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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Acronyms

AF	acre-feet
AFY	acre-feet per year
ASR	aquifer storage and recovery
ATM	agricultural transfer method
AwwaRF	American Water Works Association Research Foundation
BOR	U.S. Bureau of Reclamation
CBEF	Center for Business and Economic Forecasting
CCGA	Colorado Corn Growers Association
CDOW	Colorado Division of Wildlife
CDPHE	Colorado Department of Health and Environment
CDSS	Colorado Decision Support System
cfs	cubic feet per second
CFWE	Colorado Foundation for Water Education
CRWAS	Colorado River Water Availability Study
CSA	Combined Service Area
CSU	Colorado State University
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
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
ET	evapotranspiration
FCSA	FS cost share agreement
FR	Feasibility Report
FRWC	Front Range Water Council
FS	Feasibility Study
GIS	geographic information system
gpcd	gallons per capita per day
HB	House Bill
IBCC	Interbasin Compact Committee
IPPs	identified projects and processes
ISA	Interruptible Supply Agreement
ISF	instream flow
IWR	Irrigation Water Requirements
LSPWMSSR	Lower South Platte River Water Management and Storage Sites Reconnaissance Study
M&I	municipal and industrial
MWRD	Metro Wastewater Reclamation District
NCNA	Nonconsumptive Needs Assessments
NEPA	National Environmental Policy Act
NHD	National Hydrography Dataset
NISP	Northern Integrated Supply Project
POR	period of record
PPRWA	Pikes Peak Regional Water Authority
PWP	Prairie Waters Project
PWSD	Parker Water & Sanitation District
RO	reverse osmosis
SB	Senate Bill
SDO	State Demographer's Office
SMWSA	South Metro Water Supply Authority
SPDSS	South Platte Decision Support System

SRGAP	Southwest Regional Gap Analysis Project
SSI	self-supplied industrial
SWSI	Statewide Water Supply Initiative
UMC	Upper Mountain Counties
USACE	U.S. Army Corps of Engineers
USGS	U.S. Geological Survey
WateReuse	WateReuse Foundation
WGFP	Windy Gap Firming Project
WISE	Water Infrastructure and Supply Efficiency
WSL CU	Water Supply Limited Consumptive Use
WSRA	Water Supply Reserve Account
ZLD	zero liquid discharge

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Metro Basin Roundtable Executive Summary

Overview

As a region, the Metro Basin Roundtable has both the largest new demand (~230,000 acre-feet per year [AFY]) and water supply gap (~130,000 AFY) in the State of Colorado. Major factors contributing to this include the addition of about 1.6 million new people and the need to augment nonrenewable groundwater resources.

The Metro Basin Roundtable believes that the economics of Colorado indicate how interdependent Colorado is as a state. Colorado's economic landscape is defined by Colorado's high quality of life, business climate, education, and agriculture, as evidenced by the following statistics:

- High Quality of Life:
  - 4th Most Preferred State to Live in
  - 4th Happiest State in Nation
  - Ranked 1st for the Lowest Level of Obesity
  - Tied for 2nd for the Highest Amount of Physical Activity
- Excellent Business Climate:
  - 2nd in Entrepreneurial Activity
  - 3rd Highest Venture Capital per Capita
  - 4th Best State for Business
  - 8th in High Tech Exports
  - 10th Most Fortune 500 Company Headquarters
  - 3rd Highest Number of Persons over the age of 25 with a Bachelors or More Advanced Degree
- Research and Development Inputs
  - 4th Highest
- Agricultural Outputs
  - 8th in the Nation
- Environment
  - Headwaters of Five Major River Systems that Supply Water to 19 States
  - 4th Highest Percent of Public Lands (24 percent and over 16 million acres)
- Recreation
  - Most Rafted River in the Nation (Arkansas)
  - Six out of 10 of the Best Ski Resorts in the Nation

Our high quality of life, such as the opportunities in the state for skiing, flat and white water boating, camping, hiking, biking, hunting, fishing, and wildlife watching contribute to Colorado's ability to attract company headquarters and high quality employees.

The social and economic engine of the Front Range attracts people to the state who, in turn, support recreational economies and agricultural production outside the Front Range corridor. In addition, the tax revenue generated in the Metro and Front Range area helps support rural regions of the state. For instance, the Front Range generates about 85 percent of the state's sales and income tax revenue (~$4.4 billion), all of which does not return to the Front Range. The six major counties in the Metro Basin Roundtable's region (Adams, Arapahoe, Broomfield, Denver, Douglas, and Jefferson) alone make up more than half of the sales tax collected in the state, contributing a disproportionate amount of state sales tax revenue.

As the state grows its economy, the Statewide Water Supply Initiative (SWSI) 2010 report predicts that about half of the new jobs that will be created are going to be filled by people moving into Colorado, and most of those will be moving into the Denver Metro area. The Metro Basin Roundtable believes there is a statewide responsibility to ensure that reliable water supplies are available to support this economic engine. We believe this can be accomplished by making efficient use of local resources through conservation, reuse, local storage and the formation of regional partnerships involving a sharing of infrastructure and water. However, wise, cooperative use of agricultural water sources and West Slope water remains vital. The development of agricultural and West Slope supplies for urban Metro area uses must be accomplished in a manner that benefits not only Metro communities, but the local "source" communities and their economies and environments. Meeting the Metro area's water needs, therefore, helps the state as a whole, as long as it doesn't deleteriously affect recreational opportunities and rural economies that contribute to Coloradoans high quality of life. In order to explore, review, and implement responsible ways of meeting the Metro area's future water needs, the basin roundtable has focused its Water Supply Reserve Account (WSRA) funds to study and put into practice innovative approaches to:

- Active conservation, e.g., rotary sprinkler nozzles
- Reuse, e.g., zero liquid discharge (ZLD) reverse osmosis (RO) plants
- Groundwater/aquifer storage and recharge (ASR), e.g., the Denver Basin, Lost Creek, Upper Mountain Counties Study
- Multi-purpose projects, e.g., Chatfield Reservoir reallocation
- Alternative agricultural transfers, e.g., deficit irrigation
- Collaborative new supply development, e.g., Flaming Gorge Task Force Assessment
- Nonconsumptive Needs, e.g., River South Greenway Master Plan

In addition, many Metro water providers are investing their own dollars to advance the above list and pursue active conservation, land use changes, cooperative infrastructure, reuse, multi-purpose, and in-basin opportunities.

Land use: The Metro area is expected to become 10 percent denser in the future. Although higher density results in higher demand per acre of development, regionally it saves water through smaller or no lawns for the people projected to live here in the future. Additionally, several cities limit lawn size and/or the amount of grass that can be grown on a new development. In addition, some municipalities, like Aurora, have active programs to incentivize grass replacement.

Conservation: Metro providers are among the leaders in developing conservation plans, realizing measurable conservation savings, and building extensive reuse projects. The Metro Basin Roundtable has the smallest gallons per capita per day usage rate (155 gpcd), below that of other parts of the state. This rate of use was achieved even though there is significant commercial activity in the region and outdoor water use. As a whole, per capita water usage in the Metro area has declined by about 20 percent since 2000. The basin roundtable and most of the water providers in the Metro area are committed to continued achievement of measurable conservation savings. For this reason, in addition to having water provider programs that encourage conservation for new and existing homes, the Metro Basin Roundtable encourages local governments and water providers to consider the short-term conservation recommendations made by the Interbasin Compact Committee (IBCC). Such efforts will help the state as a whole manage for risk and use its water more wisely.

Cooperative and Innovative Infrastructure and Reuse: The Water Infrastructure and Supply Efficiency (WISE) partnership, described in more detail in the body of this report, will promote the cooperative use of infrastructure and maximize the reuse potential of fully consumable water supplies. Metro area cities are already finding ways to maximize their water supplies by exchanging their return flows of fully consumable water supplies. The Metro Basin Roundtable has also explored the development of innovative technologies that could be used for generating reusable supplies, such as ZLD, to enhance local water supplies. ZLD reduces the liquid waste brine-stream from RO treatment to a solid form that can be applied rather than returned to a water body.

Multi-purpose Projects: The Chatfield Reservoir reallocation project seeks to use an existing storage reservoir to capture water that would otherwise not be available for either municipal or agricultural use. It requires no new dam construction and will continue to support the environmental and recreational opportunities in the Metro area.

Nonconsumptive Projects: The Metro Basin Roundtable supported planning efforts to enhance and maintain nonconsumptive needs. In particular, it supported the Greenway Foundation's efforts to develop the River South Greenway Master Plan.

Alternative Agricultural Transfers: Water providers in the Metro area are committed to helping maintain viable agriculture in the South Platte River Basin and in Colorado as a whole. For that reason, cities like Parker are exploring the affects of fallowing and deficit irrigation on crop productivity.

In Summary

The Metro area is working to meet its needs through a wide array of responsible water supply projects and methods. Nonetheless, the needs are still large enough that the basin roundtable finds that additional water supplies from the West Slope and agriculture will be needed to augment water supply activities already underway within the Metro and South Platte area. For this reason, the Metro Basin Roundtable supports the pursuit of new supply options for the future.

The Metro Basin Roundtable believes that it is imperative to move forward with implementation of the consumptive and nonconsumptive identified projects and processes (IPPs) to help fulfill a responsibility to the health, safety, and welfare of the area's residents. Without the IPPs, the water supply gap will be larger, and the eventual impacts of replacement projects to environmental and recreational values will likely be greater and more challenging to mitigate. In addition, the Metro Basin Roundtable encourages water providers to continue ongoing and planned measurable conservation efforts, and to utilize alternative agricultural transfer methods when in both buyers' and sellers' best interests.

With regard to new water supplies from the West Slope, the Metro Basin Roundtable looks forward to working with other roundtables and/or appropriate stakeholders to determine the best way forward.

Major Findings

The Metro area serves a vital role in Colorado's statewide economy across the state through the generation of tax dollars, utilization of recreational opportunities, and purchases of agricultural products. Likewise, healthy agricultural and recreational economies and opportunities are important to the quality of life in the Metro area.

- The Metro area has the largest municipal and industrial (M&I) new demand and largest gap in the State of Colorado, as shown in the figures below.

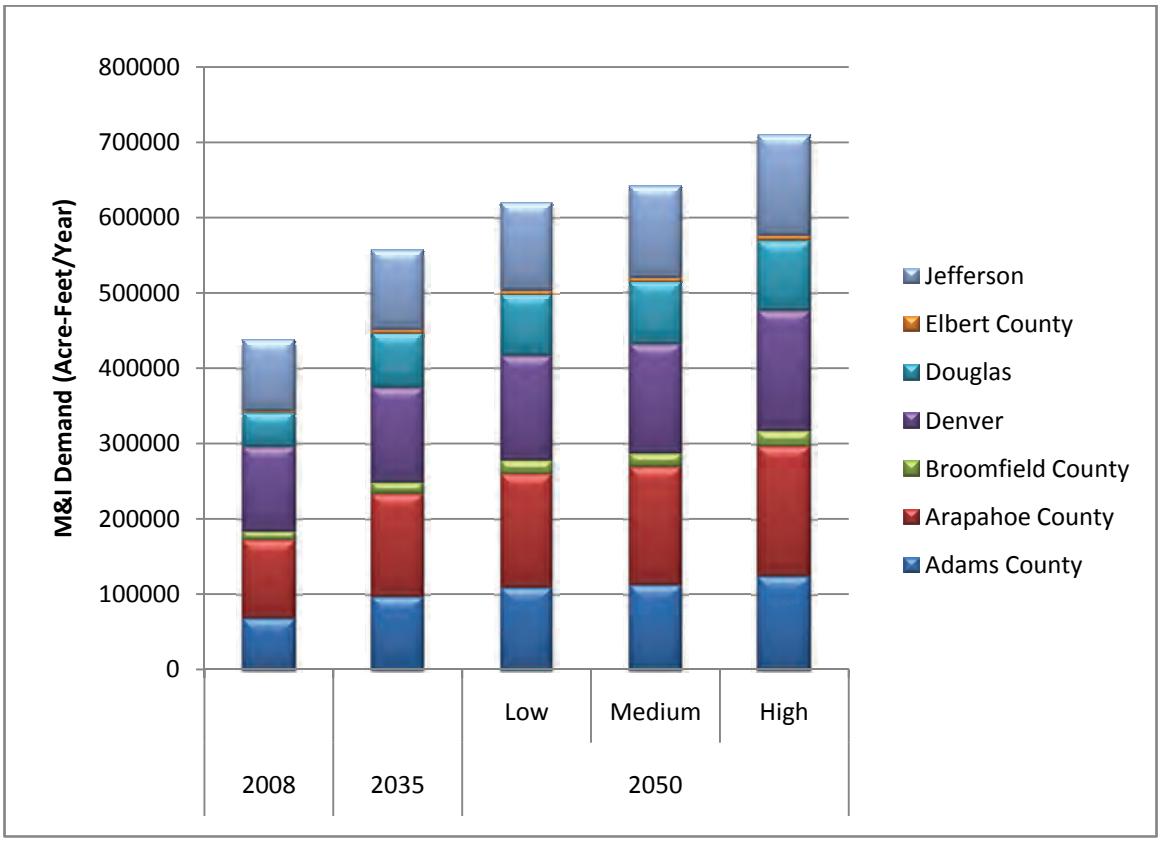

Figure ES-1 Metro Basin M&I Water Demands

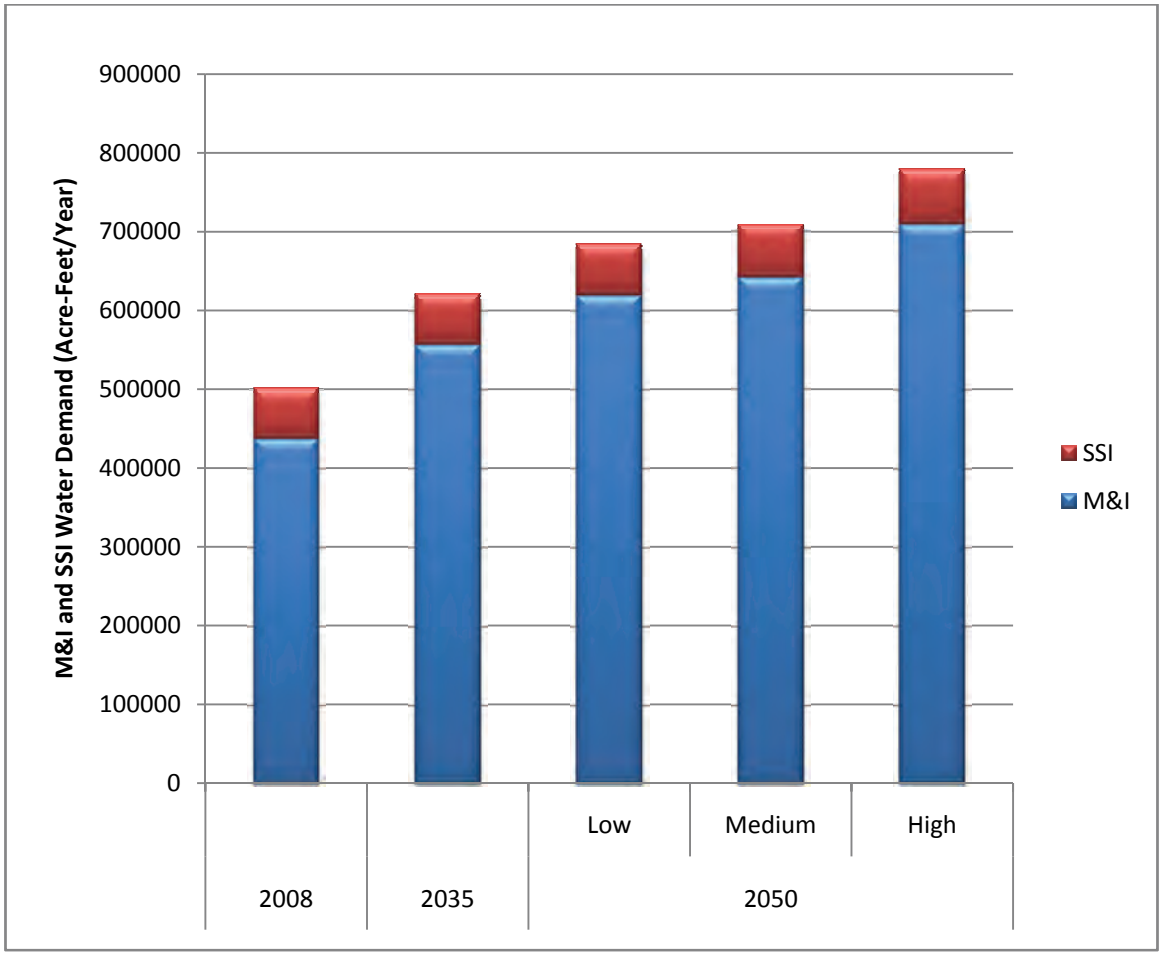

Figure ES-2 Metro Basin M&I and SSI Water Demands

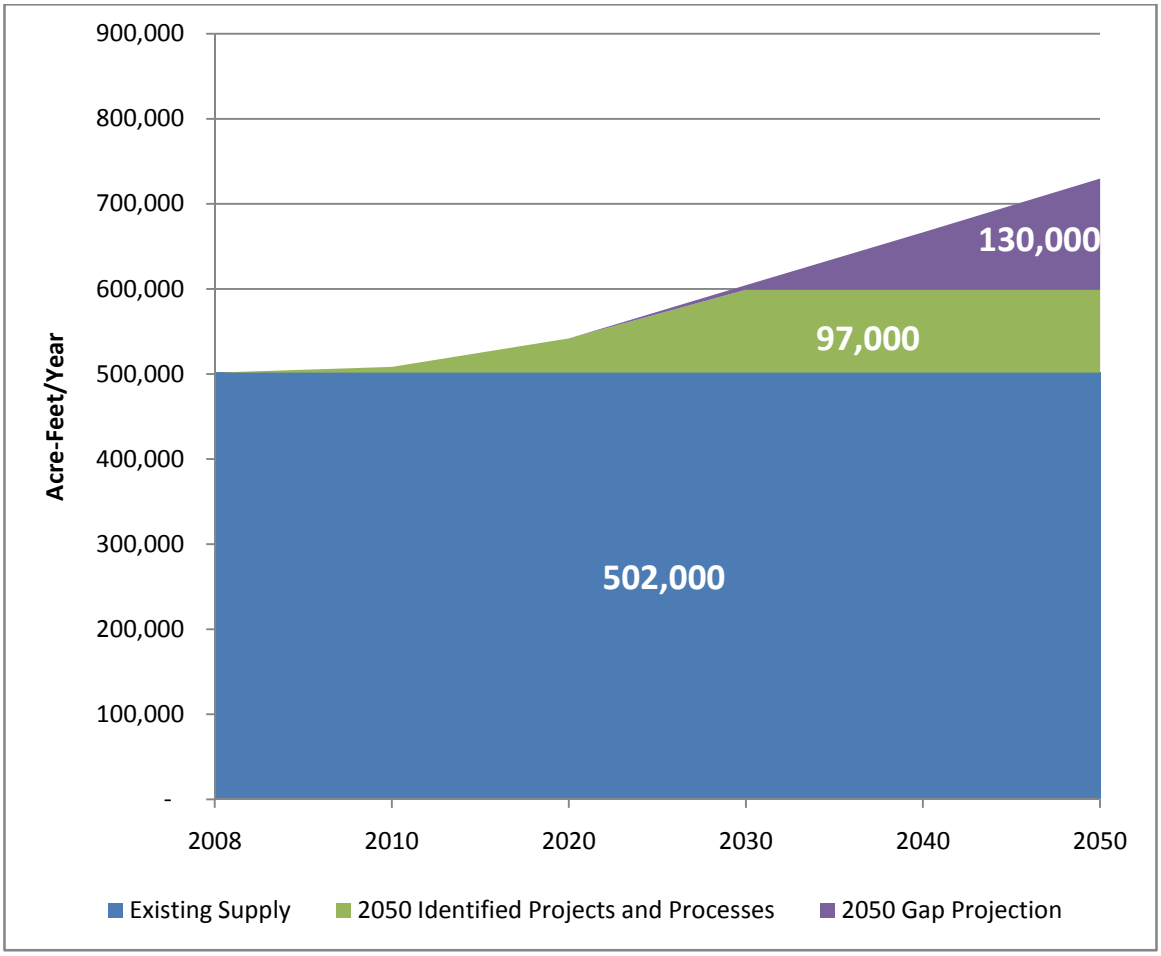

Figure ES-3 Metro Basin M&I and SSI Gap Medium Scenario (IPPs at 60% Success Rate)

- The Metro Basin Roundtable identified six nonconsumptive IPP's in the Metro area.
- Without additional water supplies, the long-term use of the Denver Basin aquifers is not sustainable as a main water supply. Water from the Denver Basin aquifer can be used to help manage risks during times of drought.
- The Metro area is leading Colorado in the areas of conservation, reuse, and cooperative infrastructure.
- Several Metro water providers have determined that ASR is a viable option for helping to manage their water supplies.
- South Platte agriculture is important to the Metro area. However, to the extent that the gap cannot be met with other strategies agricultural transfer methods will continue. Alternatives to traditional transfers will be a part of the solution to meeting the Metro area's needs.
- The Metro area is meeting many of its needs through conservation, reuse, cooperation, and maximization of available supplies. Nonetheless additional agricultural transfers and new West Slope supplies will be needed to support the Metro area.

