic scales.
[2] Arkansas gaps include additional 13,500 AFY for Urban Counties replacement of nonrenewable groundwater supplies.
[3] Metro gaps include additional 20,850 AFY for South Metro replacement of nonrenewable groundwater supplies.

Colorado faces immediate M&I water supply needs. **Figure 5-2** illustrates the timing of the statewide M&I and SSI gap for the medium gap scenario. The statewide existing supply is 1,161,000 AFY and is assumed to remain constant through 2050, except for the replacement of nontributary groundwater in Douglas and El Paso counties. Under the medium gap scenario Colorado's immediate M&I water supply needs are met with the successful implementation of the IPPs. The associated yield of the IPPs increases steadily from 2010 through 2020, then at a higher rate of growth through 2030. Under the medium gap scenario, the IPPs are fully implemented by 2030 and yield about 350,000 AFY. Without the successful implementation of additional IPPs, increases in demand after 2030 are assumed to be gap, leading to a 2050 M&I gap of approximately 390,000 AFY for the medium gap scenario.

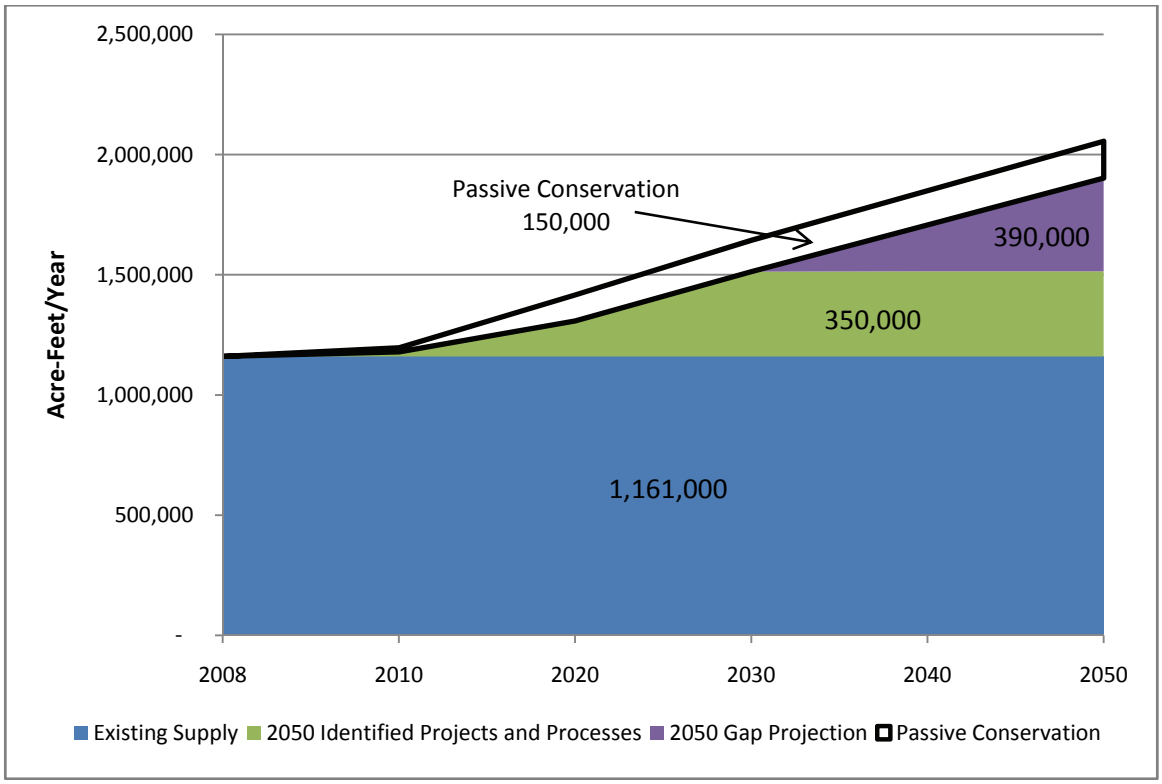

Figure 5-2 Statewide M&I and SSI Gap Summary Medium Scenario (IPPs at 70% Success Rate)

Note that while this plot does illustrate the temporal evolution of existing supplies, IPPs, and the gap, it is not intended to serve as a definitive timeline for the development of these parameters. A level of uncertainty remains for most components of this analysis; demand increases may come sooner or later than projected and IPPs may have more or less success than anticipated in these calculations. Thus, the figure functions as a representation of the interrelated nature of IPPs and the gap. At any given point in time, the sum of existing supplies, IPPs, and gap are equal to demands. The figure illustrates that the need for successful implementation of the IPPs is immediate. As long as the development of IPPs keeps pace with demands, the gap will be minimal. However, if demands continue to increase beyond the development of presently identified IPPs or if successful IPP yield development occurs at a lower rate, the gap will continue to grow in magnitude and will appear at an earlier point in time. It is also important to note the spatial variability of the M&I gap. Some areas of the state will have an M&I gap sooner than others. Plots illustrating the low and high gap scenario statewide and the low, medium, and high gap scenarios for all basins are included in Appendix J of the SWSI 2010 Report.

Figure 5-3 illustrates the relative percentages of 2050 net new water needs occupied by IPPs and the gap for each basin for the medium gap scenario. The pie chart shown on the map for each basin is scaled to represent the magnitude of the 2050 medium demand. IPP success rates are defined as shown for the "Alternative Portfolio" in Table 5-3; at the statewide level, the overall IPP success rate is approximately 70 percent for the medium gap scenario.

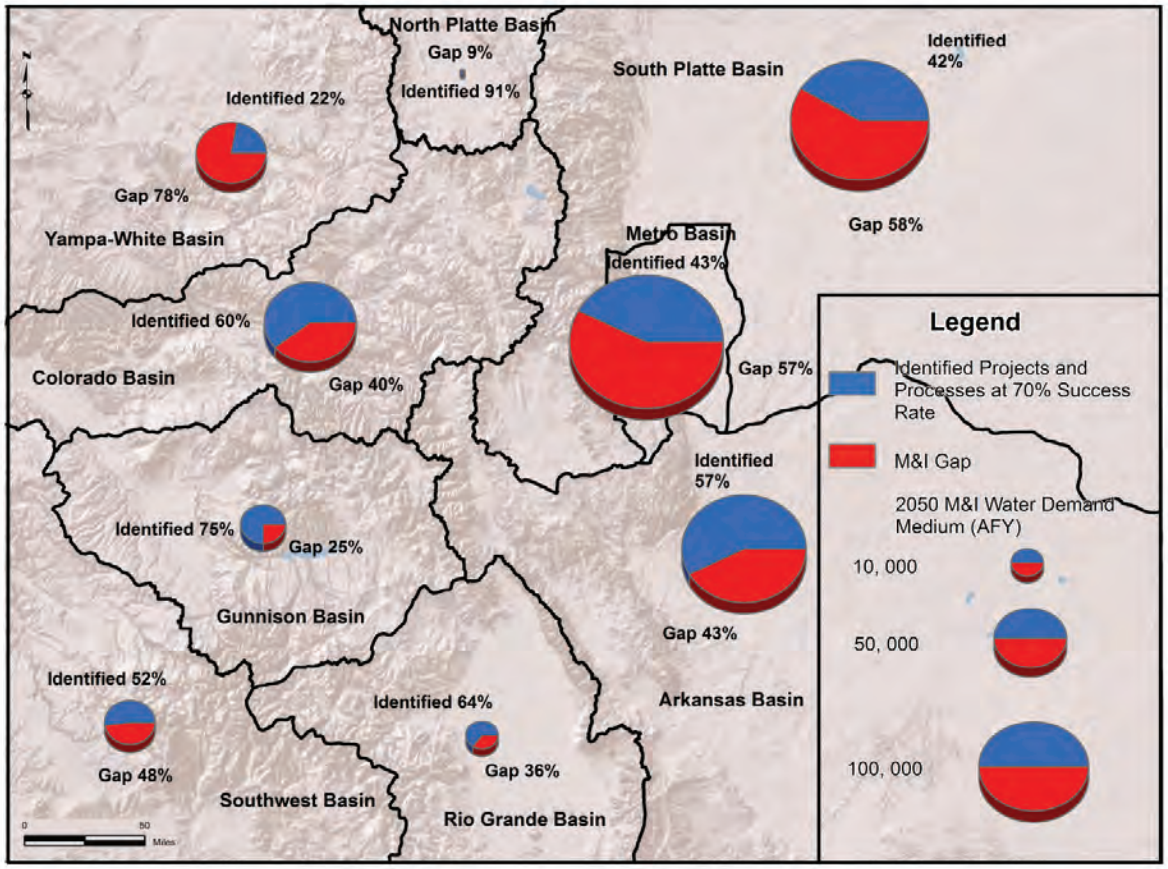

Figure 5-3 2050 M&I and SSI Gap Analysis – Medium Gap Scenario

For the Arkansas, Colorado, Gunnison, North Platte, and Rio Grande Basins, IPPs (illustrated as the blue part of the pie charts) meet 50 percent or more of the 2050 medium demand as a result of 90 percent IPP yield success rate in these basins. Southwest Basin IPPs also exceed 50 percent of 2050 medium demand despite a success rate of only 75 percent. The Yampa-White Basin has a 90 percent IPP yield success rate for the medium gap scenario, but the high yet uncertain demands associated with future SSI uses result in a very large water supply gap (78 percent, illustrated in red) in 2050. Future M&I and SSI water supply gaps for the South Platte and Metro Basins exceed 50 percent due to significantly reduced IPP yield success rates, at 60 percent. For these basins in particular, and also in the Arkansas Basin, a significant reduction in the success of yield development from planned projects and processes identified by Front Range water providers will likely lead to much greater increases in agricultural transfers as a means to meet future demands (see Section 4).