- Additional storage and infrastructure are essential to optimally manage water from all sources, including, conservation, reuse, native supplies, agriculture, and the West Slope.
- Regional and cooperative partnerships will be important in meeting the future needs of the Metro area.

Recommendations and Next Steps

1) **Conservation:** Continue implementing measurable conservation practices as outlined in the Water Conservation Plans submitted to Colorado Water Conservation Board (CWCB). In addition, encourage local governments and water providers to consider the IBCC conservation recommendations (see details in IBCC report). These are summarized below:

   a. Develop unified statewide messaging about water and water conservation that is consistent, sustained, and simple.

   b. Adoption of indoor plumbing codes that require water efficiency standards that meet or exceed the U.S. Environmental Protection Agency's (EPA's) WaterSense fixture and appliance specification for all new residential and commercial construction and renovation that requires building permits.

   c. An executive order for all state agencies to reduce their water demand.

   d. Find ways to support water providers with funding and other assistance in pursuing the best available technologies and practices to minimize water loss in conveyance, storage, treatment, and distribution and to design consumers' water bills so that cost, consumption, and rates are clearly displayed.

   e. Adoption of water efficiency standards that meet or exceed EPA's WaterSense product and certification specification in all new landscaping plans and projects requiring supplemental irrigation.

2) **Identified Projects and Processes:** Support the implementation of IPPs, including for example Chatfield Reservoir Reallocation, Gross Reservoir expansion, WISE partnership, reuse projects, agricultural transfers, and other planned projects. Ask the project proponents if they would like support, such as letters or WSRA grants. Support IPPs from other roundtables to help assure their success.

3) **Alternative Agricultural Transfers:** Meet with the South Platte Basin Roundtable, IBCC's Agricultural Subcommittee, and agricultural entities to discuss how to utilize agricultural water sources for municipal needs while supporting agricultural and rural economies.

4) **Nonconsumptive:** Support and move forward nonconsumptive IPPs in the Metro Basin and support the inclusion of nonconsumptive needs in the development of projects outside of the roundtable's geographic area. Ask the project proponents if they would like support, such as letters or WSRA grants.

5) **Storage and Infrastructure:** Support above-ground storage, ASR, and cooperative infrastructure projects, as storage will be needed for maximizing capture of snowmelt and other high flows, conservation water savings, reuse, and additional South Platte, agricultural, and transbasin water supplies. Seek funding to assess additional storage and infrastructure opportunities through a WSRA grant.

6) **New Supply:** Work to preserve and advance opportunities for new supply development on the West Slope for future use on the West Slope and the Front Range. In addition, the Metro Basin Roundtable is eager to explore collaborative opportunities with other roundtables and/or appropriate stakeholders to determine the best way forward, to identify water sources which can increase supplies for the expected growth on the Front Range while minimizing risk and creating benefits to agriculture, the environment, recreation, or current water users. This should involve specific conversations with the Gunnison, Colorado, and Yampa-White Basin Roundtables as well as supporting the Flaming Gorge Task Force. The Metro Basin Roundtable will also consult with the South Platte and Arkansas Basin Roundtables to determine their interest.

7) Pursue conservation, IPPs, agricultural transfers, storage and infrastructure, and new supply projects concurrently.

Section 1
Introduction

1.1 Metro Basin Roundtable Overview

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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 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 Metro Basin Roundtable's needs assessment that have been completed to date.

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.

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.

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 Metro 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 Metro 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.

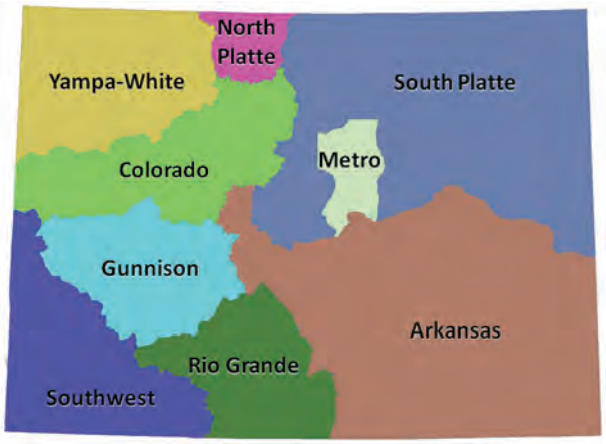


Figure 1-1 Colorado's nine basin roundtables provide a voluntary and collaborative process to help the state address its water challenges

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 IPPs that will reduce the municipal and industrial (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 Metro 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 Metro Basin. Following is a description of the contents of this Basin Needs Assessment Report:

- **Section 2** is a summary of the **Metro 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 **Metro 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 **Metro 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 Metro Basin M&I Needs** are described at a regional 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 **Metro Basin Roundtable's Strategies to Address Consumptive and Nonconsumptive Needs** as well as the basin roundtable's recommended next steps.

Section 2
Metro 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 Metro Basin nonconsumptive identified projects and methods are summarized in Section 3 of this report.

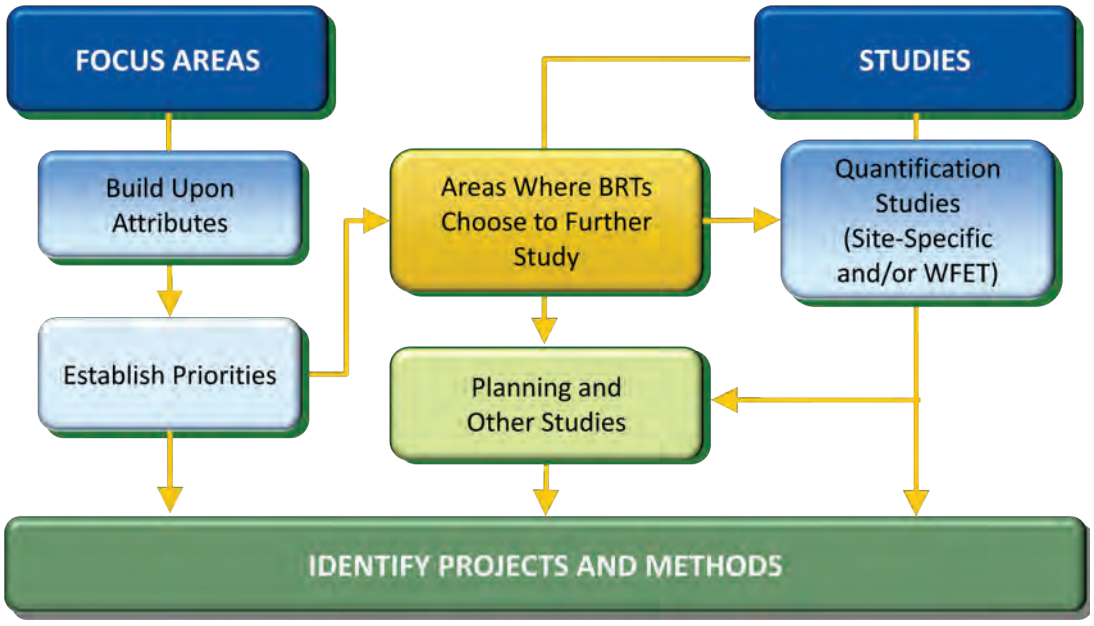


Figure 2-1 Nonconsumptive Needs Assessment Methodology

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 Metro Basin Roundtable used Method 3, which reviewed all available data layers for their basin, and based on stakeholder knowledge and outreach, selected stream reaches that represented the majority of environmental and recreational activity in their basins.

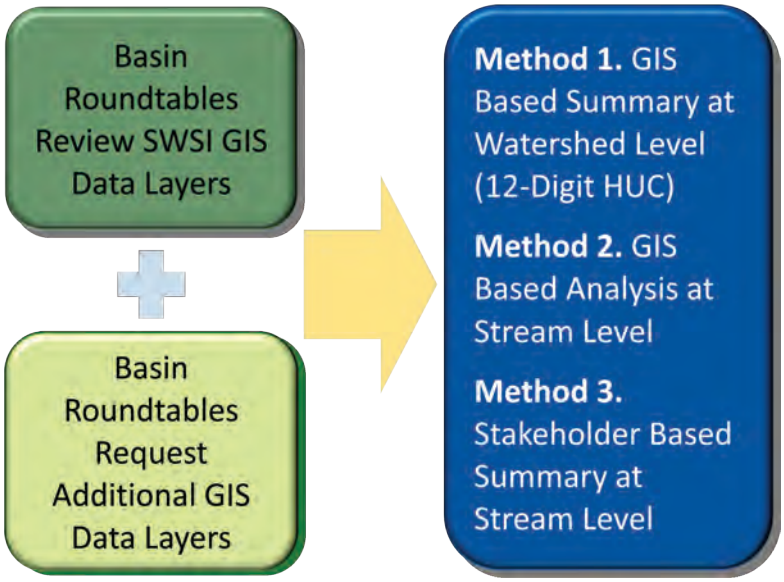


Figure 2-2 Basin Roundtable Focus Area Mapping Methodology

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

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

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	

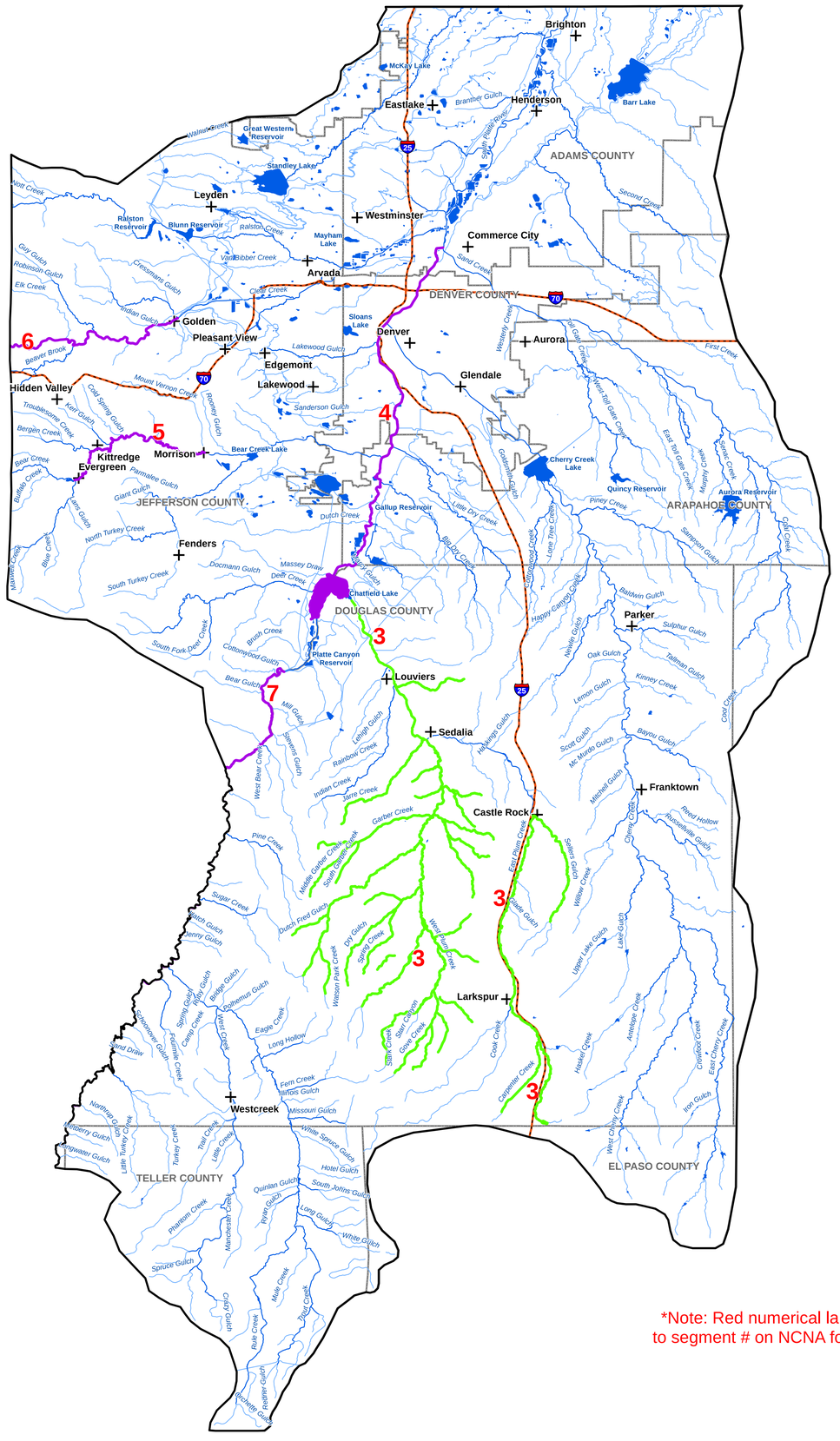
2.2.2 GIS Analysis of Data Layers

The Metro Basin Roundtable examined their collected environmental and recreational data layers and utilized a stakeholder process to establish what the environmental and recreational focus areas should be for their respective basins. The basin roundtables summarized their environmental and recreational attributes on a map and created a table summarizing why the segment was included as a focus area and important attributes for each segment. This information has been summarized at the National Hydrography Dataset (NHD) stream reach level. Detailed information about this approach is summarized in Appendix C of the SWSI 2010 Report.

2.3 Nonconsumptive Focus Area Mapping Results

Using the methodologies and techniques outlined above, the Metro 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 Hydrologic Unit Code or stream segment. In addition, the presence of specific attributes (e.g., Iowa darter, trout, kayaking, etc.) is also summarized as well as information designated by the basin roundtable through creation of tables associated with their map. **Figure 2-3** can be used as GeoPDFs in the electronic version of this report. To utilize the maps 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 2-3 shows the Metro Basin's Major Environmental and Recreational Stream Segments as determined by the basin roundtable. The map is labeled with numbers to correspond with the data matrix. The matrix was linked to the spatial data layers in GIS and exported as a GeoPDF. The GeoPDF allows the viewer to select the waterbody and display the linked table, which contains the following waterbody characteristic:

- Segment description
- Environmental (is this waterbody purpose environmental?)
- Recreational (is this waterbody purpose recreational?)
- Rationale for consideration



*Note: Red numerical labels correspond to segment # on NCNA focus area matrix.

Legend

Candidate Environmental and Recreational Focus Areas

- Environmental Focus Area
- Environmental and Recreational Focus Area
- Recreational Focus Area
- Highways
- Rivers and Streams
- Lakes and Reservoirs
- Cities and Towns
- County Boundary

N
W E
S

0 2.5 5 10 15
Miles

1 inch = 2.5 miles

Figure 2-3

Metro Basin Nonconsumptive Needs Assessment Candidate Environmental and Recreational Focus Areas

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Section 3
Metro Basin Nonconsumptive Projects and Methods

3.1 Nonconsumptive Projects and Methods Overview

Section 2 of this report summarizes the nonconsumptive needs in the Metro 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 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 describes the methodology used to gather nonconsumptive projects and methods across the state. Section 3.3 summarizes the methodology used to analyze the project and method information. Section 3.4 explains the results of the analysis for the Metro Basin Roundtable.

3.2 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 Water Supply Reserve Account (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 CWCB's efforts, the Colorado Division of Wildlife (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.

As has been recognized elsewhere in this document and others, the fisheries in Colorado are nationally renowned; as such, the economy of many headwater communities, including the South Platte River Basin, are substantially dependent on the health and viability of the aquatic community. Lower in the basin, the South Platte supports threatened populations of plains fish species. Managing recreational, listed, and non-listed conservation species are the primary goals for the Aquatic Section staff, and include a substantial commitment to raising fish in hatcheries for recreational and conservation purposes. Included below is a bulleted list of tasks that fishery managers and staff routinely undertake to manage fisheries:

- Monitoring of fisheries for population estimates, measures of 'quality' (e.g., Gold Medal Waters), and species composition;
- Growth and stocking of recreational and conservation cold- and warm-water species;
- Aquatic nuisance species monitoring and control (e.g., quagga and zebra mussels; virile crayfish; non-native predatory fish);
- Fishery regulatory review and implementation (i.e., establishment of and updates to fishery bag and possession limits);
- Participation in Federal Endangered Fish Recovery Programs;
- Serving as the CWCB's 'biological consultants' for ISF appropriations;
- Aquatic pathogen and water quality contamination research, response, and spill investigation;
- Work with local communities and stakeholder groups to implement local projects, such as removing migration barriers (or in the case of native cutthroat trout, installing migration barriers to stratify native and non-native populations of trout) or stream habitat improvement projects;
- Formal regulatory processes governed by state or federal statute (county 1041 consultation, National Environmental Policy Act, U.S. Army Corps of Engineers Section 404 permitting);
- Participation as official liaisons to the basin roundtable processes.

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:

- 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.

3.3 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 at the end of this section 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 Metro Basin (Figure 3-1 is a combination of Metro and South Platte). 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 Metro and South Platte Basins, the basin roundtables identified 1,400 miles of water bodies as focus areas. For these focus areas, 65 percent have an associated project or method. **Table 3-5** below summarizes the project and method protections identified for the Metro and South Platte Basin. In the attribute column of Table 3-5, the environmental and recreational attributes collected by the basin roundtable are summarized. The recreation attribute category includes attributes from whitewater and flatwater boating. The Warm Water Fish State Endangered, Threatened and Species of Special Concern category includes plains fish species in the South Platte and Metro Basins. Important Riparian and Wetland Areas category includes significant riparian areas and rare plant communities. Finally, the fishing attribute category includes streams and identified lakes as fishing areas.

Table 3-5 Summary of Protections for Metro and South Platte Basins 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
Fishing	32%	11%	7%	50%
Greenback Cutthroat Trout	51%	21%	12%	84%
Important Riparian and Wetland Areas	2%	40%	`%	42%
Plains Fish State Endangered, Threatened and Species of Special Concern	33%	1%	17%	51%
Recreation	0%	0%	0%	0%
Waterfowl Hunting and Viewing	0%	24%	2%	26%

3.4 Nonconsumptive Projects and Methods Highlights for the Metro Basin

3.4.1 South Platte River – Segment 15

In 2006 Metro Wastewater Reclamation District (MWRD) completed a detailed aquatic life habitat assessment project on a segment of the South Platte River known as Segment 15. Segment 15 is a 26-mile segment of the South Platte River that begins in Denver and ends just upstream of Big Dry Creek near Fort Lupton that MWRD's facility discharges to. The results of the assessment indicated that the largest limiting factor for fish species within the segment was physical habitat.

Based on the results of the habitat assessment MWRD, through a tiered analysis that considered cost and benefit, determined that the most appropriate location to improve physical habitat within Segment 15 would be a 2-mile section of river near Henderson, Colorado. Improvements within this 2-mile section would result in bridging the gap between two other sections of the river that were determined to already have good physical habitat. This would effectively create a 6-mile stretch of river that would have good physical habitat for the fish population of the river. Upon determination of the best location for habitat improvements MWRD embarked upon a phased instillation of habitat. The first phase was completed in February of 2009 and consisted of a riffle, a tree snag, a backwater pool, and a spur dike field. Biological monitoring prior to the habitat improvements indicated there were 12 species of fish present within this section of river. Upon completion of the Phase 1 improvements, the number of species within the 2-mile section had increased by four, bringing the total number of species to 16. This increase in species seems to indicate that the habitat improvements have been successful. Construction of phase two habitat improvements is scheduled to begin in October of this year.

3.4.2 South Platte River Greenway

The South Platte River Greenway has transformed how the South Platte River is perceived and used in the reaches flowing through the Denver Metro area. As the Denver Metro area population is expected to increase over the next 20 to 30 years, the South Platte River Greenway will provide amenities for residents, people working downtown, and visitors a place to enjoy the South Platte River. The core principals on South Platte River Greenway Projects are:

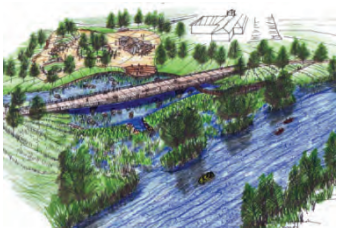
1. Maintain or improve channel flood capacity.
2. Enhance water quality; follow best management practices to the maximum extent possible.
3. Always enhance wildlife habitat—both aquatic and terrestrial.
4. Provide maintenance and emergency access to the river.
5. Provide world class trail and recreational experience on the river.
6. Facilitate a comprehensive design process including all stakeholders and reviewing agencies.

There are several priority projects for the South Platte River Greenway. These projects include Grant Frontier and Overland Regional Park, Vanderbilt and Jackson - Habitat Parks, Sun Valley Riverfront Park, Confluence Park, and Art Bridge.

Grant Frontier and Overland Regional Park is designed to provide multi-use river access facilities and provide a new recreational destination for southern Denver residents. Existing drop structures will be reconstructed into multiple drop structures to provide state-of-the-art boating and fishing experiences.

The redevelopment of Vanderbilt and Jackson - Habitat Parks will inform children and adults about the importance the South Platte River plays in nature and their daily lives. The parks will include an outdoor

classroom, improved boating and fishing access, urban tent camping area, interpretive trail including low water use information, an improved Greenway trail, soccer field, and playground.



Sun Valley Riverfront Park is located in an area where the City and County of Denver Housing Authority is planning for the redevelopment of adjacent neighborhoods into a mixed use area. Sun Valley Park includes a "natural play area" with large boulders, scenic overlooks, seating and picnic areas, and an improved Greenway trail.

Confluence Park is located at the confluence of the South Platte River and Cherry Creek. At this location the construction of Shoemaker Plaza, a regional trail, and cantilevered ramps started the revitalization of the South Platte River in the 1970s. Recently Confluence Park received some enhancements to bring the facilities up to current accessibility or trail standards. Shoemaker Plaza was outfitted with seating/table/ umbrella structures.

The Art Bridge Project creates a new riverfront park and pedestrian river crossing in northern Denver. The recreational highlights of the Art Bridge are an art park, sculpture garden, community garden, river access, boat launch, soccer field, trailhead with parking, and an improved greenway trail. The project will increase the floodplain volume, create an area for wetlands and riparian habitat, and treat runoff from adjacent neighborhoods improving water quality.

3.4.3 Chatfield Reallocation Project

The plan to reallocate storage space in Chatfield Reservoir to provide 20,600 acre-feet for nonflood control purposes is moving forward. The draft Environmental Impact Statement (EIS) is almost complete. The next step is release of the draft followed by a public comment period beginning this summer.

Congress authorized reallocation of Chatfield Reservoir water storage space in the Water Resources Development Act of 1986. The U. S. Army Corps of Engineers (USACE) concluded that there was additional usable capacity there. It has taken 25 years to get this project close to reality. In all that time, the need for additional water for the Front Range has also been well known. Efforts to conserve water have doubled and redoubled.

Preliminary studies leading to the EIS began in 1997 and work on the EIS itself was launched in 2004. The non-federal sponsor for the project is the State of Colorado through the CWCB.

The Chatfield Coordinating Committee participates in biannual trips to Washington, D.C. to visit the Colorado congressional delegation and lobby for federal funds. The trips also include meetings with USACE, the Office of the Assistant Secretary of the Army for Civil Works, Office of Management and Budget, and House and Senate congressional committees. All members of the Colorado congressional delegation have been very supportive of the effort to complete the Feasibility Report/EIS study.

The Chatfield Reservoir Reallocation study has been funded 50 percent by USACE and 50 percent by the State of Colorado and the local water providers. All of the construction required will be funded by the water user agencies including environmental mitigation costs, and the recreational modification costs to Chatfield State Park. In all, the costs borne by the water users will come to more than $100 million. Despite the significant costs of the overall project, the water users believe the price per acre-foot of water will still be a good deal and this "Identified Project" will help fill the Front Range water supply gap.

Legend

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

Projects

- CDOW
- CWCB
- ISF
- Stewardship
- WSRA

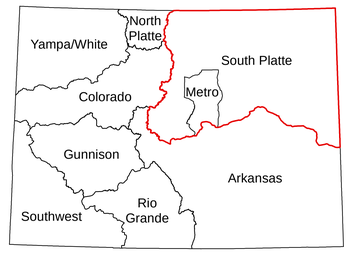


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Figure 3-1

South Platte Basin Nonconsumptive Needs Assessment Focus Areas with Projects and Methods

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Table 3-4 Metro Basin Nonconsumptive Identified Projects and Processes Summary

Project Location	Project Name	Project Type	Project Status	Basin Roundtable Attributes Identified	Project Protections	Reach ID
Cache La Poudre	Investigating operations change	Flow Protection	Planned	Audubon important bird areas, Brassy Minnow, Common Garter Snake, Common Shiner, Iowa Darter, Northern Leopard Frog , Preble's Meadow Jumping Mouse, Significant Riparian/Wetland Communities	Active Bald Eagle Nests-D, Brassy Minnow-D, CWCB Instream Flow Water Rights-D, Gold Metal Trout Streams-D, High Recreation Rivers -D, Iowa Darter-I, Stonecat-D	23
Black Hollow Creek	Barrier Construction	Project	Completed	Colorado Outstanding Waters, CWCB instream flow water rights, Greenback Cutthroat Trout, Rare Plants, Significant Riparian/Wetland Communities, Wilderness Area Waters	Suckermouth Minnow -D	12
Big Thompson River from Estes Park to Dillon Tunnel	Minimum flow releases from Olympus Dam - U.S. Bureau of Reclamation and Northern Colorado Water Conservancy District	Flow Protection	Ongoing	CWCB instream flow water rights, Preble's Meadow Jumping Mouse, River and stream fishing, Significant Riparian/Wetland Communities, Whitewater Boating	Common Shiner-I, Iowa Darter-I, Rare Plants-D	15
Big Thompson River above Waltonia	Big Thompson River Instream Fish Habitat Project	Project	Completed	CWCB instream flow water rights, Preble's Meadow Jumping Mouse, River and stream fishing, Significant Riparian/Wetland Communities, Whitewater Boating	Ducks Unlimited Projects-D	15
Bard Creek	Bard Creek Instream Habitat Structures	Project	Completed	Boreal Toad, CWCB instream flow water rights, Greenback Cutthroat Trout, Rare Plants, Significant Riparian/Wetland Communities, Whitewater Boating	Suckermouth Minnow -D	12
Cache la Poudre (near I-25)	Cache la Poudre bank stabilization	Water Quality Protection	Completed	Audubon important bird areas, Brassy Minnow, Common Garter Snake, Common Shiner, High Recreation Lakes and Reservoirs, Iowa Darter, Northern Leopard Frog , Preble's Meadow Jumping Mouse, Rare Plants, Significant Riparian/Wetland Communities	Active Bald Eagle Nests-I, Common Shiner-I, CWCB Instream Flow Water Rights-D, Gold Metal Trout Streams-D, High Recreation Rivers -D, Iowa Darter-I, Stonecat-I	23
South Platte (from Eleven-mile reservoir outlet to confluence with the North Platte) and North Platte (from Insmont to confluence with South Platte)	South Platte Protection Plan #8 - New operating and monitoring equipment	Information	Completed	Eligible Wild and Scenic, Flatwater Boating, Gold Metal Trout Streams, Iowa Darter, Northern Leopard Frog , Preble's Meadow Jumping Mouse, Rare Plants, Reservoir and Lake Fishing, River and stream fishing, River Otter Sightings, Significant Riparian/Wetland Communities, Whitewater Boating		7, 8
South Boulder Creek from Gross Reservoir to Mouth	Fish passage on diversion structures	Project	Completed	Common Garter Snake, Common Shiner, CWCB instream flow water rights, Northern Leopard Frog , Preble's Meadow Jumping Mouse, Rare Plants, River and stream fishing, Significant Riparian/Wetland Communities, Whitewater Boating	Brassy Minnow-D, Common Shiner-I, CWCB Instream Flow Water Rights-D, Ducks Unlimited Projects-D, Gold Metal Trout Streams-I, Iowa Darter-I	11
South Platte through Metro Area	Metro Area River Restoration Proposals	Project	Planned?	Audubon important bird areas, Common Garter Snake, Common Shiner, Ducks unlimited projects, Eligible Wild and Scenic, High Recreation Lakes and Reservoirs, Iowa Darter, Northern Cricket Frog, Northern Leopard Frog , Northern Redbelly Dace, Plains Leopard Frog, Preble's Meadow Jumping Mouse, Rare Plants, Reservoir and Lake Fishing, River and stream fishing, Significant Riparian/Wetland Communities, Whitewater Boating, Yellow Mud Turtle		4, 7
South Platte through Metro Area	Chatfield Reallocation	Project / flow Protection	Ongoing	Audubon important bird areas, Common Garter Snake, Common Shiner, Ducks unlimited projects, Eligible Wild and Scenic, High Recreation Lakes and Reservoirs, Iowa Darter, Northern Cricket Frog, Northern Leopard Frog , Northern Redbelly Dace, Plains Leopard Frog, Preble's Meadow Jumping Mouse, Rare Plants, Reservoir and Lake Fishing, River and stream fishing, Significant Riparian/Wetland Communities, Whitewater Boating, Yellow Mud Turtle	Active Bald Eagle Nests-D, Colorado Outstanding Waters-D, Common Garter Snake-D, Common Shiner-I, CWCB Instream Flow Water Rights-D, Gold Metal Trout Streams-I, High Recreation Rivers -D, Iowa Darter-I, River and Stream Fishing-D	4, 7

Table 3-4 Metro Basin Nonconsumptive Identified Projects and Processes Summary

Project Location	Project Name	Project Type	Project Status	Basin Roundtable Attributes Identified	Project Protections	Reach ID
South Platte River upstream of Michigan Creek	Hayman Fire Restoration	Information	Planned	Eligible Wild and Scenic, River and stream fishing, Significant Riparian/Wetland Communities, Whitewater Boating		7
South Platte below Horse Creek	Trumbull Trout Habitat Enhancement	Project	Completed	Eligible Wild and Scenic, Gold Metal Trout Streams, Preble's Meadow Jumping Mouse, River and stream fishing, Significant Riparian/Wetland Communities, Whitewater Boating	Ducks Unlimited Projects-D, Waterfowl Hunting / Viewing-D	7
South Platte (from Eleven-mile reservoir outlet to confluence with the North Platte) and North Platte (from Insmont to confluence with South Platte)	South Platte Protection Plan #9 - Stream Channel Maintenance	Water Quality Protection	Planned	Eligible Wild and Scenic, Flatwater Boating, Gold Metal Trout Streams, Iowa Darter, Northern Leopard Frog , Preble's Meadow Jumping Mouse, Rare Plants, Reservoir and Lake Fishing, River and stream fishing, River Otter Sightings, Significant Riparian/Wetland Communities, Whitewater Boating	Active Bald Eagle Nests-I, Audubon Important Bird Areas-I, Brassy Minnow-I, Common Shiner-I, Ducks Unlimited Projects-I, Waterfowl Hunting / Viewing-I	7, 8
South Platte (from Eleven-mile reservoir outlet to confluence with the North Platte) and North Platte (from Insmont to confluence with South Platte)	South Platte Protection Plan #7 - Planning meetings b/t Operators and fisheries and whitewater interests	Information	Completed	Eligible Wild and Scenic, Flatwater Boating, Gold Metal Trout Streams, Iowa Darter, Northern Leopard Frog , Preble's Meadow Jumping Mouse, Rare Plants, Reservoir and Lake Fishing, River and stream fishing, River Otter Sightings, Significant Riparian/Wetland Communities, Whitewater Boating		7, 8
South Platte (from Eleven-mile reservoir outlet to confluence with the North Platte) and North Platte (from Insmont to confluence with South Platte)	South Platte Protection Plan #6 - Channel work on North Fork	Information	Completed	Eligible Wild and Scenic, Flatwater Boating, Iowa Darter, Northern Leopard Frog , Preble's Meadow Jumping Mouse, Rare Plants, Reservoir and Lake Fishing, River and stream fishing, River Otter Sightings, Significant Riparian/Wetland Communities, Whitewater Boating		7
South Platte (from Eleven-mile reservoir outlet to confluence with the North Platte) and North Platte (from Insmont to confluence with South Platte)	South Platte Protection Plan #4 - Cheeseman Reservoir	Flow Protection	Completed	Eligible Wild and Scenic, Gold Metal Trout Streams, Preble's Meadow Jumping Mouse, River and stream fishing, Significant Riparian/Wetland Communities, Whitewater Boating	Audubon Important Bird Areas-D, Brassy Minnow-D, Common Shiner-I, Ducks Unlimited Projects-D, Gold Metal Trout Streams-I, Iowa Darter-I, Waterfowl Hunting / Viewing-D	7
South Platte (from Eleven-mile reservoir outlet to confluence with the North Platte) and North Platte (from Insmont to confluence with South Platte)	South Platte Protection Plan #2 - Spinney Mountain Reservoir	Flow Protection	Completed	Eligible Wild and Scenic, Flatwater Boating, Gold Metal Trout Streams, Iowa Darter, Northern Leopard Frog , Preble's Meadow Jumping Mouse, Rare Plants, Reservoir and Lake Fishing, River and stream fishing, River Otter Sightings, Significant Riparian/Wetland Communities, Whitewater Boating	Active Bald Eagle Nests-D, Audubon Important Bird Areas-D, Brassy Minnow-D, Common Shiner-I, Ducks Unlimited Projects-D, Gold Metal Trout Streams-I, Iowa Darter-I, Waterfowl Hunting / Viewing-D	7, 8
Saint Vrain (near Longmont)	Saint Vrain stream realignment and wetland enhancement	Project	Completed	Brassy Minnow, Common Shiner, Ducks unlimited projects, Iowa Darter, Lake Chub, Northern Redbelly Dace, Preble's Meadow Jumping Mouse, Stonecat	Active Bald Eagle Nests-D, Colorado Outstanding Waters-D, Common Garter Snake-D, Gold Metal Trout Streams-D, Northern Cricket Frog-D, Stonecat-D, Yellow Mud Turtle -D	17
South Platte at Happy Meadows	Happy Meadows/ Sportsman's Paradise River Restoration	Project	Completed	Eligible Wild and Scenic, Northern Leopard Frog , River and stream fishing, Significant Riparian/Wetland Communities, Whitewater Boating	Ducks Unlimited Projects-D	7
South Platte (from Eleven-mile reservoir outlet to confluence with the North Platte) and North Platte (from Insmont to confluence with South Platte)	South Platte Protection Plan #3 - Eleven Mile Reservoir	Flow Protection	Completed	Eligible Wild and Scenic, Flatwater Boating, Iowa Darter, Northern Leopard Frog , Preble's Meadow Jumping Mouse, Rare Plants, Reservoir and Lake Fishing, River and stream fishing, River Otter Sightings, Significant Riparian/Wetland Communities, Whitewater Boating	Active Bald Eagle Nests-D, Audubon Important Bird Areas-D, Brassy Minnow-D, Common Shiner-I, Ducks Unlimited Projects-D, Gold Metal Trout Streams-I, Iowa Darter-I, Waterfowl Hunting / Viewing-D	7
Tarryall Creek	Eagle Rock Ranch Stream Stabilization	Project	Completed	CWCB instream flow water rights, River and stream fishing, Waterfowl Hunting / Viewing	Ducks Unlimited Projects-D	10
Strontia Springs Reservoir to L.C. Pump Station	Strontia Springs Reservoir to L.C. Pump Station instream flows	Flow Protection	Completed	Common Shiner, Eligible Wild and Scenic, Iowa Darter, Northern Redbelly Dace, Preble's Meadow Jumping Mouse, River and stream fishing, Significant Riparian/Wetland Communities, Whitewater Boating	Active Bald Eagle Nests-D, Audubon Important Bird Areas-D, Common Garter Snake-D, Ducks Unlimited Projects-D, Gold Metal Trout Streams-D, Iowa Darter-I	7