It must be clearly understood that the low, medium, and high gap scenarios evaluated in this study are based on assumptions about the implementation of IPPs made for the purposes of conducting the analyses. In reality, both demand growth and the development of IPPs will be impacted by various factors that will likely cause them to fall somewhere between the low and high values highlighted above. However, it remains highly probable that there will be some level of gap regardless of the level of IPPs development, and a portfolio of solutions will be needed to meet Colorado's future M&I water needs.

Of particular importance will be the implementation of new projects and sources of water in the event that not all IPPs currently undergoing National Environmental Policy Act (NEPA) review receive permits for project construction from the jurisdictional federal agency (U.S. Bureau of Reclamation or U.S. Army Corps

of Engineers for most ongoing Environmental Impact Statements projects). The list of these projects includes high-yield regional projects such as Northern Integrated Supply Company, Windy Gap Firming Project, Southern Delivery System, the Moffat Collection System Project, Chatfield Reallocation, and others.

The significance of the yield that would be provided by IPPs currently or soon to be engaged in the NEPA process—particularly in the South Platte, Metro, and Arkansas Basins—is illustrated in **Figures 5-4** and **5-5**. For the medium growth scenario and assuming 100 percent IPP success rate, South Platte Basin and Metro IPPs in NEPA represent 115,000 AFY of potential yield, or about 40 percent of the total IPP yield for the combined basins. Likewise, NEPA IPPs in the Arkansas Basin total nearly 49,000 AFY, or roughly 51 percent of overall IPP yield for the medium growth scenario. Note that in Figures 5-4 and 5-5 the new demand values also include the replacement of nonrenewable groundwater.

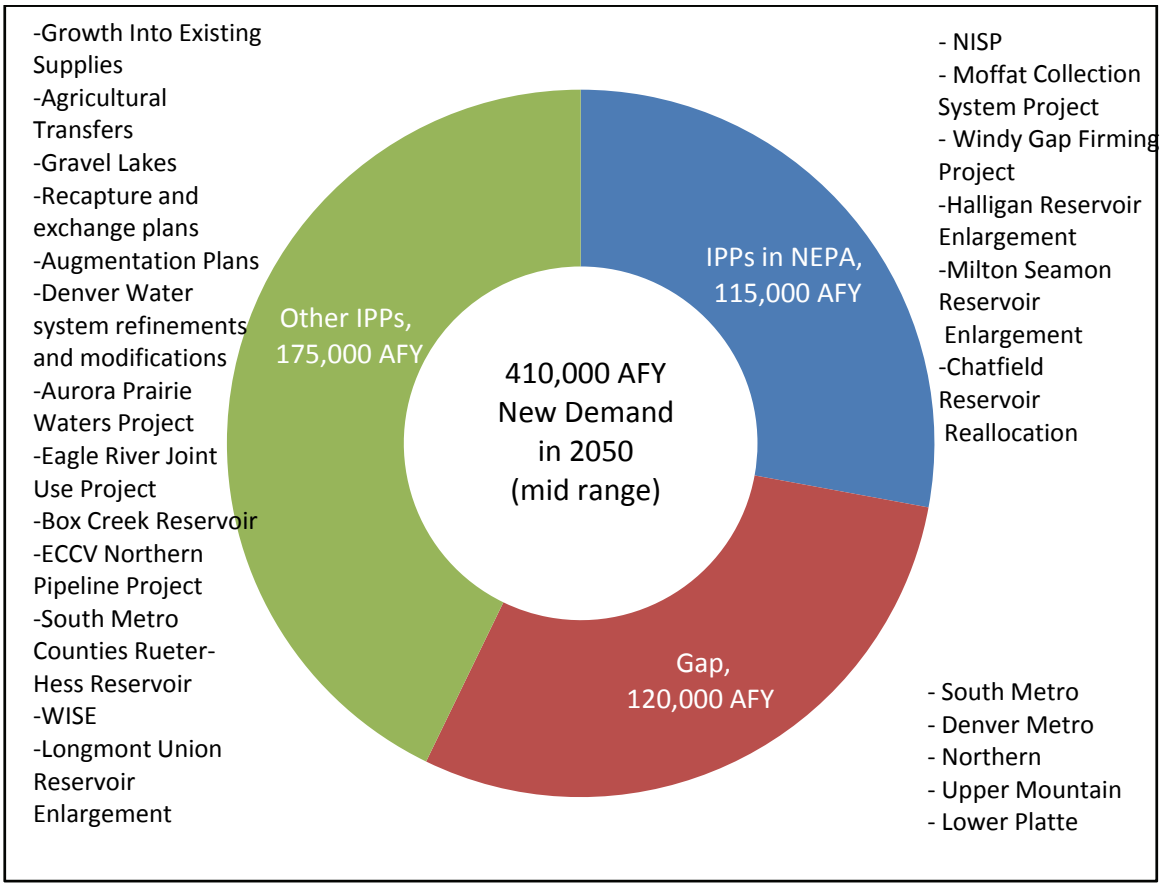

Figure 5-4 Potential Yield of NEPA Projects Relative to 2050 New Demands, Other IPPs, and Gap in South Platte and Metro Basins

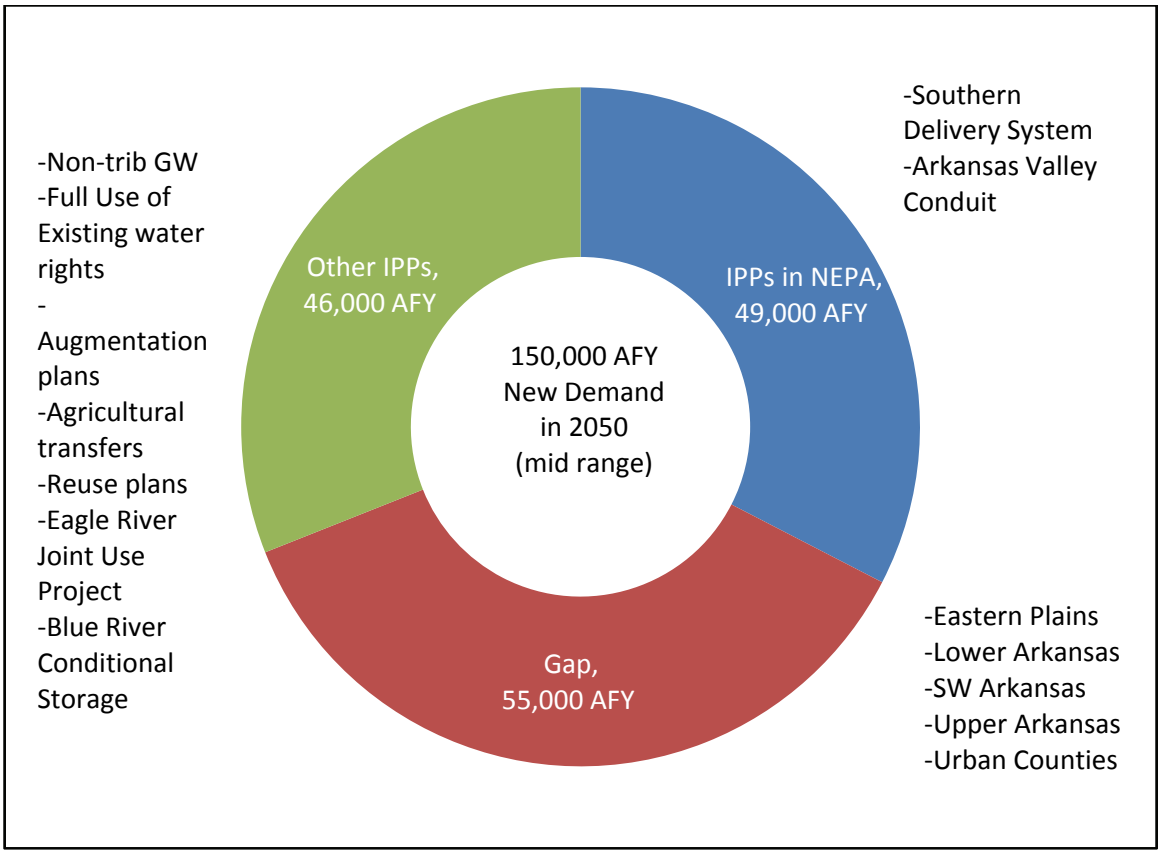

Figure 5-5 Potential Yield of NEPA Projects Relative to 2050 New Demands, Other IPPs, and Gap in Arkansas Basin

The following section provides additional results of the gap analysis for each basin roundtable area.