Table 3-4 Metro Basin Nonconsumptive Identified Projects and Processes Summary

Project Location	Project Name	Project Type	Project Status	Basin Roundtable Attributes Identified	Project Protections	Reach ID
Gross Reservoir	Potential Environmental Pool	Flow Protection	Planned	Common Garter Snake, Common Shiner, CWCB instream flow water rights, Northern Leopard Frog , Preble's Meadow Jumping Mouse, Rare Plants, River and stream fishing, Significant Riparian/Wetland Communities, Whitewater Boating		11
Metro Denver Greenways	Recreational and Riparian Improvements along the South Platte	Project	Completed	Audubon important bird areas, Common Shiner, Ducks unlimited projects, High Recreation Lakes and Reservoirs, Iowa Darter, Northern Cricket Frog, Northern Leopard Frog , Plains Leopard Frog, Preble's Meadow Jumping Mouse, Whitewater Boating, Yellow Mud Turtle		4
Metro Denver Greenways	Expansion / Enhancement to Confluence Park	Project	Completed	Audubon important bird areas, Common Shiner, Ducks unlimited projects, High Recreation Lakes and Reservoirs, Iowa Darter, Northern Cricket Frog, Northern Leopard Frog , Plains Leopard Frog, Preble's Meadow Jumping Mouse, Whitewater Boating, Yellow Mud Turtle		4
Metro Denver Greenways	Chatfield Reallocation Program	Flow Protection	Planned	Audubon important bird areas, Common Shiner, Ducks unlimited projects, High Recreation Lakes and Reservoirs, Iowa Darter, Northern Cricket Frog, Northern Leopard Frog , Plains Leopard Frog, Preble's Meadow Jumping Mouse, Whitewater Boating, Yellow Mud Turtle		4
Lower Tarryall Creek	Tarryall Reservoir Outlet Channel Reconstruction	Project	Completed	CWCB instream flow water rights, Flatwater Boating, Reservoir and Lake Fishing, River and stream fishing, Waterfowl Hunting / Viewing	Ducks Unlimited Projects-D, River Otter-D	10
Jefferson County - one mile of stream along Highway 6	Improve fish habitat and recreational opportunities	Project	Planned	Brassy Minnow, Common Shiner, Iowa Darter, Preble's Meadow Jumping Mouse, Rare Plants, River and stream fishing, Whitewater Boating		6
Metro Denver Greenways	Westerly Creek Greenway Master Plan	Information	Planned	Audubon important bird areas, Common Shiner, Ducks unlimited projects, High Recreation Lakes and Reservoirs, Iowa Darter, Northern Cricket Frog, Northern Leopard Frog , Plains Leopard Frog, Preble's Meadow Jumping Mouse, Whitewater Boating, Yellow Mud Turtle		4
Five-Mile Creek	Five-Mile Creek Channel Reconstruction	Project	Completed	CWCB instream flow water rights, Gold Metal Trout Streams, Rare Plants, River and stream fishing, Significant Riparian/Wetland Communities, Whitewater Boating	Ducks Unlimited Projects-D	7
Confluence of Clear Creek and Spring Gulch	General Herkimer Mill Site	Project	Completed	Rare Plants, River and stream fishing, Significant Riparian/Wetland Communities	Ducks Unlimited Projects-I	6
Como Creek	Como Creek Fishery Habitat Structures	Project	Completed	Brassy Minnow, Common Shiner, CWCB instream flow water rights, Greenback Cutthroat Trout, Iowa Darter, Northern Leopard Frog , Northern Redbelly Dace, Significant Riparian/Wetland Communities	Suckermouth Minnow -D	12
Clear Creek - Golden - just above recreational in-channel diversion	Golden Mile habitat improvement for fisheries - focused on brown trout mainly	Project	Completed	Brassy Minnow, Common Shiner, Iowa Darter, Preble's Meadow Jumping Mouse, Rare Plants, River and stream fishing, Whitewater Boating		6
Clear Creek	Courtney-Ryley-Cooper	Project	Completed	Rare Plants, River and stream fishing, Significant Riparian/Wetland Communities	Ducks Unlimited Projects-D	6
Cache La Poudre River at Mountain Park Campground	Mountain Park Campground Fish Habitat Project	Project	Completed	CWCB instream flow water rights, Eligible Wild and Scenic, Preble's Meadow Jumping Mouse, River and stream fishing, Significant Riparian/Wetland Communities, Whitewater Boating	Ducks Unlimited Projects-D	21

Table 3-4 Metro Basin Nonconsumptive Identified Projects and Processes Summary

Project Location	Project Name	Project Type	Project Status	Basin Roundtable Attributes Identified	Project Protections	Reach ID
Cache La Poudre River at Kelly Flats Campground	Kelly Flats Campground Bank Stabilization	Project	Completed	CWCB instream flow water rights, Eligible Wild and Scenic, Preble's Meadow Jumping Mouse, River and stream fishing, Significant Riparian/Wetland Communities, Whitewater Boating	Ducks Unlimited Projects-D, Gold Metal Trout Streams-D, Iowa Darter-D	21
North Fork of the Poudre	Halligan-Seaman Shared Vision Planning	Project / flow Protection	Ongoing	Common Shiner, CWCB instream flow water rights, Eligible Wild and Scenic, Iowa Darter, Preble's Meadow Jumping Mouse, River and stream fishing, Significant Riparian/Wetland Communities, Waterfowl Hunting / Viewing, Whitewater Boating	Active Bald Eagle Nests-D, Audubon Important Bird Areas-D, CWCB Instream Flow Water Rights-D, Ducks Unlimited Projects-D, Iowa Darter-D	13
Cache La Poudre River at Dutch George	Dutch George bank Stabilization	Project	Completed	CWCB instream flow water rights, Eligible Wild and Scenic, Preble's Meadow Jumping Mouse, River and stream fishing, Significant Riparian/Wetland Communities, Whitewater Boating	Ducks Unlimited Projects-D, Gold Metal Trout Streams-D, Iowa Darter-D	21
Metro Denver Greenways	River North Greenway Master Plan	Information	Completed	Audubon important bird areas, Common Shiner, Ducks unlimited projects, High Recreation Lakes and Reservoirs, Iowa Darter, Northern Cricket Frog, Northern Leopard Frog , Plains Leopard Frog, Preble's Meadow Jumping Mouse, Whitewater Boating, Yellow Mud Turtle		4
Metro Denver Greenways	River South Greenway Master Plan	Information	Completed	Audubon important bird areas, Common Shiner, Ducks unlimited projects, High Recreation Lakes and Reservoirs, Iowa Darter, Northern Cricket Frog, Northern Leopard Frog , Plains Leopard Frog, Preble's Meadow Jumping Mouse, Whitewater Boating, Yellow Mud Turtle		4
North Fork of South Platte (just below Antero)	North Fork Fish Channel	Project	Completed	Flatwater Boating, Rare Plants, Reservoir and Lake Fishing, River and stream fishing, Significant Riparian/Wetland Communities	Ducks Unlimited Projects-D	9
North Fork of South Platte	Lazy River Stream Restoration	Project	Completed	Eligible Wild and Scenic, River and stream fishing, Significant Riparian/Wetland Communities, Whitewater Boating	Ducks Unlimited Projects-D	8
Middle Fork of South Platte	Santa Maria Ranch Riparian Restoration	Project	Completed	CWCB instream flow water rights, Gold Metal Trout Streams, River and stream fishing, Waterfowl Hunting / Viewing, Whitewater Boating	Ducks Unlimited Projects-D, Waterfowl Hunting / Viewing-D	7
Middle Fork of South Platte	Buffalo Peaks Ranch Fish Habitat	Project	Completed	CWCB instream flow water rights, Gold Metal Trout Streams, Rare Plants, River and stream fishing, Significant Riparian/Wetland Communities, Whitewater Boating	Ducks Unlimited Projects-D, Waterfowl Hunting / Viewing-D	7
Middle Fork at Buffalo Peaks SWA	Buffalo Peak Ranch fishery restoration - channel modification to provide better habitat restoration for brown trout	Project	Completed	CWCB instream flow water rights, CWCB natural lake level water rights, Gold Metal Trout Streams, Iowa Darter, Rare Plants, River and stream fishing, Significant Riparian/Wetland Communities, Waterfowl Hunting / Viewing, Whitewater Boating		7
S Boulder Creek	Various bank stabilization and riparian restoration projects	Restoration	0	Common Garter Snake, Common Shiner, CWCB instream flow water rights, Ducks unlimited projects, Northern Leopard Frog , Preble's Meadow Jumping Mouse, Rare Plants, River and stream fishing, Significant Riparian/Wetland Communities, Whitewater Boating		11
South Platte (from Eleven-mile reservoir outlet to confluence with the North Platte) and North Platte (from Insmont to confluence with South Platte)	South Platte Protection Plan #5 - Outflow Ramping from Eleven Mile / Cheeseman Reservoir / Roberts Tunnel	Flow Protection	Completed	Eligible Wild and Scenic, Flatwater Boating, Gold Metal Trout Streams, Iowa Darter, Northern Leopard Frog , Preble's Meadow Jumping Mouse, Rare Plants, Reservoir and Lake Fishing, River and stream fishing, River Otter Sightings, Significant Riparian/Wetland Communities, Whitewater Boating	Active Bald Eagle Nests-D, Audubon Important Bird Areas-D, Brassy Minnow-D, Common Shiner-I, Ducks Unlimited Projects-D, Gold Metal Trout Streams-I, Iowa Darter-I, Waterfowl Hunting / Viewing-D	7

Table 3-4 Metro Basin Nonconsumptive Identified Projects and Processes Summary

Project Location	Project Name	Project Type	Project Status	Basin Roundtable Attributes Identified	Project Protections	Reach ID
0	Land conservation	Project	Planned	Bald Eagle Sites, Brassy Minnow, Common Garter Snake, Common Shiner, Ducks unlimited projects, Iowa Darter, Northern Leopard Frog , Plains Minnow, Preble's Meadow Jumping Mouse, Significant Riparian/Wetland Communities, Suckermouth Minnow, Waterfowl Hunting / Viewing		1, 2
0	Tamarack Project	Project	Ongoing	Brassy Minnow, Common Garter Snake, Common Shiner, Ducks unlimited projects, Iowa Darter, Plains Minnow, Significant Riparian/Wetland Communities, Suckermouth Minnow, Waterfowl Hunting / Viewing	Colorado Outstanding Waters-D, CWCB Instream Flow Water Rights-D, Iowa Darter-I, Northern Leopard Frog -D, Preble's Meadow Jumping Mouse -D, River Otter-D, Stonecat-D	1, 2
0	St. Vrain Creek Corridor Committee releases 1000 AF/yr to benefit minnows	flow protection	0	Bald Eagle Sites, Brassy Minnow, Common Garter Snake, Common Shiner, CWCB instream flow water rights, CWCB natural lake level water rights, Ducks unlimited projects, High Recreation Lakes and Reservoirs, Iowa Darter, Lake Chub, Northern Leopard Frog , Northern Redbelly Dace, Preble's Meadow Jumping Mouse, Rare Plants, recreational in-channel diversion structures, River and stream fishing, River Otter Sightings, Significant Riparian/Wetland Communities, Stonecat, Whitewater Boating, Wood Frog	Active Bald Eagle Nests-I, Brassy Minnow-D, Colorado Outstanding Waters-I, Common Garter Snake-I, CWCB Instream Flow Water Rights-D, Gold Metal Trout Streams-D, Northern Cricket Frog-D, Stonecat-I	14, 17
0	Seasonal wetland habitat restoration	Project	Ongoing	Bald Eagle Sites, Brassy Minnow, Common Garter Snake, Common Shiner, Ducks unlimited projects, Iowa Darter, Northern Leopard Frog , Plains Minnow, Preble's Meadow Jumping Mouse, Significant Riparian/Wetland Communities, Suckermouth Minnow, Waterfowl Hunting / Viewing		1, 2
0	Riparian restoration project	0	0	Iowa Darter, Preble's Meadow Jumping Mouse	Active Bald Eagle Nests-D	22
0	Land conservation	Project	Ongoing	Bald Eagle Sites, Brassy Minnow, Common Garter Snake, Common Shiner, Ducks unlimited projects, Iowa Darter, Northern Leopard Frog , Plains Minnow, Preble's Meadow Jumping Mouse, Significant Riparian/Wetland Communities, Suckermouth Minnow, Waterfowl Hunting / Viewing	Active Bald Eagle Nests-D, Brassy Minnow-D, Colorado Outstanding Waters-D , CWCB Instream Flow Water Rights-D, Gold Metal Trout Streams-D, Iowa Darter-D, Northern Leopard Frog -D, Preble's Meadow Jumping Mouse -D, River Otter-D, Significant Plant Communities-I, Stonecat-D	1, 2
0	Riparian habitat improvement education and outreach	Project	Ongoing	Audubon important bird areas, Brassy Minnow, Common Shiner, CWCB instream flow water rights, Iowa Darter, Northern Redbelly Dace, Preble's Meadow Jumping Mouse, Rare Plants, River and stream fishing, Significant Riparian/Wetland Communities, Waterfowl Hunting / Viewing, Whitewater Boating	Active Bald Eagle Nests-I, Common Garter Snake-I, Ducks Unlimited Projects-D, Gold Metal Trout Streams-D, High Recreation Rivers -D, Iowa Darter-D, River Otter-I, Stonecat-I	3, 5

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Section 4
Metro 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 Metro 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 Metro 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, or 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 Metro Basin at the county level. As the most populous river basins in the state, the South Platte and Metro Basins are projected to grow from approximately 3.5 million people in the year 2008 to about 6 million people by the year 2050. This amounts to an increase of about 2.5 million people, or about 73 percent, during that period. About 69 percent of all Colorado residents resided in the South Platte Basin in the year 2008; by the year 2050, that proportion will decrease only slightly to about two-thirds. Consistent with predicted population trends, the South Platte and Metro Basins have the largest employment of all basins, totaling over 2 million jobs in 2007. Over 3.4 million job opportunities are expected by 2050. Regional and national service jobs led employment in 2007 and will remain the largest source of employment in these basins in 2050. Household basic sector employment is anticipated to grow more rapidly than other basic sectors (174 percent increase between 2007 and 2050), and tourism jobs are expected to grow by about 83 percent over the same period.

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**

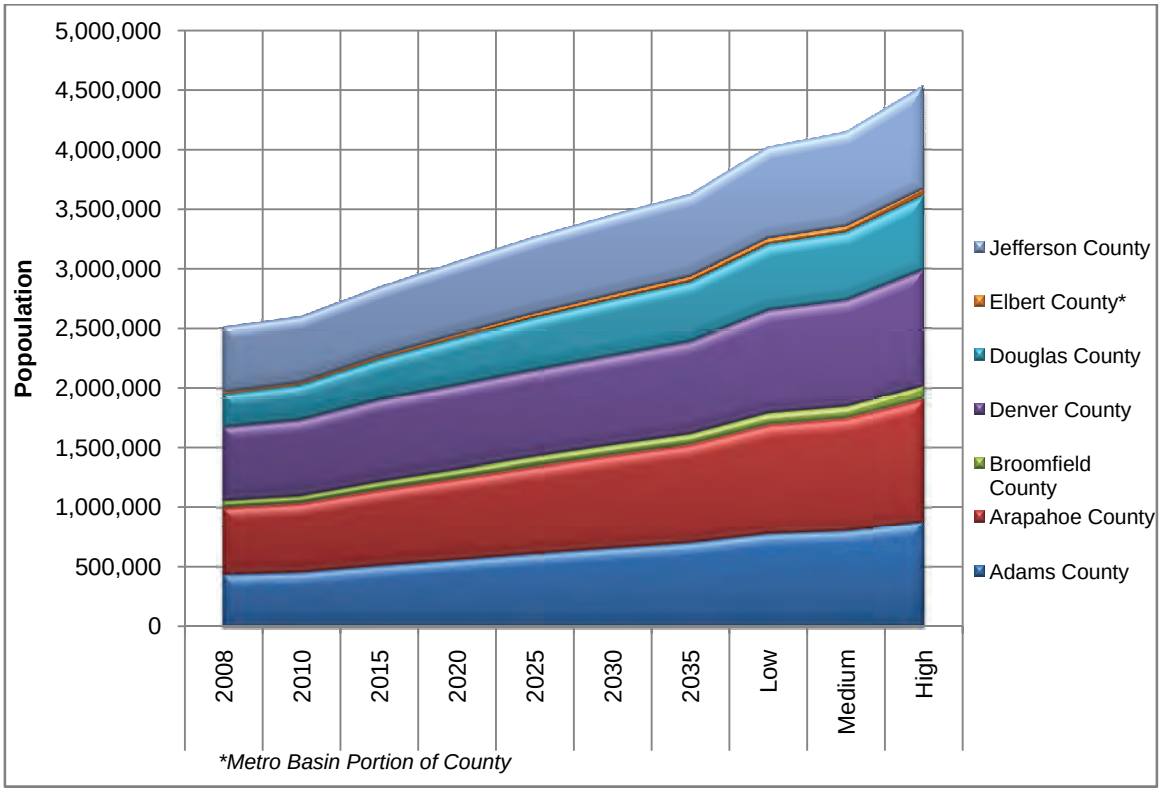

Figure 4-1 Metro Basin Population Projections through 2050

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 Conservation Highlights

Metro Basin water providers have implemented and enhanced their water conservation programs. The following are examples of the conservation programs currently ongoing in the Metro Basin.

South Metro Water Supply Authority – Water Conservation Programs

The Douglas County/South Metro region takes water conservation seriously. Every water provider that is defined as a "covered entity" by state statute (i.e., providing at least 2,000 acre-feet per year (AFY) to customers) now has a state approved water conservation plan in effect, the first such region in the State of Colorado to achieve this level of commitment to the wise use of water. Going a step further, Douglas County government has teamed with the CWCB to create a regional small user water conservation plan that covers small water providers, and even individual well owners. Gallons per capita per day use of water in the region, systemwide, is currently 148 gpcd. This figure reflects the most efficient use of water in the State of Colorado. If users in the region matched the pace of water users on the Western Slope using 225 gallons of water per day, the region's 300,000 residents would use an additional 26,000 acre-feet (AF) of water per year.

Typical features of plans in the region include a tiered rate structure that encourages water efficiency. In this arrangement, water budgets identify how much water should be used by each customer. If the customer exceeds the targeted consumption, the unit cost of water to the customer rises sharply. In addition to pricing incentives, the reuse of water is commonplace throughout the region, with many outdoor parks and recreation facilities utilizing reuse water supplies for outdoor irrigation.

While home construction in the region is recent, and indoor water efficiency is high, additional efficiencies are being pursued in outdoor irrigation. evapotranspiration (ET) irrigation controllers are in use in municipal and common space areas. These controllers help make sure that just the right amount of water is used to keep common spaces in healthy condition. This summer Douglas County Water Resource Authority will install rotary sprinkler nozzles in 1,000 yards. These devices are up to 30 percent more efficient that traditional sprinkler heads. The study should yield data points to confirm the actual amount of water that can be saved through the use of these nozzles. In as much as half of the region's water use is outdoor irrigation, these initiatives can enhance the region's leading role in water efficiency.

Education is a robust part of the water efficiency efforts in place; 6,548 school age students were educated in 2010 about the importance of water efficiency in future solutions for the region and for the state. In this unique program, high school students are trained about water and efficiency. They in turn train fourth grade students about water and efficiency. Advertisements for available rebates have been featured in local newspapers, and ads targeted to the region by way of cable television. In several seasons, television ads ran on Colorado Rockies baseball telecasts. Every single family residence in the region – 107,000 homes – has received a DVD illustrating just how easy and attractive Xeriscape efforts can be. These programs represent the most robust water education effort in the State of Colorado.

We take conservation seriously. We are achieving serious results. Conservation is an important component of water solutions for the future. We support all water users in Colorado to use water efficiently, every chance they get.

City of Thornton Water Conservation Program

The City of Thornton has witnessed the rewards that successful conservation education can produce. A variety of educational and promotional techniques have instilled a solid water conservation ethic throughout the community. This is evident in the fact that Thornton has maintained one of the lowest residential daily per capita water consumption rates among Front Range cities.

In 2003, an inclining block rate structure, revised landscape standards, and residential water-efficiency upgrade incentives were established, which helped reduce residential demand from 106 gpcd in 2001 to 88 gpcd in 2010. An updated Water Conservation Plan, adopted in 2009, demonstrates the ability of existing and planned programs to reduce demand by 2,800 AF annually by the year 2027, which is enough to supply 6,700 single-family residences.

Thornton's Water Conservation Program currently includes:

- "Save the Water" Social Marketing Campaign to promote enduring, water-efficient behaviors in the community. The campaign features a group of animated household appliances, The League of Water Savers, which encourages citizens to join their cause and pledge to save 10 gallons of water a day.
- Water Conservation Ambassador Program: Thornton residents who are passionate about water conservation and volunteer their time to help city staff with grassroots campaign efforts.
- Residential Toilet and Clothes Washer Rebates.
- Showerhead Exchange Program.
- Residential Indoor Audits.
- Residential and Commercial Irrigation System Inspections.
- Matched Precipitation Rate Spray Nozzle Retrofits.
- Multi-family Toilet Rebates.
- Commercial Toilet and Urinal Rebates.

Potential new programs outlined in the Water Conservation Plan:

- Smart Irrigation Controller and Rain Sensor Rebates.
- Hot Water Recirculation System Incentive.
- Tap fee incentives for water-efficient new construction and a soil amendment incentive are also being researched.

Denver Water – Water Conservation Program

Conservation Highlights

Denver Water launched an aggressive 10-year plan in 2007 to speed up the pace of conservation in its service area. The goal is to reduce overall water use 22 percent by 2016 from 2002 – 2004 pre-drought levels. To date, the Denver Water conservation plan has kept water use 19 to 20 percent below pre-drought use, on track to meet its 2016 goal.

2007-2010 Highlights

- Conservation programs target all customer and water use types
  - Advertising – "Use Only What You Need"
  - Rules – day and time water waste rules, new landscaping rules, large area landscape rules
  - Incentives – Commercial, industrial, government, low-income, and landscape incentive programs
  - Rebates – toilets, clothes washers, aerators, showerheads, ET controllers, rain gauges
  - Education – elementary schools program
- $40 million spent on conservation programs
- 58,000 residential rebates have been issued

Aurora Water - Water Conservation Program

Aurora Water has one of the oldest and more dynamic conservation efforts in the state, achieving a 30 percent reduction per capita water use since 2000. Started in 1980, the Water Conservation Office's mission is to promote the efficient use of Aurora's water through the education of its customers. Programs include curriculum-based education and teacher training in the Aurora and Cherry Creek Schools, the Youth Water Festival, in its 18th year and attended by 1,600 fifth grade students, several public Xeriscape gardens throughout the city, xeric, landscaping, gardening, and irrigation classes and home water audits for both interior and exterior use. Beginning in 2004, Aurora began an active rebate program for toilets, high efficiency washers, and xeric landscaping. Staffed by 12 employees, the office has helped saved approximately 4,871 AF between 2005 and 2010. Aurora's conservation programs have received much recognition, including the "Top Drop" award from Western Resource Advocates and the "Water Conservation ReWard" from the Center for Resource Conservation."

4.2.2.3 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 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.

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

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
Adams County	69,000	110,000	120,000	130,000	140,000	98,000	110,000	110,000	120,000
Arapahoe County	100,000	150,000	170,000	170,000	190,000	140,000	150,000	160,000	170,000
Broomfield County	11,000	17,000	19,000	20,000	22,000	16,000	17,000	18,000	20,000
Denver	110,000	140,000	160,000	160,000	180,000	130,000	140,000	140,000	160,000
Douglas	46,000	81,000	90,000	93,000	100,000	73,000	81,000	84,000	93,000
Elbert County-Metro Basin Portion	86	240	260	270	280	230	250	260	270
Jefferson	94,000	120,000	130,000	140,000	150,000	100,000	120,000	120,000	130,000
Total	**430,000**	**620,000**	**690,000**	**710,000**	**780,000**	**560,000**	**620,000**	**630,000**	**690,000**

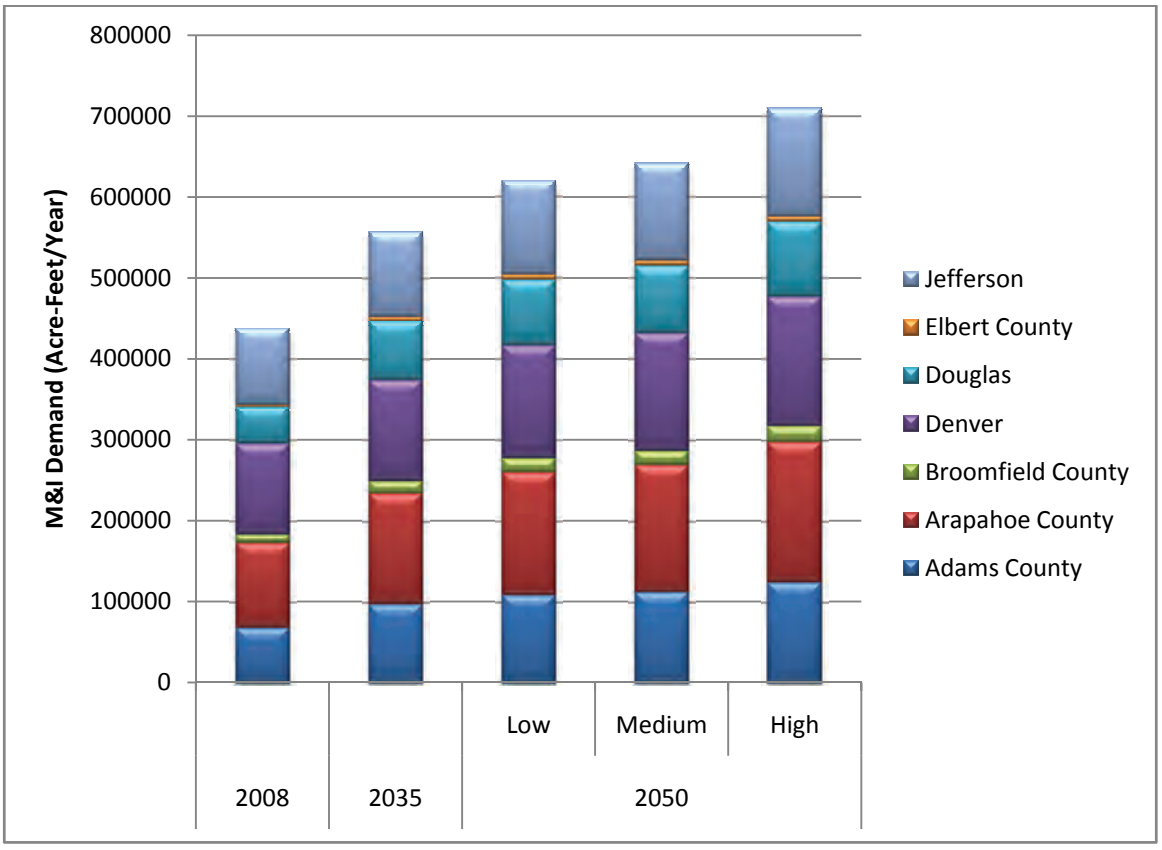

Figure 4-2 Metro Basin M&I Water Demands

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 Large Industry

The goal of this subsector is to identify large self-supplied industries in Colorado with significant consumptive water demands. These include Coors Brewing Company in Jefferson County. The sources of

information used to develop the SSI estimates for large industry are detailed in Appendix H of the SWSI 2010 Report. Results of the large industry subsector water demands forecast are provided in **Table 4-4**. No low, medium, and high growth scenarios are considered for this subsector.

Table 4-4 Large Industry Demands (AFY)

County	2008	2035/2050
Jefferson	52,400	52,400

4.2.3.2 Thermoelectric Power Generation

Water use at coal-fired and natural gas power facilities is included in the SSI water demands estimates. In 2006, nearly 95 percent of Colorado's electricity was produced from coal (71 percent) and natural gas (23 percent). Although Colorado's General Assembly has adopted a state renewable electricity standard that requires 20 percent of the state's electric portfolio to be from renewable resources of energy by 2020, demand for coal-fired and natural gas energy production will remain significant into the future. Generation facilities using fossil fuels require cooling systems to condense steam turbine exhaust. Cooling water is the most economical method to condense steam.

For SWSI 1, estimates of current and future water use at various power generation facilities in Colorado were obtained from power producers. For this update, SWSI 1 baseline estimates were assumed to stay constant until 2035. To extend 2035 projections to 2050 for Adams County and Denver County percent increases were assumed for the low, medium, and high scenarios, respectively, as follows—5 percent, 25 percent, and 50 percent. These percentages were based on expected population increases throughout the state. **Table 4-5** provides the estimates of thermoelectric water demands with 2050 low, medium, and high scenarios.

Table 4-5 Estimated Thermoelectric Power Generation Water Demands (AFY)

			2050		
County	2008	2035	Low	Med	High
Adams	9,600	9,600	10,100	12,000	14,400
Denver	2,400	2,400	2,500	3,000	3,500
Total	**12,000**	**12,000**	**12,600**	**15,000**	**17,900**

4.2.3.3 Metro Basin SSI Summary

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

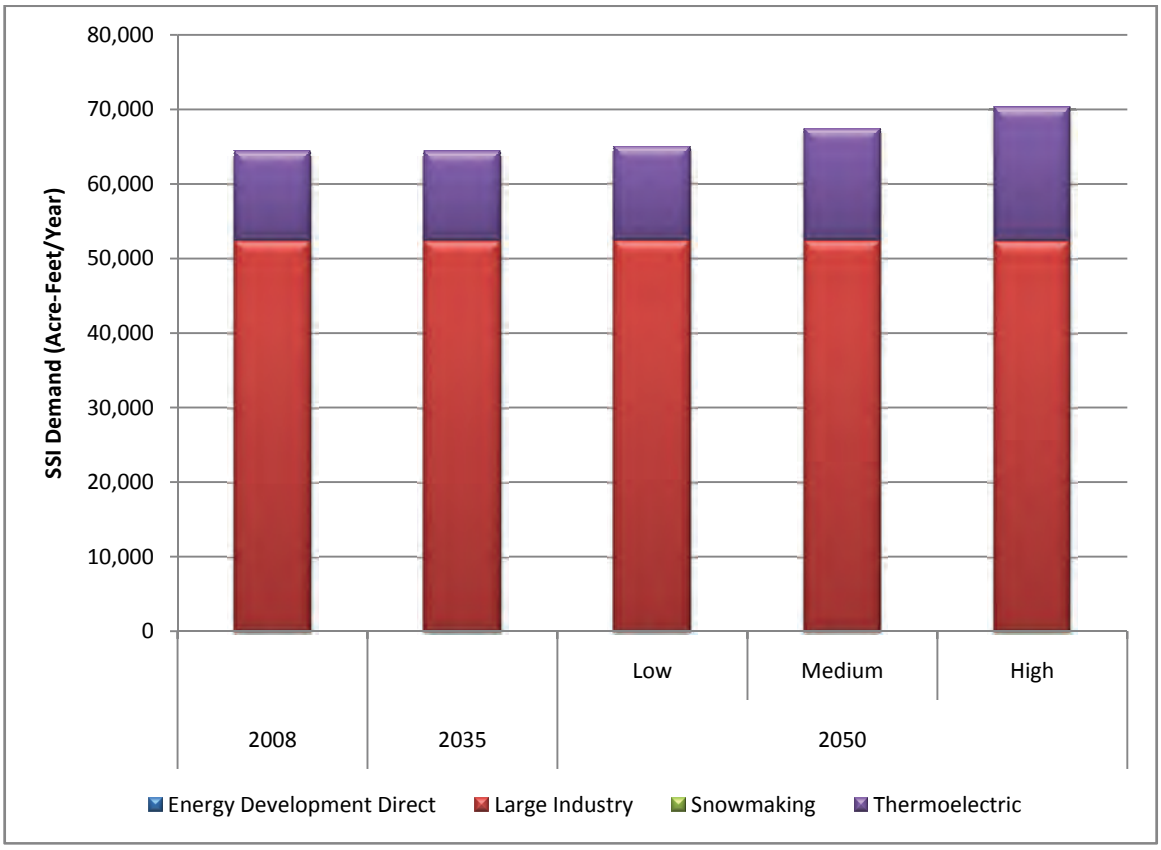

Figure 4-3 Metro Basin SSI Water Demands

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 4-6** and **Figure 4-4** summarize the Metro 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 4-6 Summary of M&I and SSI Demands for Arkansas Basin (AFY)

Basin	Demand Type[1,2]	2008	2035	2050 Low	2050 Med	2050 High
Metro	M&I	437,000	557,000	620,000	642,000	709,000
	SSI	64,400	64,400	65,000	67,400	70,300
	Total	501,400	621,400	685,000	709,400	779,300
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.

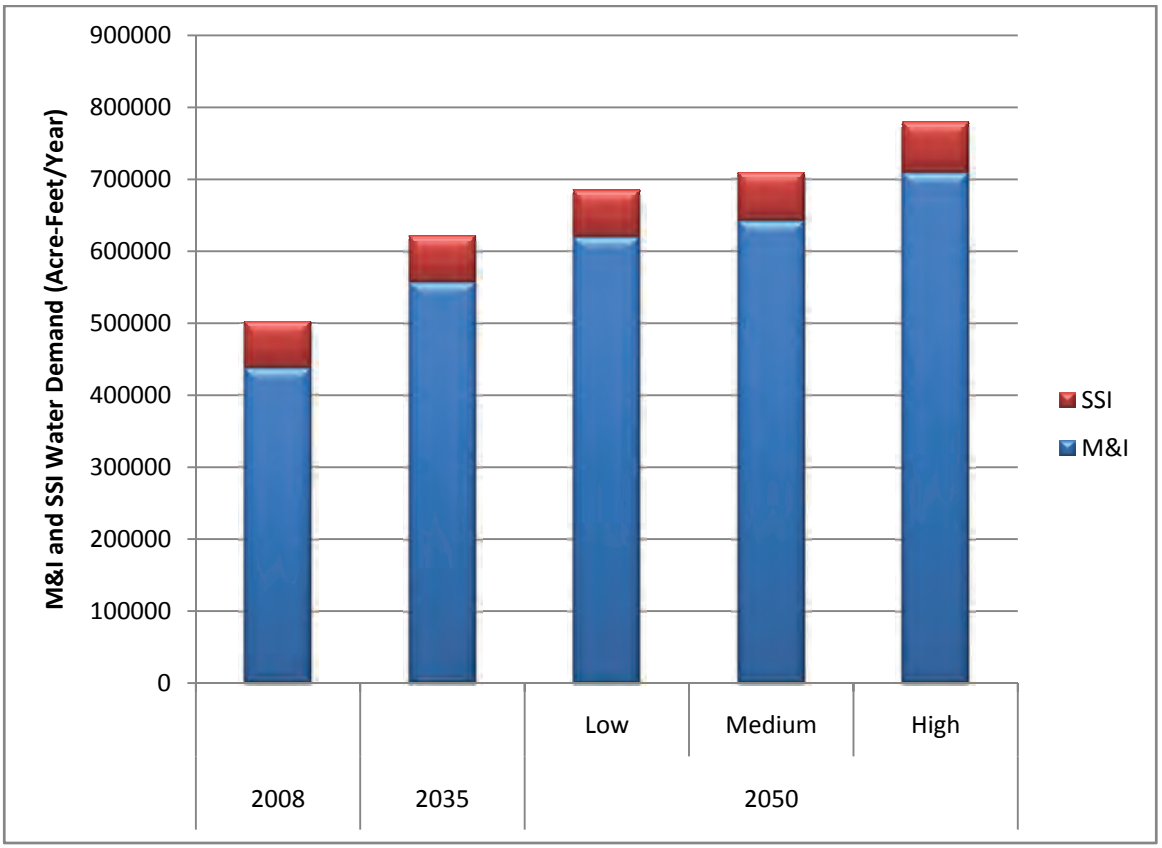

Figure 4-4. Metro Basin M&I and SSI Water Demands

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 Metro 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 re-distributed 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. For the purposes of predicting future irrigated acres it was assumed that 70 percent of M&I gap would be met from agricultural to municipal transfers. This percentage is a conservative estimate based on the assumption of 100 percent yield success rate for IPPs (see Section 5). 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.

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. 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; that is, the water required to sustain current levels of farming. 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, and a reminder that Colorado is a dry state 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. The value is in the middle of the range of factors (5 percent to 29 percent) used by the 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** shows the locations of Colorado's water districts and the spatial distribution of current irrigated acres in Colorado based on the methods presented previously. Note that spatial information was not available for the irrigated lands in the Republican River water districts.

Table 4-7 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 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.

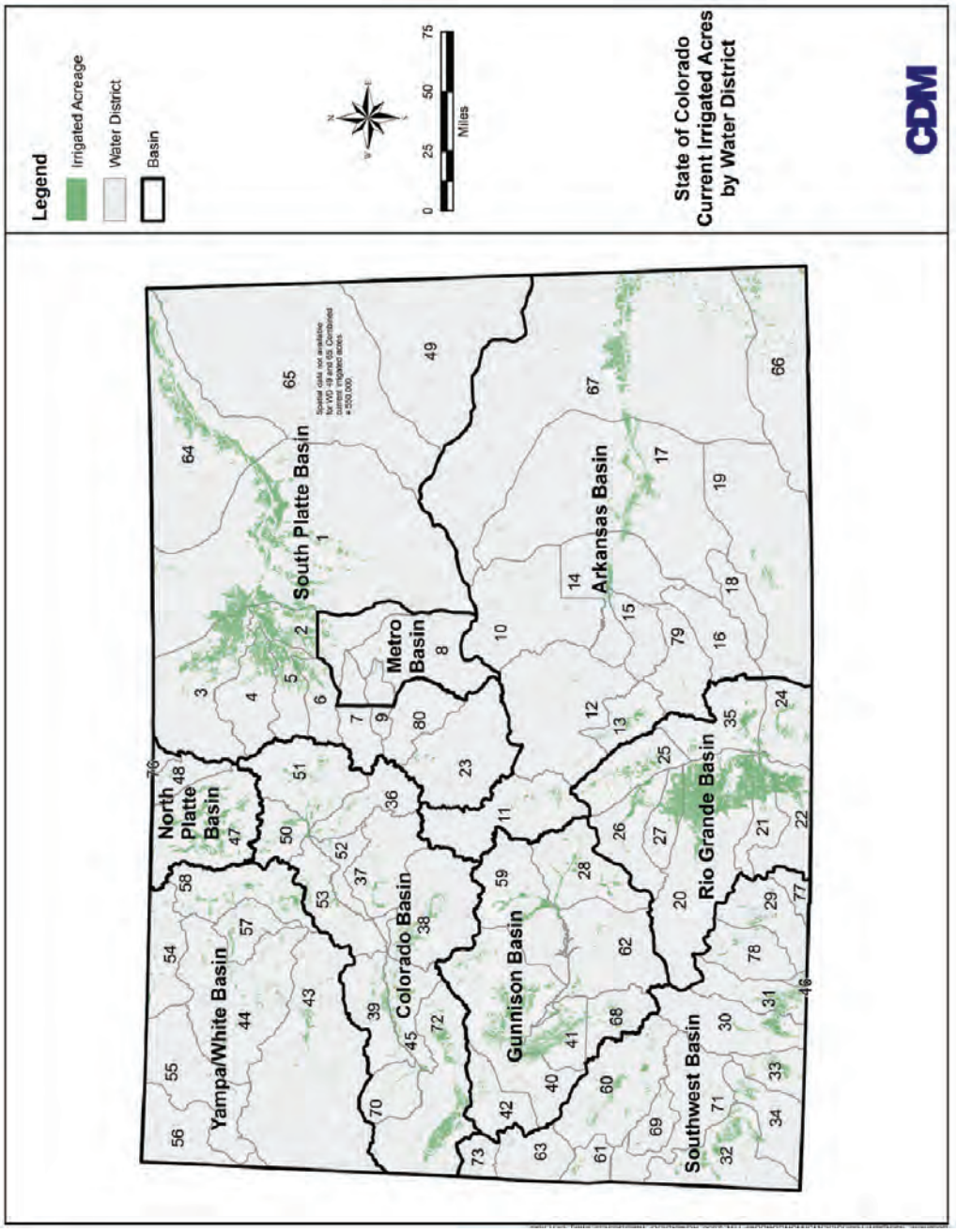

Figure 4-5 State of Colorado Current Irrigated Acres by Water District

Table 4-7 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 4-8 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.