5.3.3.2 Rio Grande Basin

Table 5-5 summarizes increased M&I and SSI demands for the year 2050, the amount of that increase provided by the IPPs, and the calculated gaps for each county in the Rio Grande Basin. The basin's existing M&I and SSI supply is estimated to be approximately 18,000 AFY, which is assumed to remain constant through the 2050 planning horizon of this study.

Under the low gap scenario (100 percent IPP success), the gap reaches 1,800 AFY in 2050. Similar development trends are observed for the medium gap scenario (90 percent IPP success), resulting in a gap of about 3,600 AFY by 2050. Under the high gap scenario in the Rio Grande Basin (90 percent IPP success), the gap is approximately 5,100 AFY in 2050. The information is shown graphically in **Figures 5-6** through **5-8.**

Table 5-5 Rio Grande Basin M&I and SSI Gaps in 2050

Region or County	Increase in M&I and SSI Demand (AFY)			Estimated Yield of Identified Projects and Processes (AFY)			Estimated Remaining M&I and SSI Gap after Identified Projects and Processes (AFY)		
				100% IPP Success Rate	Alternative IPP Success Rate (90%)	Gap at Status Quo IPP Success Rate (90%)	Gap at 100% IPP Success Rate	Gap at Alternative IPP Success Rate (90%)	Gap at Status Quo IPP Success Rate (90%)
	Low	Med	High	Low	Med	High	Low	Med	High
Alamosa County	4,100	5,100	6,600	2,900	3,300	4,100	1,200	1,900	2,500
Conejos County	1,200	1,600	2,000	1,200	1,400	1,800	0	200	200
Costilla County	100	200	200	0	0	0	100	200	200
Mineral County	90	200	300	90	200	300	0	20	30
Rio Grande County	1,200	1,700	2,400	900	800	800	300	900	1,600
Saguache County	1,000	1,100	1,300	800	700	700	200	400	600
Total[1]	**7,700**	**9,900**	**13,000**	**5,900**	**6,400**	**7,700**	**1,800**	**3,600**	**5,100**

[1] Aggregated basin total values rounded to two significant digits to reflect increased uncertainty at larger geographic scales.

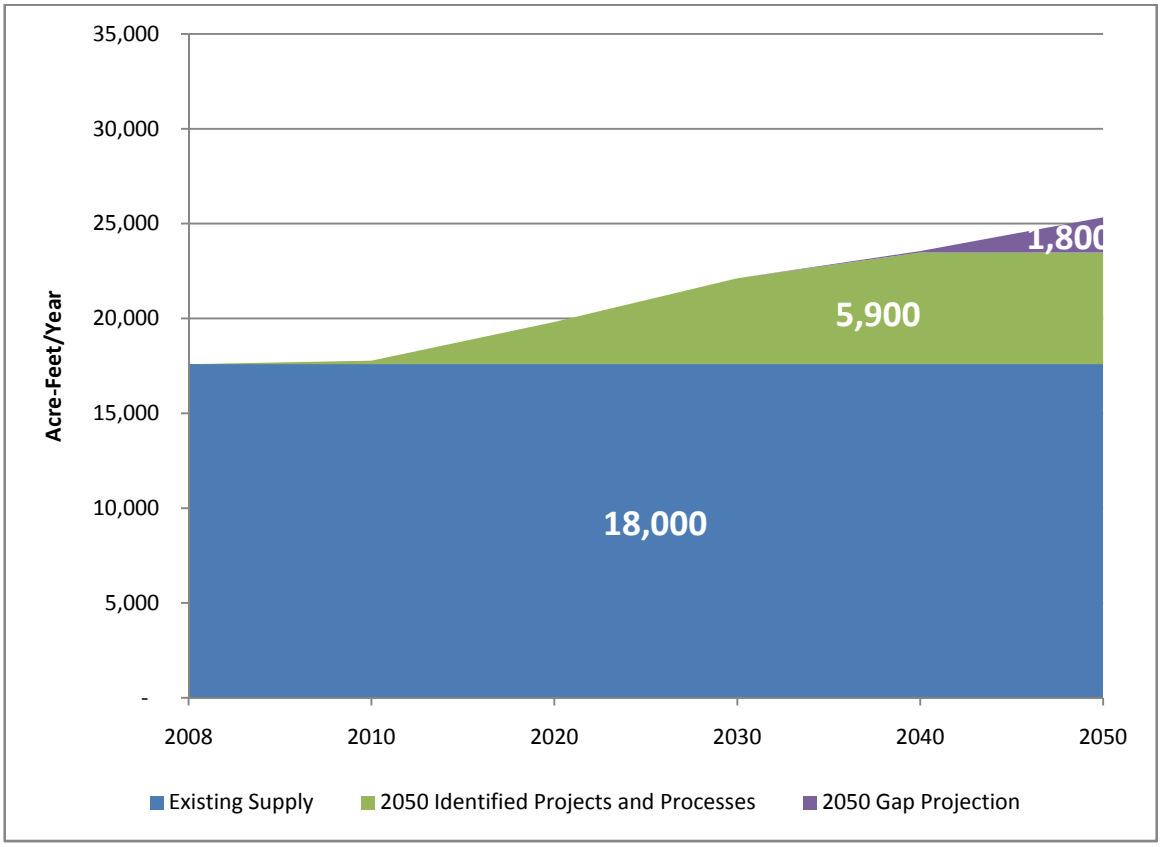

Figure 5-6 Rio Grande Basin M&I and SSI Gap Summary Low Scenario (IPPs at 100% Success Rate)

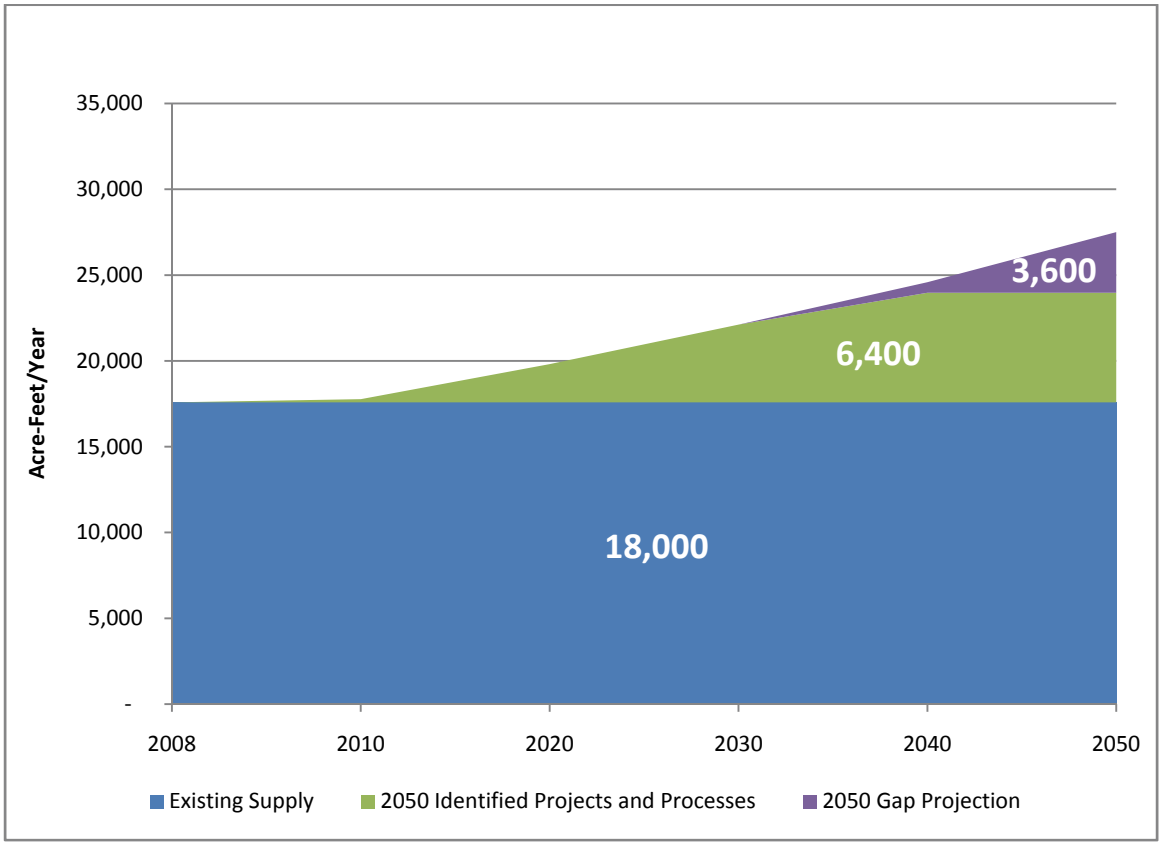

Figure 5-7 Rio Grande Basin M&I and SSI Gap Summary Medium Scenario (IPPs at 90% Success Rate)

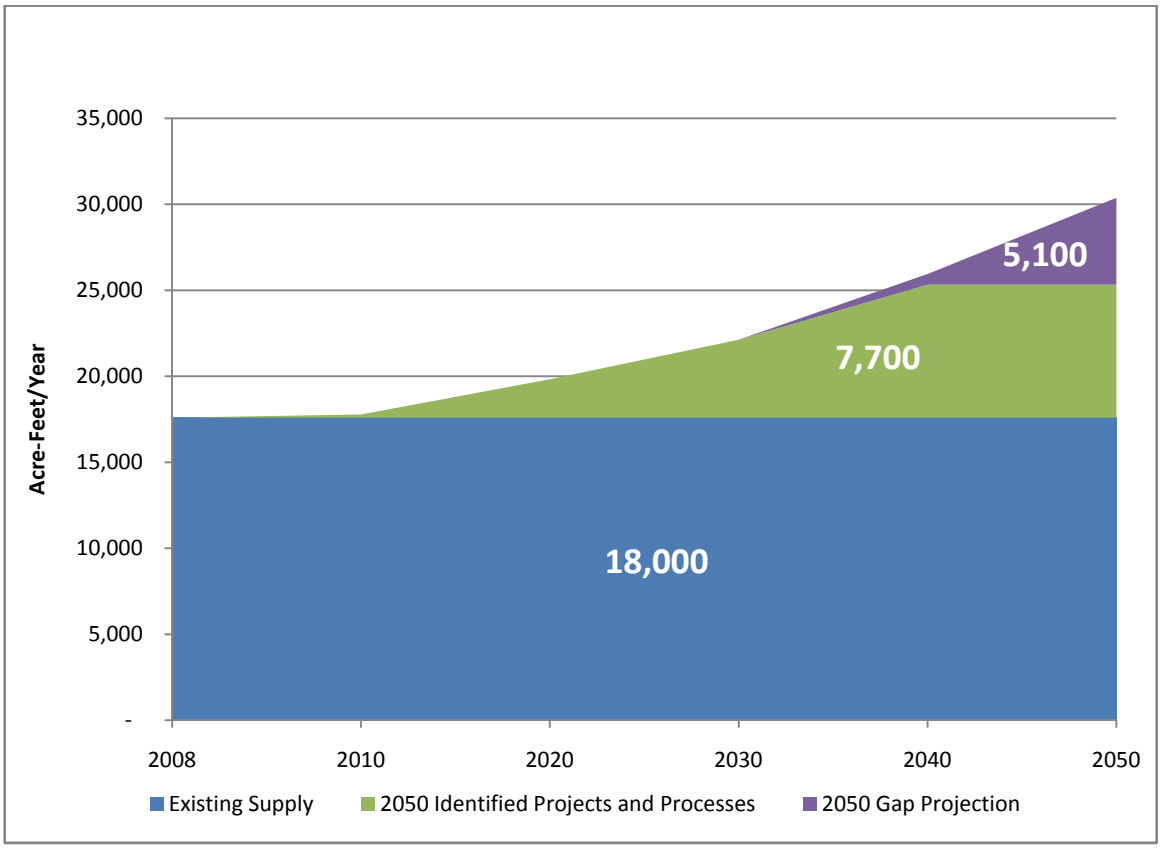

Figure 5-8. Rio Grande Basin M&I and SSI Gap Summary High Scenario (IPPs at 90% Success Rate)

Section 6
Rio Grande Basin Water Availability

6.1 Water Availability Overview

Justice Gregory J. Hobbs of the Colorado Supreme Court has stated "The 21st Century is the era of limits made applicable to water decisionmaking. Due to natural western water scarcity, we are no longer developing a resource. Instead, we are learning how to share a developed resource." These words of wisdom should serve as guidance for all parties interested in Colorado water. The amount of water available for use within the state is finite.

The Statewide Water Supply Initiative (SWSI) 2010 analyzes Colorado's water availability based on recent work by the Colorado Water Conservation Board (CWCB) and the basin roundtables. SWSI 2010 finds that unappropriated water in the South Platte, Arkansas, and Rio Grande Basins is extremely limited, and reliance on nonrenewable, nontributary groundwater as a permanent water supply creates reliability and sustainability concerns, particularly along the Front Range. It also finds that Colorado River compact entitlements are not fully utilized and that water in the Colorado River system may be available to meet future needs. However, in order to develop new water supplies in the Colorado River system, projects and methods will be needed to manage the risks of additional development.

6.2 Methodology to Evaluate Surface Water Supply Availability

This section provides a summary of statewide surface water and groundwater availability. This update summarizes work to date completed by the CWCB and the basin roundtables through the development of their basinwide water needs assessments. A comprehensive analysis of water availability for each basin was completed in SWSI 1 and is only partially updated. Future SWSI updates will provide updated water availability analysis in each basin based on additional Colorado Decision Support System (CDSS) modeling tools.

In addition to the analysis of water availability in SWSI 1, the SWSI 2010 update specifically includes an updated analysis for the basins within the Colorado River system as part of the CWCB's Colorado River Water Availability Study (CRWAS), which is summarized here. Updated information is also included for the South Platte Basin based on results of analysis directly associated with the South Platte Basin Roundtable Task Order.

In another effort related to water availability, statewide drought planning has occurred through the preparation and implementation of the Colorado Drought Mitigation and Response Plan (DMRP). In 2010, the CWCB conducted a comprehensive revision of the DMRP. The updated plan provides a blueprint for how the state will monitor, mitigate, and respond to drought.

The potential effects of climate change are quantified in the CRWAS, and provided at various locations throughout the Colorado River Basins. Reliable climate change analyses are not yet available for the other basins and are not included in this update.

6.3 Water Availability

The purpose of this section is to summarize the available data and studies indicating the level of water availability in each basin and the location of opportunities for further new water supply development.

Table 6-1 below summarizes the findings from SWSI 1 related to water supply development potential under interstate compacts and U.S. Supreme Court decrees. Colorado has entered into and is affected by nine interstate compacts, two equitable apportionment decrees, and one international treaty.