Finally, Table 4-8 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).

Table 4-8 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**

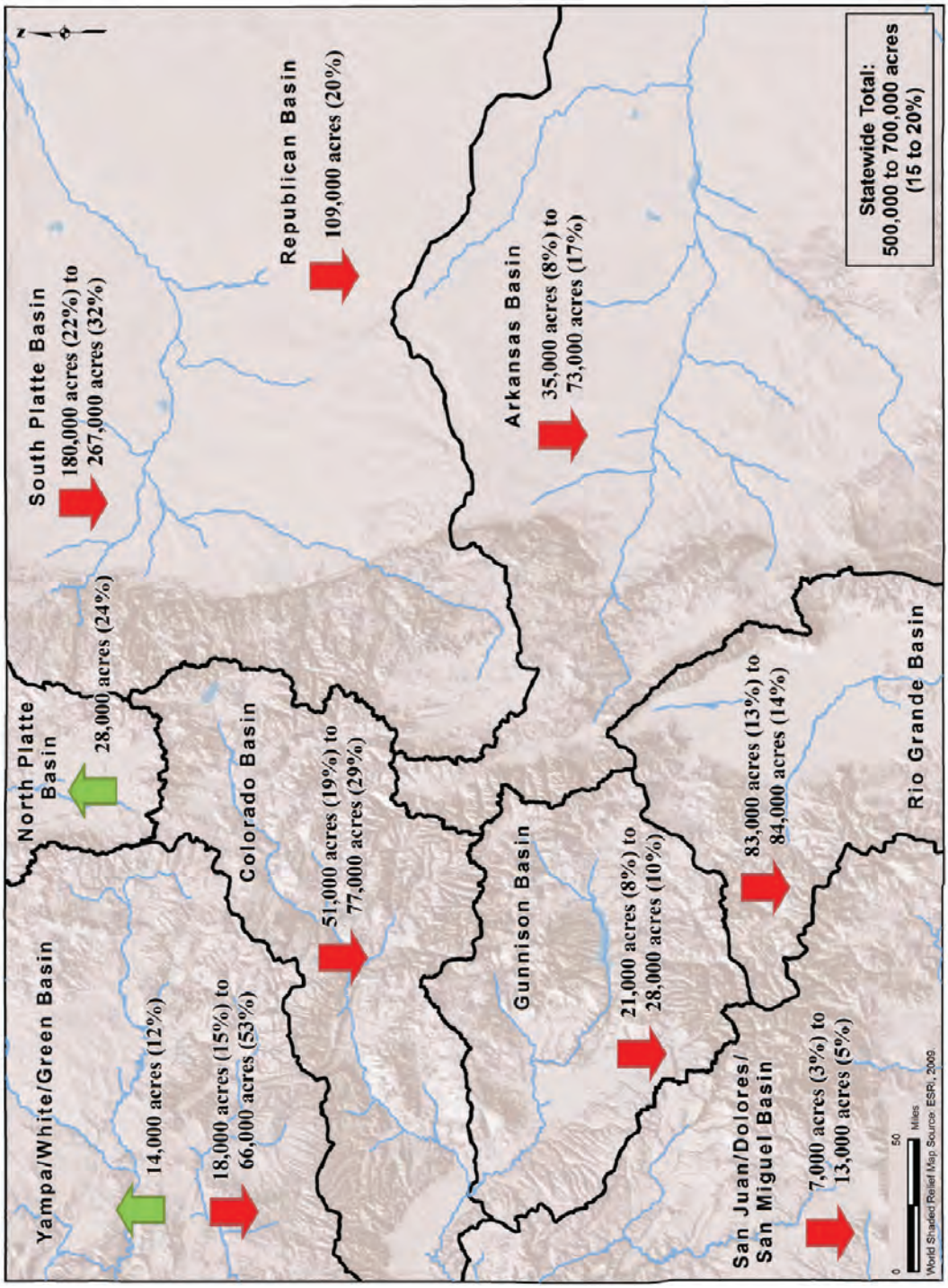

Figure 4-6 Potential Changes in Irrigated Acres by 2050

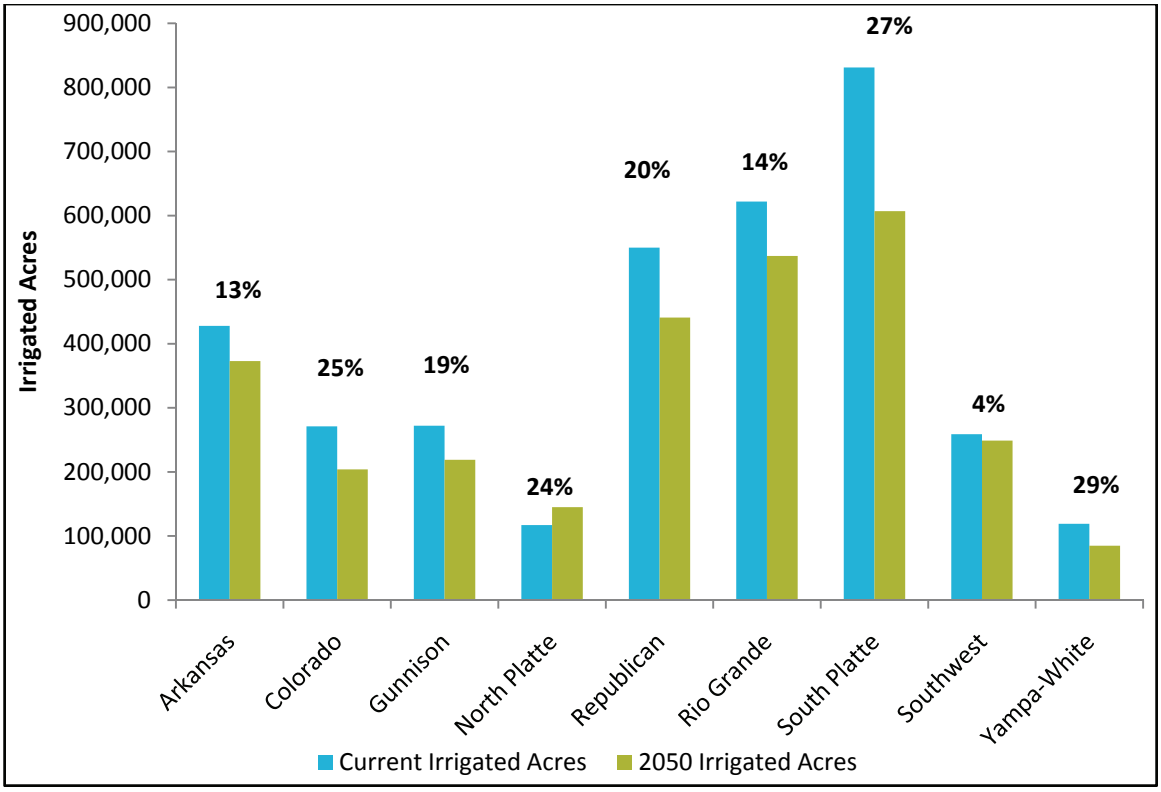

Figure 4-7 Comparison of Current and 2050 Irrigated Acres

4.3.2.3 Current Agricultural Demand Results

Table 4-9 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 4-9 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**

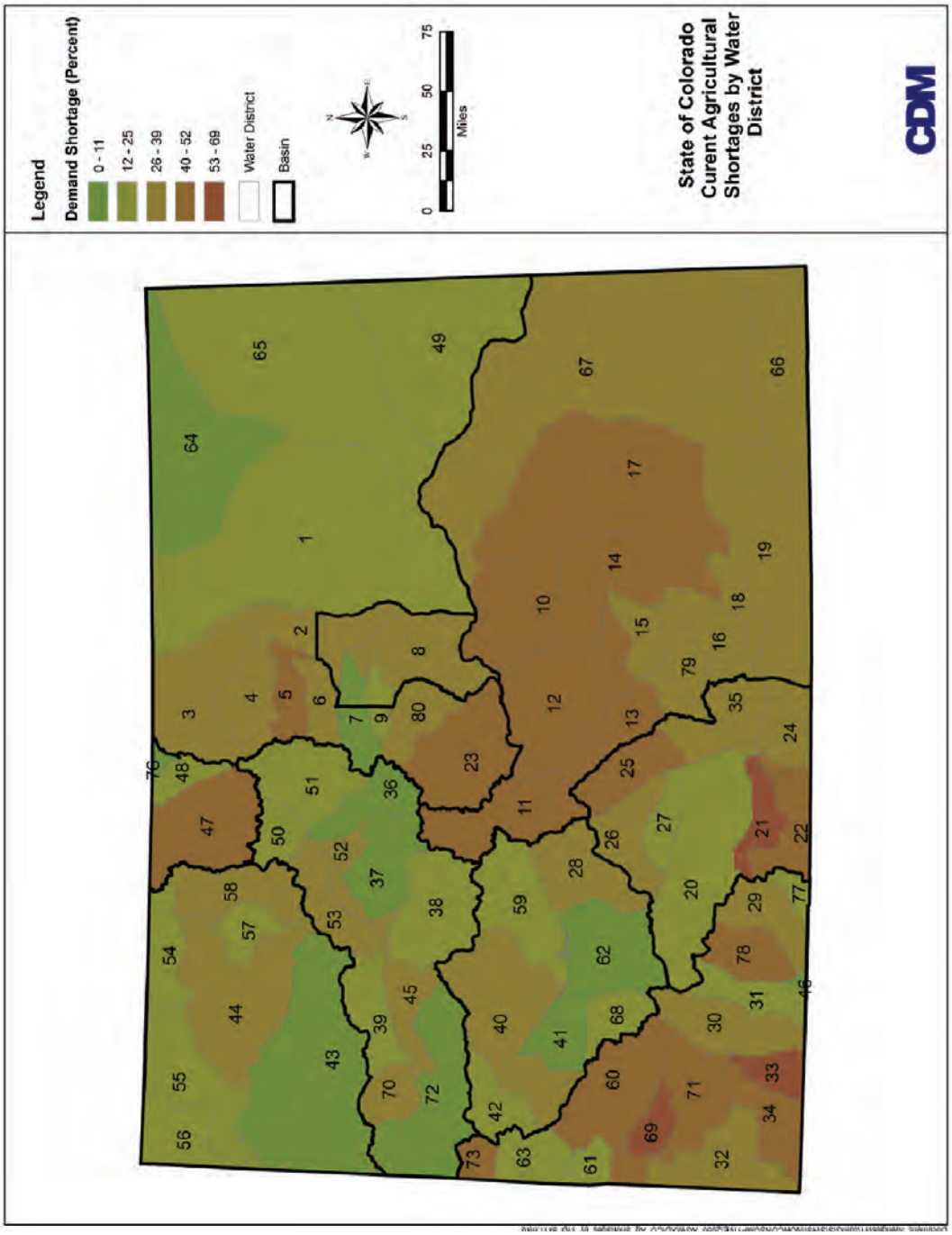

Figure 4-8 State of Colorado Current Agricultural Shortages by Water District

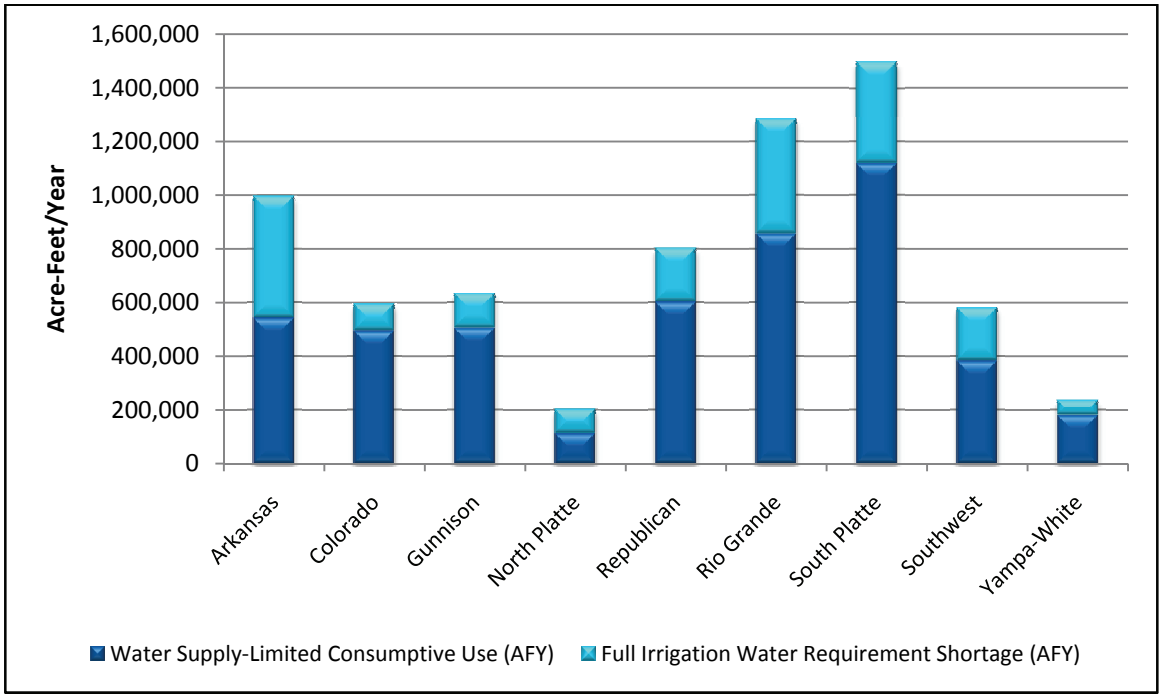

Figure 4-9 Current Agricultural Demands and Shortages

4.3.2.4 Future Agricultural Demand Results

Table 4-10 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 4-10 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**

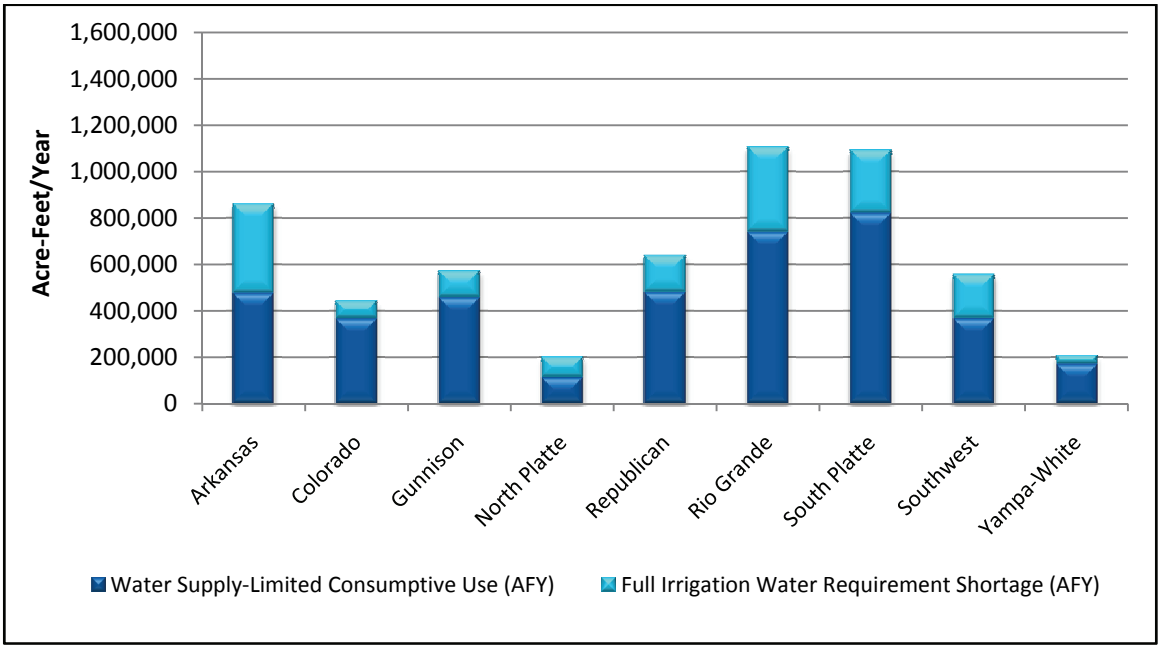

Figure 4-10 2050 Agricultural Demands and Shortages

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Section 5
Metro 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 Metro 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. As requested by the Conservation Technical Advisory Committee and for the purposes of this analysis, active conservation is considered a strategy for meeting the M&I gap and is described in Section 7.

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.

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.

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

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

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)
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.

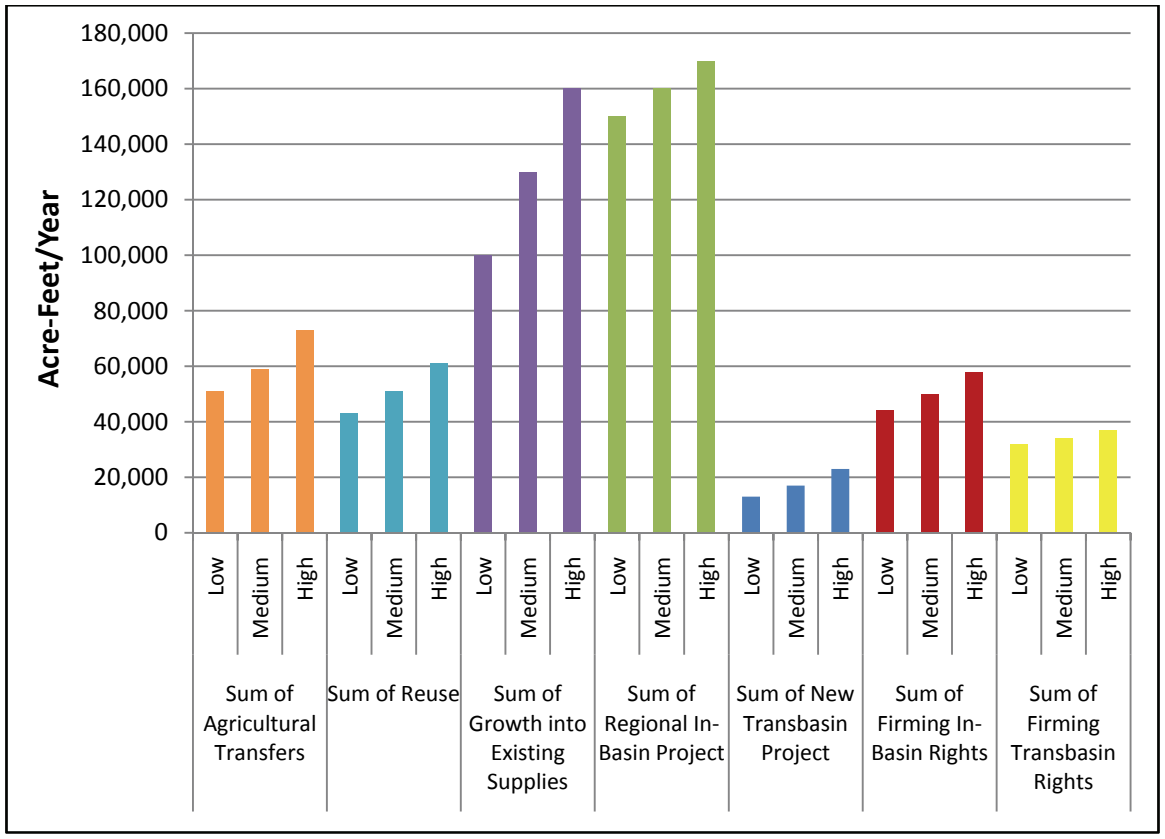

Figure 5-1 Statewide Summary of Yield for IPP Categories at 100% Success Rate

5.2.2.2 Metro Basin

As was done for the Arkansas Basin, the counties of the Metro Basin were aggregated to a regional subbasin level as follows:

- Denver Metro (Adams, Broomfield, Denver, Jefferson)
- South Metro (Arapahoe, Douglas, Elbert)

These regions are illustrated in **Figure 5-2**.