Table 6-1 Major Interstate Compacts, Decrees, and Endangered Species Programs by Basin

River Basin	Flows Legally Available under Compact or Decrees for Future Development	Interstate Compacts, Equitable Apportionment Decrees and Endangered Species Recovery Programs	Year of Compact or Decree
Arkansas		Arkansas River Compact	1948
		Kansas vs. Colorado	1995
Colorado	✓	Colorado River Compact	1922
		Upper Colorado River Basin Compact	1948
		Upper Colorado River Endangered Fish Recovery Program	—
		Rio Grande, Colorado, and Tijuana Treaty between United States and Mexico	1945
Dolores/San Juan/ San Miguel (Southwest)	✓	Colorado River Compact	1922
		La Plata River Compact	1922
		Upper Colorado River Basin Compact	1948
		Animas-La Plata Project Compact	1969
		San Juan River Basin Recovery Implementation Program	—
		Rio Grande, Colorado, and Tijuana Treaty between United States and Mexico	1945
Gunnison	✓	Colorado River Compact	1922
		Aspinall Unit Operations	—
		Upper Colorado River Basin Compact	1948
		Upper Colorado River Endangered Fish Recovery Program	—
		Rio Grande, Colorado, and Tijuana Treaty between United States and Mexico	1945
North Platte/ Laramie	✓	Nebraska vs. Wyoming	1945
		Wyoming vs. Colorado	1957
		Platte River Recovery Implementation Program	—

Table 6-1 Major Interstate Compacts, Decrees, and Endangered Species Programs by Basin, continued

River Basin	Flows Legally Available under Compact or Decrees for Future Development	Interstate Compacts, Equitable Apportionment Decrees and Endangered Species Recovery Programs	Year of Compact or Decree
Rio Grande		Rio Grande River Compact	1938
		Costilla Creek Compact (amended)	1963
		Rio Grande, Colorado, and Tijuana Treaty between United States and Mexico	1945
South Platte	✓	South Platte River Compact	1923
		Republican River Compact	1942
		Platte River Recovery Implementation Program	—
Yampa/White/Green	✓	Colorado River Compact	1922
		Upper Colorado River Basin Compact and Yampa River Portion	1948
		Upper Colorado River Endangered Fish Recovery Program	—
		Rio Grande, Colorado, and Tijuana Treaty between United States and Mexico	1945

These agreements establish how water is apportioned between Colorado and downstream states as well as between the United States and Mexico. Each agreement has a significant effect on the development of future water supplies in Colorado. Additional information about the compacts is provided in Section 1.4.

SWSI 1 found there are no reliable additional water supplies that can be developed in the Arkansas and Rio Grande Basins, except in very wet years. The North Platte Basin has the ability to increase both irrigated acres and some additional consumptive uses, consistent with the North Platte Decrees. The South Platte Basin has water that is legally and physically available for development in wet years, although unappropriated water is extremely limited.

Rio Grande River

Compact entitlements in the Colorado River Basins are not fully utilized and those basins (Colorado, Gunnison, Southwest, and Yampa-White) have water supplies that are legally and physically available for development given current patterns of water use.

SWSI 1 found that as a result of compact limitations, there is very infrequent available flow in the Rio Grande for use in Colorado and that these flows, as in the Arkansas, do not provide a reliable source for new supply development. Analyses of available flows found the following:

1. Colorado attempts to meet compact obligations each year, with little or no surplus or deficit. This is accomplished through regularly "curtailing" Colorado water users in order to meet stateline delivery requirements.

2. Slight over- or under-delivery from year to year is carried forward in the Colorado "account" and affects administration in subsequent years.

3. When Elephant Butte Reservoir in New Mexico spills, Colorado's credit and surplus on compact deliveries are canceled. Elephant Butte Reservoir spilled six times between 1950 and 1997.

4. During periods when Colorado has not reached its compact credit limit, and there is not a spill at Elephant Butte Reservoir, there is no available flow.

As was noted in Section 4, an estimated decline in irrigated acres of 80,000 acres is anticipated to protect the water table and senior water rights in the San Luis Valley. To bring about the reduction, groundwater management subdistricts were established. Special Improvement District No. 1 (the "subdistrict") was created for the closed basin in Water District 20. An amended plan of water management was created for the subdistrict; this amended plan was adopted and approved by the Division 3 Water Court subject to the terms and conditions outlined in the decree dated May 27, 2010. However, this ruling has been appealed to the Colorado Supreme Court. The Trinchera Water Conservancy District was established as a subdistrict for its area in Water District 35 but no water management plan has been developed. The State Engineer's Office is expected to issue rules for the Rio Grande Basin to facilitate well owners in the other water districts moving forward with getting subdistricts established and management plans approved.

Section 7
Future Actions of the Rio Grande Basin Roundtable

7.1 Overview

The Rio Grande Basin Roundtable has determined that the most significant issues facing the basin in the future are:

- Recognizing the basin is currently over-appropriated and there will not be any "new supplies" of water.
- The basin must be in a position to exploit any additional future surface water availability at a time when the predictions for changes in the timing and level of precipitation events are indicating these maybe significantly different when compared to the historical patterns.
- The basin has unsustainable groundwater management practices because of continuing drought conditions and changes in irrigation practices that must be addressed for the long term economic health of the basin.
- A need to continue to increase the efficiency of irrigation practices without increasing the consumptive use of available water supplies.
- Ensuring the nonconsumptive needs of the basin are met.
- The continued requirement that Colorado meets its Rio Grande Compact obligations with minimal impacts to other valley water uses.

The Rio Grande Basin Roundtable has been addressing these issues during the past 5 years through the application of Water Supply Reserve Account (WSRA) funding of relevant water projects.

The following are the items that the Rio Grande Basin Roundtable feels are significant if its future water needs are to be met through 2050.

7.1.1 Rehabilitation of Reservoirs in the Basin

The reservoirs in the Rio Grande River Basin are privately owned with the exception of Beaver Creek Reservoir, which is owned by the Colorado Division of Wildlife (CDOW). The reservoirs are old, having been constructed in the early 1900s, and because of the limited resources of the owners, each of them are facing safety and/or degradation of their infrastructure. These situations have resulted in them not being able to store their designed capacity or operational limitations.

For the basin to take advantage of any high surface water availability years it is necessary that the reservoirs be rehabilitated back to their design capacity. In addition, opportunities may exist for the reservoirs to serve multiple uses, such as storage of Rio Grande Compact water, augmentation water for Groundwater Management Districts, municipalities and water conservancy districts, and the CDOW. Such actions will require changes to be made to the historical management or retiming of storage rights of the reservoirs and require future collaboration between reservoir owners, other water users and state agencies.

7.1.2 Groundwater Management Plans

The current unsustainable groundwater uses have resulted in draw-down of the aquifers primarily because of continuing drought conditions and changes in irrigation practices that have been introduced into the basin since the 1960s, through the introduction of center pivot sprinkler systems. This issue is being addressed by the agricultural community in collaboration with the Colorado Division of Water Resources (CDWR).

Groundwater management subdistricts are being formed in the basin that will require aquifer levels to be maintained between specific limits and the use of surface water resources to be used to offset river and stream depletions and to augment wells. It is anticipated the Groundwater Management Plans will require the retiring of agricultural land to make adequate surface water resources available to meet the depletions and augmentation requirements. The groundwater management plans will ensure a balance between recharge and withdrawals.

One consequence of the application of groundwater management subdistricts, and future restricted availability of surface irrigation water will be the farming community considering growing different crops and the application of new irrigation methods and technology. This will have to be accomplished without increased overall consumptive use.

While the groundwater management subdistricts have met with controversy and opposition by a limited number of the agricultural community, the Rio Grande Basin Roundtable has stated its support of the concept and process. In the future the basin roundtable will continue to support these efforts, which may include the recharge of both the unconfined and confined aquifers. If it is determined the groundwater management subdistricts will not achieve the desired outcomes, the basin roundtable will continue to be available to seek a solution to the issue of declining aquifer levels.

7.1.3 Administration of the Rio Grande Compact

The basin is dependent on forecasting of Rio Grande stream flow through the use of depth snow and water content measurements in the watersheds. The data is collected at a limited number of sites in the watersheds. The forecasting of river flows is used by the CDWR to predict the Rio Grande Compact obligation prior to and in the early part of the irrigation year. Difference between predicted and actual river flows can have a significant impact on irrigators with water rights of lower priorities on the river. The curtailments being applied to meet the compact obligations can change significantly, causing the lower priority water rights to drop out of priority. It is felt that additional snow measuring sites be increased and the predictive tools that are being used continue to be refined. The uncertainty associated with the possible effects of climate change and changes in the watersheds make the predictive data even more important in management of the Rio Grande Compact and its impact to water right holders.

7.1.4 Increased Efficiency of Water Delivery and Irrigation Systems

Detailed information is available on the condition and operating aspects of irrigation water delivery systems on the Rio Grande, and limited information is available on systems on the Conejos and other rivers and streams.

The Rio Grande Basin Roundtable will continue its efforts to work with irrigation and ditch companies to address the specific issues identified with their delivery systems. Integral to such projects will be a determination of methods to increase agricultural water efficiency and management of the Rio Grande Compact.

In addition, project definition will include the analysis of river conditions both upstream and downstream of the specific diversion structure to determine the appropriateness to address the nonconsumptive aspects of any proposed changes. Consideration will be given to possible introduction of fish and boat passages, and appropriate river restoration.

7.1.5 Watershed Health and Management

It is anticipated that the condition and management of the watersheds in the Rio Grande Basin will become increasingly critical because of the possible effects of climate change and resulting precipitation patterns, and the recent manifestation of beetle kill of forested lands. It is not known as to the effect these natural phenomena will have on the amount and timing of snow melt and water run-off. To date the basin roundtable does not have an understanding of these issues or their solution. It is anticipated that the basin roundtable will increase its monitoring of the issues and will be available to support efforts of both federal and private landowners to mitigate the adverse conditions.

7.1.6 Nonconsumptive Needs in the Basin

The Rio Grande Basin Roundtable has become acutely aware of the role and importance of the benefits associated with nonconsumptive needs. The basin roundtable has been able to address nonconsumptive issues in the basin through water projects funded by the WSRA.

The basin roundtable will continue to ensure that all future water projects in the basin have a nonconsumptive use element. In addition, the basin roundtable will support specific nonconsumptive use projects such as the Habitat Conservation Plan for the endangered Southwest Willow Fly Catcher, the conservation efforts by basin nongovernmental organizations (NGOs) that include the tying of surface water resources to specific land and historical water uses. These efforts will ensure that wet meadows and associated wetlands will continue to be preserved and enhanced.

As stated above, the basin roundtable will support and promote any proposed activity on the rivers and streams to consider the opportunity to enhance both fisheries and recreation opportunities.

7.1.7 Drought Planning and Mitigation Strategies

Because of the long-term water issues confronting the Rio Grande Basin, the prospect of extended drought conditions could severely negatively impact the areas' economies, recreational opportunities, and the nonconsumptive use attributes. The concept of contingency planning for drought conditions is a relatively new concept for the basin; however, the basin roundtable believes it is necessary that these concepts be explored and if appropriate, mitigation strategies be developed for future implementation.

7.1.8 Municipal and Industrial Usage and Water Conservation

In the Statewide Water Supply Initiative Report, the Rio Grande Basin was reported as having the highest municipal or domestic water consumption per person in the state. There are a number of factors that could have resulted in this determination, but the Rio Grande Basin Roundtable feels it would be appropriate for this topic to be revisited to gain a greater understanding of municipal water use in the basin. The basin roundtable recognizes that in the basin the application of typical water conservation strategies for municipalities would have a minimal effect on the overall water uses and consumption compared to the water consumed in the agricultural sector. However, the basin roundtable feels that it is important that the population of the basin recognize the availability of domestic water supplies and the associated costs, especially when the agricultural community is dealing with the issues of aquifer drawdown and depletions. Already some communities have formal water conservation plans, and the basin roundtable is supportive of all communities developing plans.

The Rio Grande Basin (the San Luis Valley) has become a desirable place for the location of solar electrical generating facilities. The water operating and maintenance demands of such facilities range from minimum amounts of water for facilities using photovoltaic technology to concentrated solar powered facilities of 10 acre-feet (AF) of consumptive use per year per megawatt. A facility of 300 megawatts would require 3,000 AF of consumptive use per year. It has been determined that is would be very difficult to locate 3,000 AF of consumptive use of surface irrigation water, taking it through Water Court as a Change in Beneficial Use Court Case, and subsequently make it available at a specific site. Consequently, the Rio Grande Basin Roundtable will be a supporter of renewal energy development facilities requiring low demands of consumptive water use.

7.2 Water Supply Reserve Account Grant Summaries

Terrace Reservoir Hydrologic Model, Survey, and Mapping Project

APPLICANT: Alamosa Riverkeepers

APPROVED: March 2007

STATUS: Complete

WSRA FUNDS: $64,500 (Basin Account)

MATCHING FUNDS: None

DESCRIPTION:

The Terrace Reservoir Hydrologic Model, Survey, and Mapping project is a critical component of the Alamosa River Instream Flow (ISF) Project. The complete Alamosa River ISF Project includes: 1) acquiring senior irrigation water rights on the Alamosa River; 2) improving the Terrace Reservoir spillway to remove the state-imposed storage restriction (2,000 AF); 3) transferring the irrigation water rights to the Colorado Water Conservation Board (CWCB) for storage in Terrace Reservoir and ISFs in the Alamosa River; and 4) operating Terrace Reservoir to store and release CWCB flows in accordance with an ISF program. The project resulted from the Summitville Mine disaster and conclusions reported in CWCB's Alamosa River Watershed Restoration Master Plan and Environmental Assessment Final Report. The hydrologic model, site survey, and mapping are the first step of the project. The Alamosa Riverkeepers is partnering on the project with the Terrace Irrigation Company, which owns and operates Terrace Reservoir.

Preliminary Design Rio Grande Reservoir Multi-Use Rehabilitation and Enlargement

APPLICANT: San Luis Valley Irrigation District

APPROVED: March 2007

STATUS: Complete

WSRA FUNDS: $288,000 (Statewide Account)

MATCHING FUNDS: None

DESCRIPTION:
The San Luis Valley Irrigation District owns and operates Rio Grande Reservoir, the only on-stream, mainstem reservoir on the Rio Grande in Colorado. The reservoir's current storage capacity is approximately 54,000 AF, primarily for irrigation use within the district. The district recently completed an initial report on a potential reservoir enlargement, which concluded that the dam height could most likely be raised by about 10 feet, yielding an additional 10,000 AF of storage. The additional storage could help better meet Colorado's Rio Grande Compact obligations, reregulate flows for instream and riparian needs, store augmentation water for domestic and commercial development, increase the conservation pool for fish habitat and flood control, and redesign the outlet works for safer water delivery. The proposed study and design work will examine the project's engineering, environmental, water use, and legal issues.

Rio Grande Basin Conservation Reserve Enhancement Program

APPLICANT: Colorado Rio Grande Restoration Foundation

APPROVED: May 2007

STATUS: Complete

WSRA FUNDS: $36,750 (Basin Account)

MATCHING FUNDS: None

DESCRIPTION:
The unsustainable use of water in the San Luis Valley affecting the aquifer, local economy, wetlands, and hydrological conditions calls for immediate and targeted actions to reverse the trend. This project involves the development of a proposal to the U.S. Department of Agriculture's (USDA's) Conservation Reserve Enhancement Program (CREP) to benefit Subdistrict No. 1 of the Rio Grande Water Conservation District. The project ultimately seeks a CREP Agreement requesting enrollment of approximately 40,000 acres of irrigated cropland in the San Luis Valley of the Rio Grande Watershed in Colorado. The CREP program will provide a strong financial incentive to remove lands from irrigation in order to address water shortages in the confined and unconfined aquifers of the valley. Upon completion and USDA approval of the CREP proposal and the CREP agreement, and upon full implementation, this project will place 40,000 acres of previously cropped land into native vegetation and reduce water consumption within Subdistrict No. 1 by approximately 60,000 AF per year. A fully implemented CREP in Subdistrict No. 1 will make a substantial contribution to its goals of significantly reducing consumptive use within the Closed Basin. The program seeks to leverage approximately 60 million federal dollars to provide cost-share, incentives, and annual rental payments to producers that enroll in the CREP program.

Romero Guadalupe Channel Rectification Project

APPLICANT: Romero Irrigation Company

APPROVED: September 2007

STATUS: Complete

WSRA FUNDS: $83,700 (Basin Account)

MATCHING FUNDS: $88,600

DESCRIPTION:
This project by the Romero Irrigation Company and Guadalupe Main Ditch Company, two of the oldest ditch companies on the Conejos River, addresses consumptive and nonconsumptive needs of the ditch companies and the Conejos River, while reducing potential flooding in the Town of Guadalupe, and enhancing fish habitat and riparian areas. Based on design work by the Natural Resources Conservation Service (NRCS), the project involves stabilizing the Conejos River by reshaping and improving the condition of the channel, placing of J-Hook vane structures, creating rock weirs, and stream bank restoration. The channel restoration will better accommodate flood flows, maintain a stable width to depth ratio, allow for the conveyance of suspended solids, ensure the stability of structures during flood events, improve water quality, and help the state meet its Compact obligation.