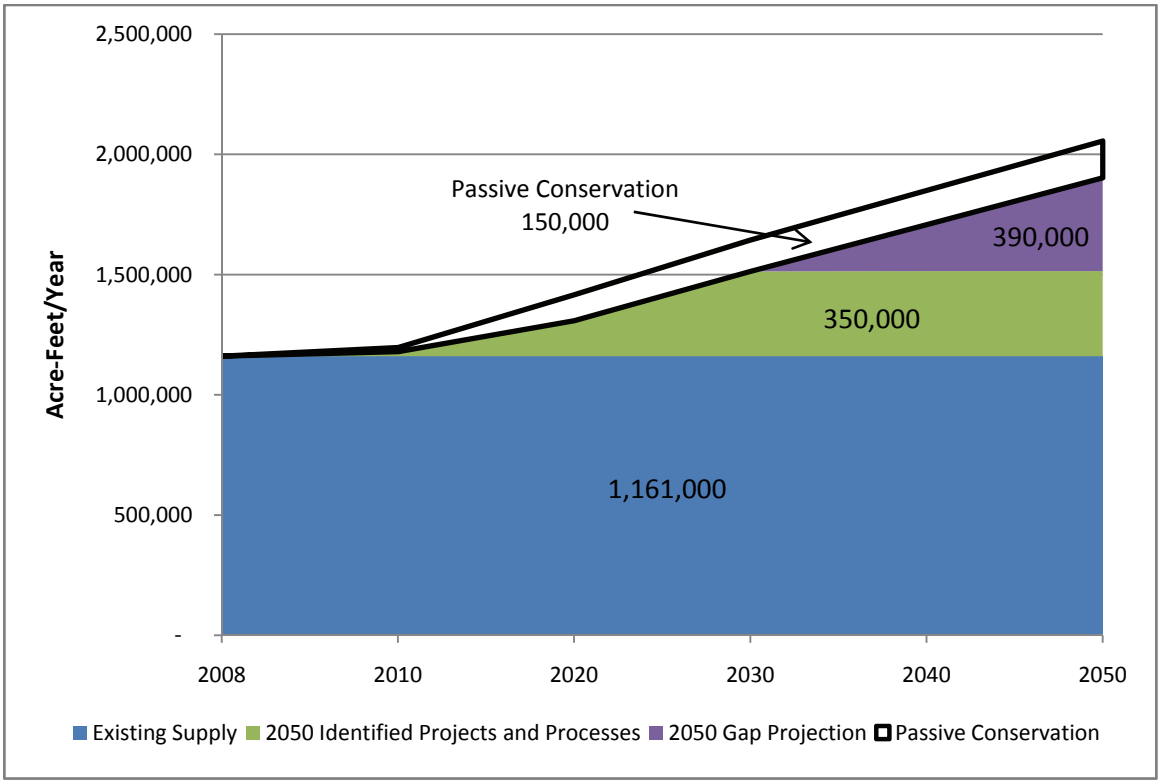

Figure 5-2 Statewide M&I and SSI Gap Summary Medium Scenario (IPPs at 70% Success Rate)

In the Metro Basin, reuse is being pursued by almost all cities that own reusable supplies. The trend toward the use of gravel pit sites that are no longer mined for storage of reusable effluent will expand. The potential for future water rights exchanges of effluent will be considerably less in the Denver and South Metro areas as most of the exchange potential has already been tied up with existing exchange water rights applications. These exchanges, however, will continue to be made when and where feasible. Direct reuse of effluent is largely focused on nonpotable uses such as irrigation of parks and golf courses, though other nonpotable uses are becoming more prevalent (e.g., power plant cooling water supply). A few cases of indirect potable reuse—intentionally augmenting raw drinking water supplies with treated reclaimed domestic wastewater effluent—are being implemented or planned, and more are likely in the future as water treatment technology advances. Specific IPPs associated with reuse include Aurora's Prairie Waters Project; Thornton, Northglenn, and Brighton recapture and exchange plans; the East Cherry Creek Valley Northern Pipeline Project; and planned reuse by the Town of Castle Rock.

The Denver Water Combined Service Area (CSA) extends into nearly every surrounding county, meeting at least some of the water supply needs of Denver, Arapahoe, Jefferson, Douglas, and Adams counties. Therefore, proposed future system refinements and modifications and the Moffat Collection System Project will meet some of the 2050 M&I needs in all of those counties. Other providers in the Denver Metro area will rely on existing supplies, reuse, exchanges, gravel lake storage, new storage and reservoir enlargements (e.g., Chatfield Reallocation Project), and agricultural transfers from Clear Creek and elsewhere.

SWSI 1 noted that there are no reliable surface water supplies that can be developed from the South Platte using surface water diversions as the sole water supply source. In addition to reuse and other projects previously mentioned, IPPs for the South Metro area include the Water Infrastructure and Supply Efficiency Partnership between Denver Water, Aurora Water, and the South Metro Water Supply Authority as well as the nearly 15,000 AF enlargement of Rueter-Hess Reservoir by Parker Water & Sanitation District and other water providers.

Based on data collected during the CWCB interview process, IPPs for the City of Aurora and Denver Water were apportioned to multiple counties as follows:

- City of Aurora IPPs were split between Adams County (40 percent), Arapahoe County (58 percent), and Douglas County (2 percent). These percentages are based on the portion of Aurora's population located in each county.
- Denver Water IPPs were proportionally split among several Metro Basin counties based on the percentage of county population located within Denver Water's CSA. The relative proportion of Denver Water IPPs and provider-specified gap applied to each county varied by growth scenario (low/medium/high). However, the base percentages served by Denver Water are as follows:
  - Denver County – 100 percent
  - Arapahoe County – 35 percent
  - Jefferson County – 54 percent
  - Douglas County – 5 percent
  - Adams County – 10 percent

The yield associated with the Chatfield Reallocation Project was distributed based on participant storage ratios adjusted to reflect the pending sale of Brighton's share to other participants. These adjusted storage ratios were assumed to be directly applicable to yield as well, so they were applied to the estimated 8,500 AFY project yield.

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

Table 5-2 Metro 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)
Denver Metro	14,500 – 23,100	5,200 – 8,700	33,400 – 61,200	8,800 – 12,900	7,600 – 14,700	900 – 1,400	3,500 – 4,800	73,900 – 126,800
Denver Metro IPPs • Growth into existing supplies • Agricultural transfers (Clear Creek; South Platte and Beebe Draw Project) • Gravel lakes and other firming storage • Recapture and exchange plans • System refinements and modifications • Prairie Waters Project • Chatfield Reallocation Project • Eagle River Joint Use Project • Box Creek Reservoir • Moffat Collection System Project • Windy Gap Firming Project • Highway 93 Lakes								
South Metro	5,100 – 9,600	8,700 – 12,400	22,100 – 24,900	25,300 – 25,900	5,800 – 7,800	0	0	67,000 – 80,600
South Metro IPPs • Growth into existing supplies • Agricultural transfers • System refinements and modifications • Prairie Waters Project • East Cherry Creek Valley Northern Pipeline Project • Chatfield Reallocation Project • Eagle River Joint Use Project • Box Creek Reservoir • Moffat Collection System Project • Rueter-Hess Reservoir enlargement • Water Infrastructure and Supply Efficiency (WISE) • Other reuse projects								
Total[1]	**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**

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

5.2.2.3 IPP Highlights

Denver – Moffat Firming

If approved, the Moffat Collection System Project would produce 18,000 AF of new supply by expanding Gross Reservoir. The current dam height would increase from 340 feet to approximately 465 feet, adding 72,000 AF to the reservoir's capacity. The U.S. Army Corps of Engineers (USACE) is currently preparing a Final Environmental Impact Statement (EIS) and Denver Water anticipates receiving a permit from the USACE in 2012. Additionally, prior to start of construction, Denver Water also needs to amend the existing Federal Energy Regulatory Commission license for Gross Reservoir. This process will take place concurrently with the Final EIS and issuance of the USACE permit.

The Colorado Wildlife Commission is currently reviewing the mitigation and enhancement plans for the Moffat Collection System Project as prepared by Denver Water. The commission will be making a recommendation as to the adequacy of these plans at their June 2011 meeting. Once approved by the commission and CWCB, the plans will become the official state position on mitigation for the Moffat Collection System Project.

Colorado River Cooperative Agreement, April 28, 2011

Focused on cooperation, the proposed agreement brings parties who traditionally have been at odds together as partners on a path to responsible water development benefitting both the East and West Slopes. It achieves better environmental health for the Colorado River Basin; maintains high-quality recreational use; and improves economics for many cities, counties, and businesses impacted by the river. The proposed agreement, which was 5 years in the making, will now be considered by towns, counties, and water entities from the headwaters to the Utah state line.

With 34 partners stretching from Grand Junction to the Denver metro area, the proposed agreement is the largest of its kind in the history of the state. In addition to its benefits for Denver Water and the West Slope, the proposed agreement will trigger a major water-sharing and conservation arrangement between Denver Water, Aurora Water, and water providers in the South Denver metro area. Taken as a whole, these landmark agreements may mark the most significant change Colorado has seen in how the state's water resources are managed.

The proposed agreement focuses on significantly enhancing the environmental health of much of the Colorado River Basin and its tributaries, as well as supporting many West Slope cities, towns, counties, and water providers as they work to improve the quality and quantity of water through new municipal water projects and river management initiatives. In exchange for environmental enhancements, including financial support for municipal water projects and providing additional water supply and service area restrictions, the agreement will remove opposition to Denver Water's Moffat Collection System Project.

WISE Partnership and WISE Water Supplies

In 2008, Denver Water and Aurora Water initiated detailed evaluations of using their individual water resources and infrastructure collaboratively to meet their long-term water supply needs. As part of that effort, now known as the WISE partnership, Denver Water and Aurora Water identified the potential for supplies to be made intermittently available to South Metro Water Supply Authority (SMWSA) members through an extension of the collaborative process.

The WISE partnership is based largely on the utilization of available Denver Water and Aurora Water reusable return flows available in the South Platte River generally downstream of Denver. In September 2010, Aurora began operating the Prairie Waters Project (PWP); a major renewable supply project that includes:

- Diversion from the South Platte River near Brighton via alluvial wells utilizing river bank filtration
- Aquifer recharge and recovery
- Conveyance of over 30 miles to the Peter Binney Water Purification Facility near Aurora Reservoir
- Advanced treatment at that facility

According to initial planning work completed by Denver Water and Aurora Water, it is expected that Aurora Water will only need the full capacity of its PWP system in peak summer demand periods of drought years. Outside those periods, Aurora Water anticipates having available water supplies and infrastructure capacity that could allow it to make treated water available to other utilities.

Denver Water also owns reusable return flow supplies in the South Platte River below Denver. While a portion of Denver Water's return flows are designated for further treatment and urban non-potable reuse via its Recycled Water Treatment Plant, a significant quantity of return flows are discharged to the South Platte River.

In some years, Denver Water could benefit from an ability to recapture those flows or other water resources that may be available in the Middle South Platte River. Rather than construct independent Denver Water infrastructure to infrequently or intermittently access those resources, Denver Water entered into the WISE partnership with Aurora Water to investigate the feasibility of using PWP infrastructure to accomplish those goals. When needed, Denver Water may use the PWP infrastructure and take treated water from the PWP system to blend with other Denver Water supplies. This effectively allows the PWP to function as a strategic supply reserve for Denver Water. It is anticipated that Denver Water could make its available reusable return flows accessible to others in years when Denver Water does not need to rely on the PWP to augment other supply sources.

WISE supplies to SMWSA from Aurora Water and Denver Water would be primarily off-peak and during non-drought years. Aurora Water and Denver Water will coordinate with SMWSA to minimize large fluctuations in flows from day-to-day, but the deliveries to SMWSA would vary significantly from season-to-season and year-to-year. Projections by the WISE technical modeling and engineering team based on historical hydrologies indicate that there could be extended periods where little or no water would be made available to SMWSA. During those periods, SMWSA participants in the WISE project would need to rely on alternate sources, and/or would need to draw upon WISE supplies that had been previously stored in surface reservoirs and/or aquifer storage and recovery (ASR) facilities.

South Metro Projects

SMWSA has identified and is proceeding forward with several projects to meet current and future demands. These projects include moving forward with the Chambers Pipeline from East Cherry Creek Valley's Western Line to Rueter Hess Reservoir. Parker Water and Sanitation District, one of the SMWSA entities, is near completion of the Rueter Hess Reservoir project. Rueter Hess Reservoir will provide 72,000 acre-feet (AF) of storage to accommodate the needs of Parker, Castle Rock, Castle Ones North, and Stonegate Metropolitan District. SMWSA has recently started an ASR Pilot Study to develop a greater understanding of the ASR potential in the Denver Basin aquifers.

Prairie Waters

In October, 2010, Aurora formally dedicated its PWP. The $650 million project is a state-of-the-art water reuse effort. It allows Aurora to recapture its reusable return flows on the South Platte River approximately 34 miles downstream, naturally purify the water through riverbank filtration and aquifer recharge and recovery, and then pump the supply back to the city through a 60-inch steel pipeline and three pumping plants to an advanced water treatment facility within the city. The water treatment facility utilizes softening, high intensity ultraviolet light, filtration, and activated carbon absorption. The treated water is then mixed with low total dissolved solids mountain sources. The PWP will help "firm" Aurora's water supplies in times of drought. The PWP will initially be operated at approximately 10,000 AFY, but has the capacity to grow to 50,000 AF. It may also become the infrastructure backbone of a regional water supply solution, i.e., the WISE Partnership.

FRWC Economic Study

In December 2009, the Front Range Water Council (FRWC), whose members include the major Front Range transbasin diverters, issued a report titled "Water and the Colorado Economy." It recognized that there will be significant population growth along the Front Range corridor between now and 2050, with a potential water supply gap as identified by the state in its SWSI process. It also made the following observations:

- The Front Range average annual water withdrawn is 2.9 million AF (19.4 percent of state total) of which 962,000 AF (6.4 percent of state total) is for M&I and 1.9 million AF (13 percent of state total) is for agriculture.
- While the Front Range withdraws 19.4 percent of the state's water, it generates 80 to 86 percent of the state's economy and tax revenue. Western Colorado withdraws 41 percent of the state's water and is the second largest region in the state, comprising approximately 10 percent of the economy.
- Front Range agriculture represents 33.4 percent of the state's agricultural output and 13.7 percent of the state's agricultural water withdrawals.
- The Front Range generated $386.8 billion in sales in 2007, 86 percent of the state's total.

- For every AF of water withdrawn, the Front Range generates $132,000 in sales of goods and services. This is 11 times more than the next most productive region, which is the Central Mountains.

The report went on to note the significant economic "interdependence" between the different regions of the state, with a large intrastate transfer of goods and services as people and goods move for both business and recreational purposes. Both the significance of the Front Range economic output and the interdependence between the various regions of the state should be kept in mind as future water policy is established.

5.2.2.4 South Platte Basin

For the purpose of conducting the IPP and gap analysis updates, the counties of the South Platte Basin were aggregated to regional subbasins, as follows:

- Northern (Boulder, Larimer, Weld)
- Upper Mountain (Clear Creek, Gilpin, Park, Teller)
- Lower Platte (Logan, Morgan, Sedgwick, Washington)
- High Plains (Cheyenne, Kit Carson, Lincoln, Phillips, Yuma)

The regions of the South Platte Basin are depicted in Figure 5-2 in Section 5.2.2.2.

Most of the interviewed M&I water providers indicated that they believe they will be able to meet 2050 needs using existing supplies, projects that are now underway, and future plans and projects. Most providers are pursuing enlargement of existing reservoirs and new storage, and consider those actions critical to meeting future needs.

Projects contributing to meeting the future needs of Northern South Platte M&I users include the Northern Integrated Supply Project (NISP) and the Windy Gap Firming Project (WGFP), both applied for by the Northern Colorado Water Conservancy District acting on behalf of numerous participating water providers and presently undergoing National Environmental Policy Act (NEPA) review. Yield from these projects was allocated to the counties in which the participants are located. Other major projects include the Halligan and Milton Seaman Reservoir enlargements proposed by the cities of Fort Collins and Greeley, respectively. In recent CWCB interviews, the cities of Longmont and Loveland indicated future yield from agricultural transfers via water rights dedication policies; the city of Greeley plans to pursue acquisition of Cache la Poudre Basin agricultural water rights. Other key Northern region projects include Erie's reclaimed water project; Longmont's Union Reservoir enlargement and Union Pumpback Project; and a portion of the Chatfield Reallocation Project yield for entities in Weld County.

In the High Plains region, continued reliance on nontributary groundwater supplies is expected to occur to meet future M&I needs through 2050. The northern High Plains Ogallala aquifer is anticipated to provide for the limited M&I growth anticipated in this region; thus, IPPs were set equal to 100 percent of 2050 net new M&I and SSI water needs. The Lower South Platte area will rely on existing rights and agricultural transfers for well augmentation. NISP represents a major new source of water for Morgan County (4,900 AFY). Based on SWSI 1 assumptions regarding these supply sources, IPPs for the Lower South Platte region were set equal to 50 percent of 2050 net new M&I and SSI water needs.

The Upper Mountain areas primarily rely on groundwater for M&I demands. These areas will have the challenge of the limited physical availability of groundwater. Much of the groundwater is in fractured bedrock and well yields can be highly variable and decline as additional growth occurs. Many of these areas already experience reduced well production. Additionally, the Upper Mountain Counties have large numbers of pre-1972 platted lots, which are not required to provide augmentation. Many of these lots are platted with high densities. These approved densities may impact well yields, and trucked water or onsite

storage tanks may be required to meet peak demands for some in-home domestic uses if additional development occurs.

Jefferson County is in the process of regulating densities in certain mountain areas in order to prevent over development of the limited groundwater resources. The Upper Mountain Counties Aquifer Sustainability Project, which was completed in late 2010, provides much greater detail on the current and future water needs of this region (the results of this study will be incorporated into the South Platte Basin Needs Assessment, to be completed in the first half of 2011). Despite these potential limitations, yield assumptions from SWSI 1 were followed for the present study, and IPPs for the Upper Mountain Counties region were set equal to 90 percent of 2050 net new M&I and SSI water needs. A small amount of the Chatfield Reallocation Project was assumed to be included in Park County's IPPs (42 AFY for Center of Colorado Water Conservancy District).