Rio Grande Initiative

APPLICANT: Rio Grande Headwaters Land Trust

APPROVED: March 2008

STATUS: Complete

WSRA FUNDS: $1,500,000 ($200,000 - Basin Account; $1,300,000 - Statewide Account)

MATCHING FUNDS: $8,857,385

DESCRIPTION:
The Rio Grande Initiative is a collaborative, community-based effort to protect as much of the key private lands and their senior surface water rights as possible, along the Rio Grande corridor, through voluntary, incentive-based means. Conserving the historic water use patterns along the river through this project is a key element of the Rio Grande Basin Roundtable's commitment to creating water sustainability for their basin, protecting the economic base of agriculture, and sustaining wildlife including proactively addressing critical issues of endangered species in the corridor. These historic use patterns are at risk due to increasing development pressure and potential conversion of senior surface rights for other uses. The purchase of permanent conservation easements on land and associated water rights will help sustain the economic and environmental benefits of traditional water uses in locations and patterns that are critical to the basin and the state's administration of the Rio Grande and its Compact. Funds will be used toward the purchase of conservation easements on three to four high priority properties on the Rio Grande. This activity simultaneously meets both consumptive needs of traditional water users and nonconsumptive water needs of the environment, wildlife, and recreation.

Santa Maria and Continental Reservoirs: Rehabilitation and Multiple Use Studies

APPLICANT: Santa Maria Reservoir Company

APPROVED: September 2008

STATUS: In Progress

WSRA FUNDS: $191,700 ($50,000 - Basin Account; $141,700 - Statewide Account)

MATCHING FUNDS: $18,300

DESCRIPTION:
The Continental Reservoir is a critical piece of the Santa Maria Reservoir Company system, but has been operating with a 15,000 AF storage restriction due to safety issues. The reservoir was constructed in 1910 and is operated in conjunction with the Santa Maria Reservoir (SMR). A deteriorated conveyance system between the two reservoirs also limits the amount of available water. The reservoirs store irrigation water, Rio Grande Compact water, San Luis Valley Water Conservancy District water, Colorado Department of Wildlife water, and transmountain water, along with providing flood control benefits. Although Santa Maria has a designed capacity of 43,000 AF, maximum storage in recent years has been 15,000 AF. The project will conduct engineering, hydrological, and hydraulic studies of all structures in the system to identify the best approach for removing dam storage restrictions and increasing efficiencies. This will allow the reservoir to hold and control additional Rio Grande Compact water; improve SMR's ability to hold and more effectively manage irrigation water; increase the system's value in flood control and its ability to respond in times of drought; increase SMR's options and ability to serve third parties; and greatly improve and enlarge fisheries, riparian areas, and wildlife habitat.

2008 Rio Grande Riparian Stabilization Project

APPLICANT: Colorado Rio Grande Restoration Foundation

APPROVED: September 2008

STATUS: In Progress

WSRA FUNDS: $285,000 ($35,000 - Basin Account; $250,000 - Statewide Account)

MATCHING FUNDS: $356,000

DESCRIPTION:
A 2001 study, completed with CWCB funding, assessed 91 miles of the Rio Grande from the Town of South Fork to the Alamosa/Conejos county line. This study analyzed the condition of specific reaches of the Rio Grande, and determined that a major cause of the deterioration in water quality and fishery conditions was due to increased sediment loading in the river. Continuing the implementation of the recommendations contained in the 2001 study, this project will stabilize and restore 12 miles of riparian areas in Alamosa County, involving a minimum of five land owners. The project seeks to improve water quality, wildlife habitat, and the fishery by reducing stream bank instability and sediment loading. Though many reaches of the Rio Grande need restoration, this project focuses on some of the most degraded reaches of the river.

Platoro Reservoir Restoration

APPLICANT: Conejos Water Conservancy District

APPROVED: September 2008

STATUS: In Progress

WSRA FUNDS: $250,000 ($50,000 - Basin Account; $200,000 - Statewide Account)

MATCHING FUNDS: $250,000

DESCRIPTION:
This project involves the engineering and construction of replacement butterfly valves on the Platoro Reservoir dam. It is part of a larger project that included other funding sources to repair, replace, and upgrade components of the reservoir. The project will help keep the Platoro Reservoir facility in working order so that Colorado can continue to meet its obligations under the Rio Grande Compact and provide for: flood control, irrigation, river fishery, endangered species protection, dam safety, and recreation for the 100,000-acre district service area. The project will restore the reservoir to its full operating functionality to sustainably meet the agricultural demands of the district and therefore optimize existing and future water supplies. The project will ultimately help preserve agriculture in the region and ensure both the quantity and the quality of water in the Conejos by the safe and proper regulation of flows from the reservoir.

Conejos River and North Branch Diversion and Stabilization

APPLICANT: Manassa Land and Irrigation Company

APPROVED: September 2008

STATUS: Complete

WSRA FUNDS: $383,700 ($50,000 - Basin Account; $333,700 - Statewide Account)

MATCHING FUNDS: $98,000

DESCRIPTION:
This project involves reconstructing an important diversion structure and headgate system on the Conejos River. It will optimize water supply and improve the Conejos' ability to fulfill its Compact obligation to downstream states (40 percent of the total Compact obligation). The deteriorated structure is almost 100 years old and requires frequent maintenance due to floating debris, log jams, high sediment load, bank erosion, and streambank instability. These maintenance issues produce operational difficulties, poor water quality due to bank instability, degradation of fisheries, losses of Rio Grande Compact waters during high flows, and flooding. Twelve ditch companies rely upon the diversion to irrigate a total of 22,204 acres, with excess flows returning to the main channel where they contribute to fulfilling Colorado's Rio Grande Compact obligation. The project also involves re-shaping the channel, stabilizing the streambank, and enhancing riparian areas in the vicinity of the structures.

Rio Grande Reservoir Multi-Use Rehabilitation: Refinement and Enhancement of Reservoir Reoperation and Optimization Model

APPLICANT: San Luis Valley Irrigation District

APPROVED: November 2008

STATUS: In Progress

WSRA FUNDS: $100,000 (Basin Account)

MATCHING FUNDS: None

DESCRIPTION:
The project refines and enhances the Reservoir Reoperation and Optimization Model that was developed as part of the Phase 2 study of the rehabilitation and utilization of Rio Grande Reservoir for multi-use purposes. The model provides the ability to analyze potential storage and releases from a rehabilitated Rio Grande Reservoir for various multi-use purposes. It is designed to allow the user to allocate a portion of reservoir storage to a particular use, for example Rio Grande Compact storage, and then to analyze a variety of release patterns from that storage account to determine the effect of those various release patterns on streamflows. Input on the subject model improvements has been received from the Division 3 Engineer, the Rio Grande Water Users Association, Trout Unlimited, The Nature Conservancy, the Rio Grande Wetlands Initiative, and the basin roundtable. The project will assist various entities in refining the model to provide desired information on storage potential and dynamics and/or the environmental effects of the storage and release patterns on streamflows.

San Antonio River - El Codo Ditch Diversion and Rehabilitation

APPLICANT: El Codo Ditch Company

APPROVED: May 2009

STATUS: Complete

WSRA FUNDS: $65,000 (Basin Account)

MATCHING FUNDS: $23,445

DESCRIPTION:
For the past 20 years agricultural productivity along the lands of the El Codo Ditch Company has been declining due to the effects of the deterioration, improper placement, and poor design of the existing rock structure at the diversion. The deteriorated diversion structure and dam has made diversion of the El Codo Ditch Company water rights difficult to regulate in time and amount. It has also resulted in severe erosion of the main channel and caused repeated flooding in nearby farms and communities. Phase I will address the severe erosion immediately upriver of the diversion where waters of the San Antonio threaten to overtop the river bank. Phase II will replace the problematic rock diversion structure in the main channel of the San Antonio with an NRCS-engineered concrete structure.

Lower Willow Creek Restoration Project

APPLICANT: Mineral County Fairgrounds Association

APPROVED: September 2009

STATUS: Complete

WSRA FUNDS: $250,000 ($50,000 - Basin Account; $200,000 - Statewide Account)

MATCHING FUNDS: $1,310,000

DESCRIPTION:
Historic mining practices over the last century have heavily impacted the lower Willow Creek watershed, near Creede, Colorado in terms of impaired water and habitat quality. The project will use WSRA funds towards restoring and stabilizing 3,700 linear feet of Lower Willow Creek. This includes finalizing the restoration design and reconstructing 3,700 linear feet of Lower Willow Creek. Approximately 52 acres of floodplain area will be restored. WSRA funding will serve as important match money to leverage the recently approved $398,770 Section 319 grant. These funds will combine with other sources in a $1.56 million project to restore the function of Lower Willow Creek as a natural flowing stream. The $1.56 million budget for the Lower Willow Creek Restoration project involves reconstructing the entire Lower Willow Creek up to the downstream limit of the Mineral County Fairgrounds property.

Sangre de Cristo Trinchera Diversion Canal Restoration

APPLICANT: Trinchera Irrigation Company

APPROVED: September 2009 ($200,000) and January 2010 ($54,000)

STATUS: In Progress

WSRA FUNDS: $254,000 ($104,000 - Basin Account; $150,000 - Statewide Account)

MATCHING FUNDS: $46,500

DESCRIPTION:
The Sangre de Cristo Trinchera Diversion Canal is a 24,000-foot concrete-lined segment of the Trinchera Irrigation Company system. This project seeks to replace 2,125 linear feet of that concrete lining. The canal lining was installed in 1976 and is badly deteriorated, causing the canal to operate at 50 percent of capacity, drastically reducing delivery of decreed water rights. Normally, 98 percent of Trinchera Creek's flows before irrigation season are stored in Mountain Home Reservoir. However, due to the reduced capacity of the canal, the irrigation company must prematurely release water from the reservoir, causing shortfalls in late summer and early fall when the need is greatest. This forces irrigators to use groundwater for supplemental irrigation. The proposed project seeks to restore the capacity of the canal to its original capacity of over 100 cubic feet per second.

Rio Grande Conservation Reserve Enhancement Program Phase II - Implementation

APPLICANT: Colorado Rio Grande Restoration Foundation

APPROVED: September 2009

STATUS: In Progress

WSRA FUNDS: $31,500 (Basin Account)

MATCHING FUNDS: None

DESCRIPTION:
Groundwater levels within the Closed Basin area of the San Luis Valley are declining causing reduced surface flows, increased agricultural pumping costs, and threatening the basin's objective of maintaining a sustainable water supply. Phase I of this project was funded with a previous WSRA grant of $36,750 (basin funds) to develop a proposal and a subsequent agreement requesting enrollment of approximately 40,000 acres of irrigated cropland in Subdistrict No. 1 of the Rio Grande Basin, to create the Rio Grande CREP. The CREP is a federal-state-local partnership administered by the USDA - Farm Service Agency through the authority of the 2002 Farm Bill (Conservation Title). This Phase II proposal completes the final negotiations and contracts of Phase I, finalizes the required "Programmatic Environmental Assessment," and sets in motion the Rio Grande CREP process by eliciting voluntary participation of water users in the program to fallow land and decrease groundwater use. An approved CREP in Subdistrict No. 1 will leverage approximately $94,000,000 federal dollars to provide cost-share, incentives, and annual rental payments to producers in the program.

2009 Rio Grande Stabilization Project – Phase 4

APPLICANT: Colorado Rio Grande Restoration Foundation

APPROVED: May 2010 ($50,000) and September 2010 (98,000)

STATUS: Contracting

WSRA FUNDS: $148,000 ($50,000 - Basin Account; $98,000 - Statewide Account)

MATCHING FUNDS: $352,000

DESCRIPTION:
The proposed project (Phase 4) is a riparian stabilization project on the Rio Grande in Alamosa County. The purpose of the project is to address the causes of deterioration of river function as identified in a study funded by the CWCB in 2001 (2001 Study). The 2001 Study analyzed the condition of 91 miles of the Rio Grande and determined the deterioration in water quality and fishery conditions was due to increased sediment loading. This was caused by unstable stream banks, which resulted from deteriorated conditions of the riparian zone and changing river flow patterns. From the 2001 Study, recommendations were developed to improve the river's functions. Restoration work focuses on a multi-faceted approach using proven techniques such as bioengineering, rock and wooden structures, revegetation, bank-full benches, and grazing best management practices.

Educating Today to Balance Tomorrow's Water Supply Needs

APPLICANT: Rio Grande Watershed Conservation and Education Initiative

APPROVED: May 2010

STATUS: Contracting

WSRA FUNDS: $25,000 (Basin Account)

MATCHING FUNDS: $163,900

DESCRIPTION:
This project helps residents, youth, landowners, and water stakeholders of the Rio Grande Basin to better understand the current demands and future needs of the water in the Rio Grande Basin over a 2-year period. This is part of a broader scope of general water education throughout the valley. It will encourage informed and rational discussions and decisionmaking regarding local water usage. Among other things this project will provide in-service water education training for 60 teachers, conduct the fifth annual summer "Water Festival" that attracts 300 students, hold summer camps open to valley youth ages 6-13 years old, and initiate a series of landowner workshops with learning experiences for small landowners centered on conservation planning.

San Luis Peoples Ditch Upgrade and Rehabilitation Project – Phase I

APPLICANT: San Luis Peoples Ditch Company

APPROVED: May 2010

STATUS: Contracting

WSRA FUNDS: $40,000 (Basin Account)

MATCHING FUNDS: $102,000

DESCRIPTION:
This project is Phase I of a broader upgrade and rehabilitation project. The Peoples Ditch, or "acequia," is a gravity-fed irrigation system in the oldest community in Colorado. The People's Ditch holds the first adjudicated water rights granted by a court decree in Colorado, dating to April 10, 1852. The majority of shareholders are descendants of the original founders of the acequia and some have owned family shares for nine generations. Phase I addresses the most immediate area of concern through the replacement of the Rito Seco crossing diversion structure behind a residential area. This diversion structure was built in 1945. The concrete walls have deteriorated, are cracked and crumbling. The culvert has rust holes and is leaking water, the water gates jam and is difficult to open and close. During a cloud burst in the summer of 2009, this crossover structure that diverts excess water into the Culebra River failed, causing severe flooding of residential areas in San Luis and the inability of the Peoples Ditch to divert decreed water rights.

Conejos North Branch Water Conservation and Management

APPLICANT: Manassa Land and Irrigation Company

APPROVED: January 2011

STATUS: In Progress

WSRA FUNDS: $75,000 (Rio Grande Basin Account)

MATCHING FUNDS: $119,000

DESCRIPTION:
Due to decades of channel and diversion instability the headgates of the Manassa Land and Irrigation Company (MLI) irrigation system are in disrepair. Deterioration of the two principal 100-year-old headgates requires weekly and sometimes daily maintenance. In addition, MLI has no measuring flumes, so it distributes water on a time-per-share basis rather than using a quantified distribution system. This project involves the replacement of two major headgates in the MLI system along with the installation of Parshall flumes on the five laterals in the system. This will enable MLI to quantify flows within its system.

The McDonald Ditch and Plaza Project, Phase I Planning

APPLICANT: The Colorado Rio Grande Restoration Foundation and McDonald Ditch Company

APPROVED: January 2011

STATUS: In Progress

WSRA FUNDS: $40,000 (Rio Grande Basin Account)

MATCHING FUNDS: $50,000

DESCRIPTION:
The Plaza Project – Phase I is a 5-month collaborative analysis of potential restoration and structural approaches to rehabilitate the McDonald, Silva, Atencio, and Prairie ditch diversions and to address riparian degradation in approximately 2.8 miles of the Sevenmile Plaza reach of the Rio Grande. Conducted as a scoping and feasibility study, the project will gather stakeholders and analyze options available to meet the needs of the four ditch companies, while improving the condition and function of the riparian areas, bends, and main channel of the Rio Grande in this reach. It will first determine how to integrate the rehabilitation of the McDonald Ditch Diversion with the multiple objectives of a 2001 study to analyze the condition of the Rio Grande; the restoration of the neighboring Silva, Atencio, and Prairie diversions; the stabilization of the surrounding riparian areas; and the best available science. The project will produce the Plaza Plan for implementation in Phase II, which may include replacing headgates, integrating micro-hydro power, restoring riparian areas, and stabilizing the main channel. The plan will align future actions with the interests of landowners and residents in one of Colorado's oldest communities, identifying and addressing the multiple objectives of stakeholders on the river.

Rio Grande Initiative: North Rio Grande Ranch Conservation Easement

APPLICANT: Rio Grande Headwaters Land Trust

APPROVED: March 2011

STATUS: In Progress

WSRA FUNDS: $70,000 ($15,000 - Rio Grande Basin Account; $55,000 - Statewide Account)

MATCHING FUNDS: $445,000

DESCRIPTION:

The requested funds will be used to providing matching funds toward a bargain-sale acquisition of a conservation easement on an important 320-acre Rio Grande River corridor ranch in Alamosa County, including securing the senior water rights to the property. It is a continuation of the successful Rio Grande Initiative, which benefits both consumptive and nonconsumptive water needs in the Rio Grande Basin. As an element of an ongoing, collaborative, community-based project, this conservation opportunity will directly protect senior surface water rights in order to help sustain the historic water use patterns along the Rio Grande River corridor by linking the water rights to the land through a permanent conservation easement. This is accomplished through a willing-seller/willing-buyer process for a voluntary conservation easement, which is purchased through a bargain sale and includes a substantial charitable donation of value (approximately 50 percent) by the landowner.