Anticipated yields from each category of IPPs at 100 percent success rate are summarized for the South Platte Basin in **Table 5-3.**

Table 5-3 South Platte 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)
High Plains	0	0	1,400 – 3,400	0	0	0	0	1,400 – 3,400
High Plains IPP • Nontributary groundwater								
Lower Platte	0	0	2,400 – 5,000	4,900	0	2,300 – 5,100	0	9,600 – 15,000
Lower Platte IPPs • Growth into existing supplies • Augmentation plans • NISP								
Northern	18,900 – 20,500	5,400 – 7,300	14,200 – 17,600	31,900 – 34,500	0	17,000	18,400 – 21,300	105,800 – 118,200
Northern IPPs • Growth into existing supplies • Agricultural transfers • Reclaimed water projects • Union Reservoir enlargement • NISP • WGFP • Halligan Reservoir enlargement • Milton Seaman Reservoir enlargement • Chatfield Reallocation project								
Upper Mountain	0	0	2,500 – 3,700	40	0	2,500 – 3,700	0	5,000 – 7,500
Upper Mountain IPPs • Growth into existing supplies • Augmentation plans • Chatfield Reallocation Project								
Total[1]	**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**

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

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 each of the nine basin roundtable areas.

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 CU 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 Metro Basin

Following are the assumptions used to revise the gap calculations for the Metro Basin:

- The 2050 net new water needs were calculated based on the Demands to 2050 Report as described for the general approach.
- For the Denver Metro and South Metro counties, the IPPs were quantified based on information gathered from water providers in CWCB interviews, as described in Section 5.2.2.2.
- The information/real gap was based on a combination of provider-specified gaps and/or 2050 net new water needs in excess of IPPs.

For several Metro-area counties, total IPPs exceed 2050 net new water needs. However, if there were provider-specified gaps for the county, the IPPs were scaled back accordingly. In other words, if an interviewed water provider specified a future water supply gap, IPP yield in from other providers in the county was not assumed to meet this gap, even if total countywide IPPs appear to exceed 2050 new water needs.

It was also necessary to account for additional gap in the South Metro area due to declining existing supplies. The South Metro area currently relies primarily on nontributary, nonrenewable groundwater. As noted in the South Metro Study, the costs of continued reliance on nonrenewable Denver Basin aquifer water will increase dramatically as well yields decline and additional wells and infrastructure are needed to maintain current level of groundwater pumping. These costs will not resolve the issue of the long-term reliability of the resource and the ultimate need to develop a renewable source of water. To continue to use as well yields decline, the amount needed (the gap between supply and demand) will become significant. Already, the gap values estimated for South Metro include 20,850 AFY—in addition to the amount of gap calculated based on 2050 demands and IPPs—due to the necessary replacement of existing nonrenewable groundwater supplies.

5.3.1.2 South Platte Basin

Following are the assumptions used to revise the South Platte Basin gap calculations:

- The 2050 net new water needs were calculated based on the Demands to 2050 Report as described for the general approach.
- IPPs for the various regions of the South Platte Basin were assessed as described in Section 5.2.2.3.
- Information/real gaps for the counties in the Northern region were calculated as 2050 net new water needs minus IPPs (low/medium/high); Boulder County appears to have no 2050 water supply gaps.
- Based on the calculation of IPPs, the effective information/real gaps for the outlying regions of the South Platte are as follows: Upper Mountain Counties (10 percent of 2050 net new M&I and SSI water needs); Lower South Platte (50 percent of 2050 net new M&I and SSI water needs); and High Plains (zero gap).

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. 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. 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 5-4**.

Table 5-4 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 5-5 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 5-5 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 5-3** 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.

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.

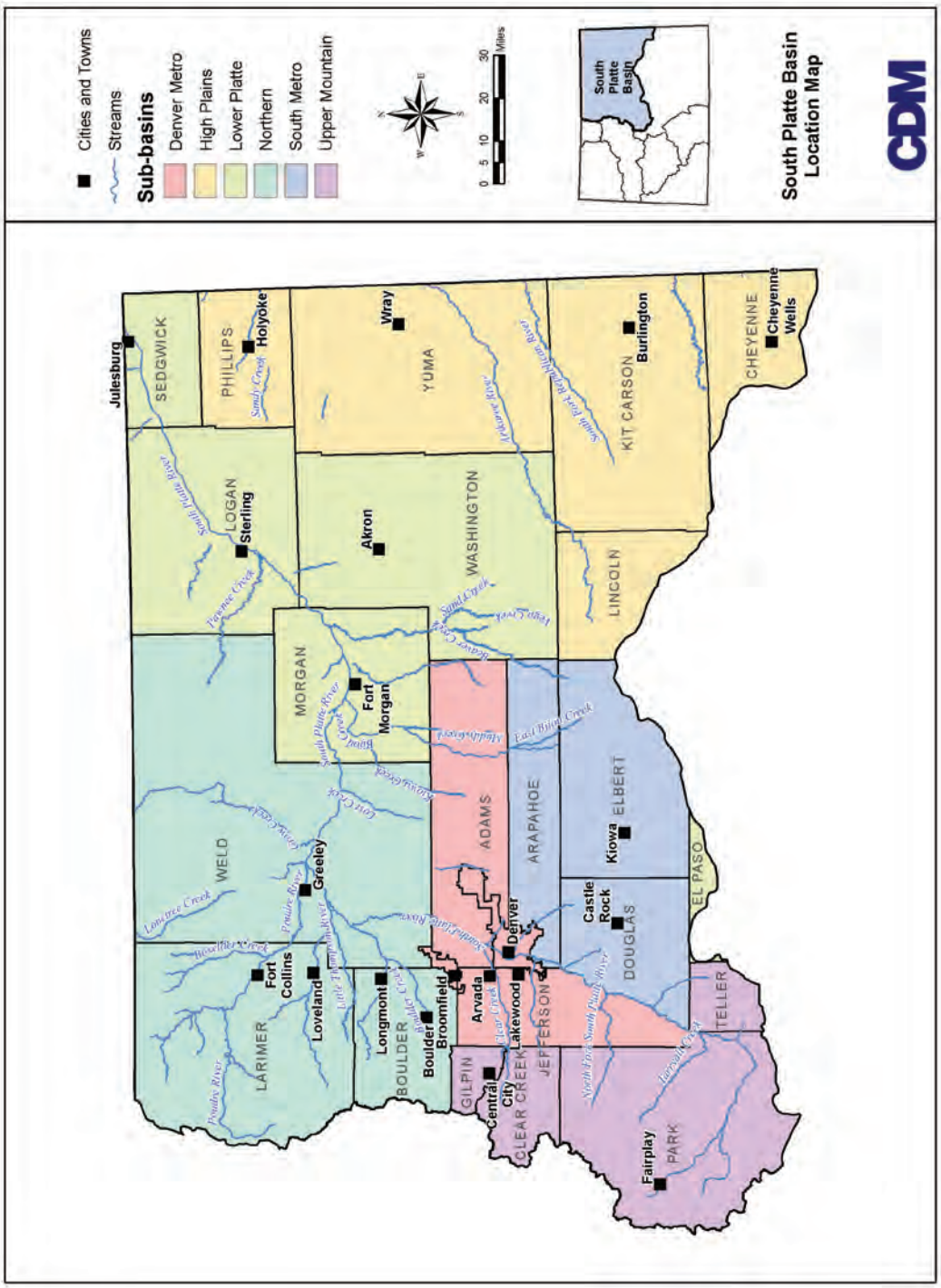

Figure 5-3 South Platte Basin Location Map

Figure 5-4 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.

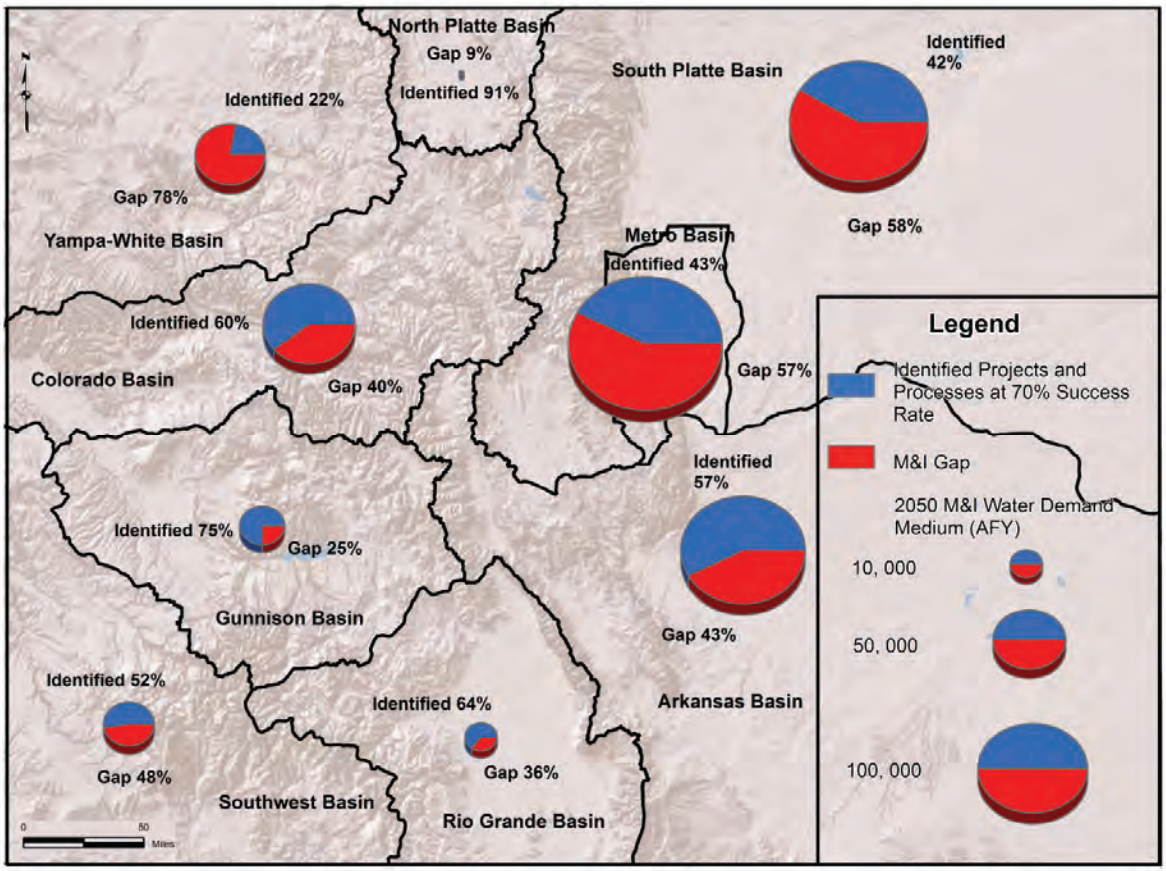

Figure 5-4 2050 M&I and SSI Gap Analysis – Medium Gap Scenario

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 NEPA review receive permits for project construction from the jurisdictional federal agency (Bureau of Reclamation or U.S. Army Corps of Engineers for most ongoing EIS projects). The list of these projects includes high-yield regional projects such as NISP, WGFP, 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 5-5** and **5-6**. 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 5-5 and 5-6 the new demand values also include the replacement of nonrenewable groundwater.

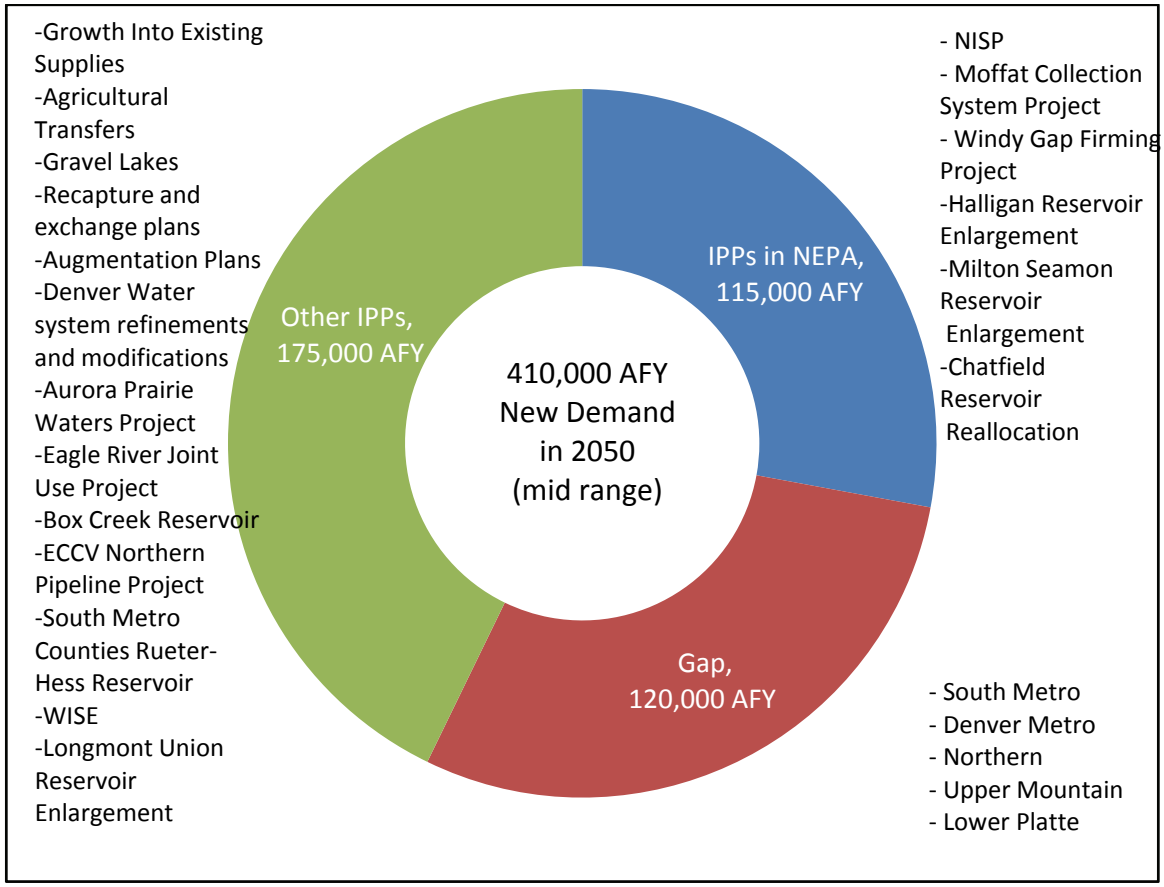

Figure 5-5 Potential Yield of NEPA Projects Relative to 2050 New Demands, Other IPPs, and Gap in South Platte and Metro Basins

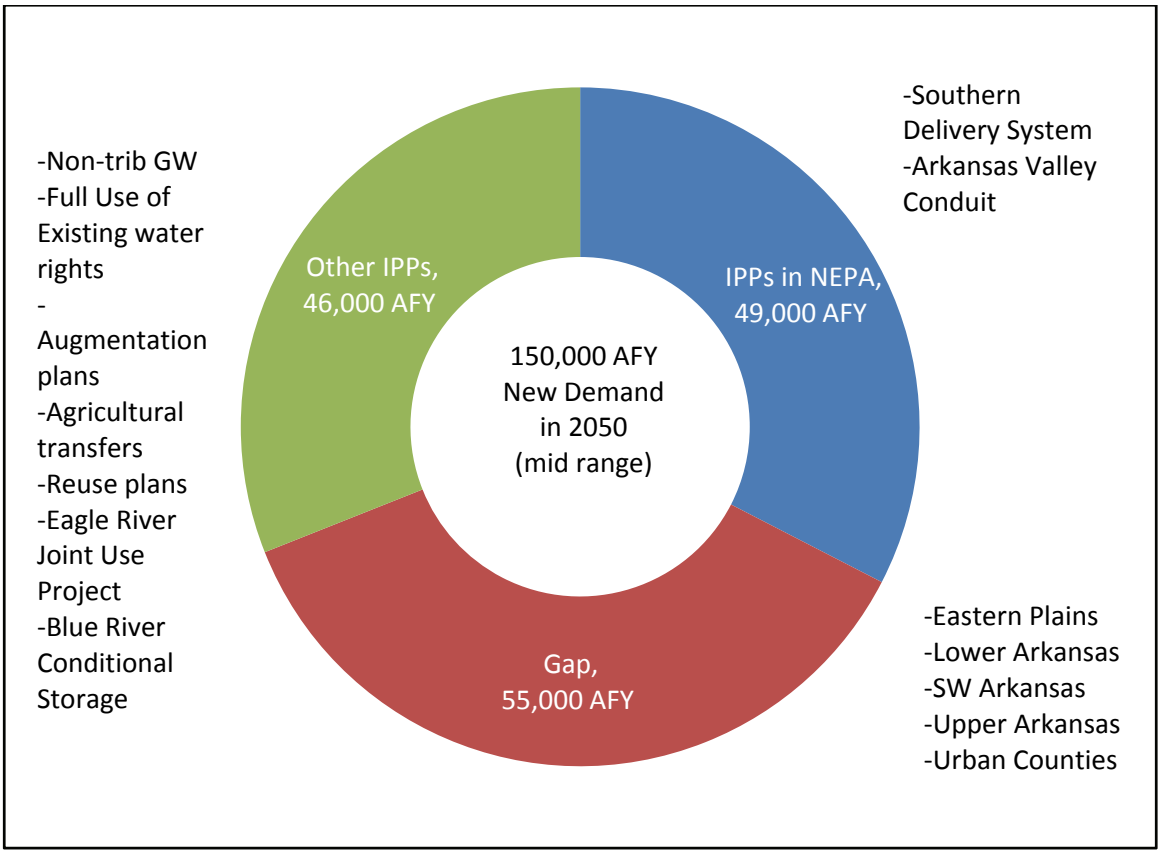

Figure 5-6. Potential Yield of NEPA Projects Relative to 2050 New Demands, Other IPPs, and Gap in Arkansas Basin

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

5.3.3.2 Metro Basin

Table 5-6 provides a summary of increased M&I and SSI demands, the amount of that increase that is met by the IPPs, and the results of the gap analysis for each region in the Metro Basin. The importance of successfully developing the IPP yield associated with projects undergoing NEPA review was discussed in Section 5.3.3.1.

Table 5-6 Metro Basin M&I and SSI Gaps in 2050

	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 (60%)	Status Quo IPP Success Rate (50%)	Gap at 100% IPP Success Rate	Gap at Alternative IPP Success Rate (60%)	Gap at Status Quo IPP Success Rate (50%)
Region or County	Low	Med	High	Low	Med	High	Low	Med	High
Denver Metro	97,000	113,100	158,000	73,900	53,700	63,400	23,100	59,300	94,600
South Metro[1]	86,000	94,300	119,800	67,000	43,600	40,300	39,800	71,500	100,300
Total[2]	**180,000**	**210,000**	**280,000**	**140,000**	**97,000**	**100,000**	**63,000**	**130,000**	**190,000**

[1] South Metro gap includes an additional 20,850 AF for replacement of nonrenewable groundwater.
[2] Aggregated basin total values rounded to two significant digits to reflect increased uncertainty at larger geographic scales.

The existing M&I and SSI supply for the Metro Basin is estimated to be 502,000 AFY and is assumed to remain constant through 2050; however, there may be a decline in the existing supply over time due to the current use of nonrenewable groundwater in some areas of the Metro Basin. After computing the 2050 net new M&I and SSI water needs and subtracting water providers' specified IPPs at varying levels of successful yield development, the estimated gaps for the Metro Basin are as follows and as shown in **Figures 5-7 through 5-9**:

- Low gap (100 percent IPP success) = 63,000 AFY
- Medium gap (60 percent IPP success) = 130,000 AFY
- High gap (50 percent IPP success) = 190,000 AFY

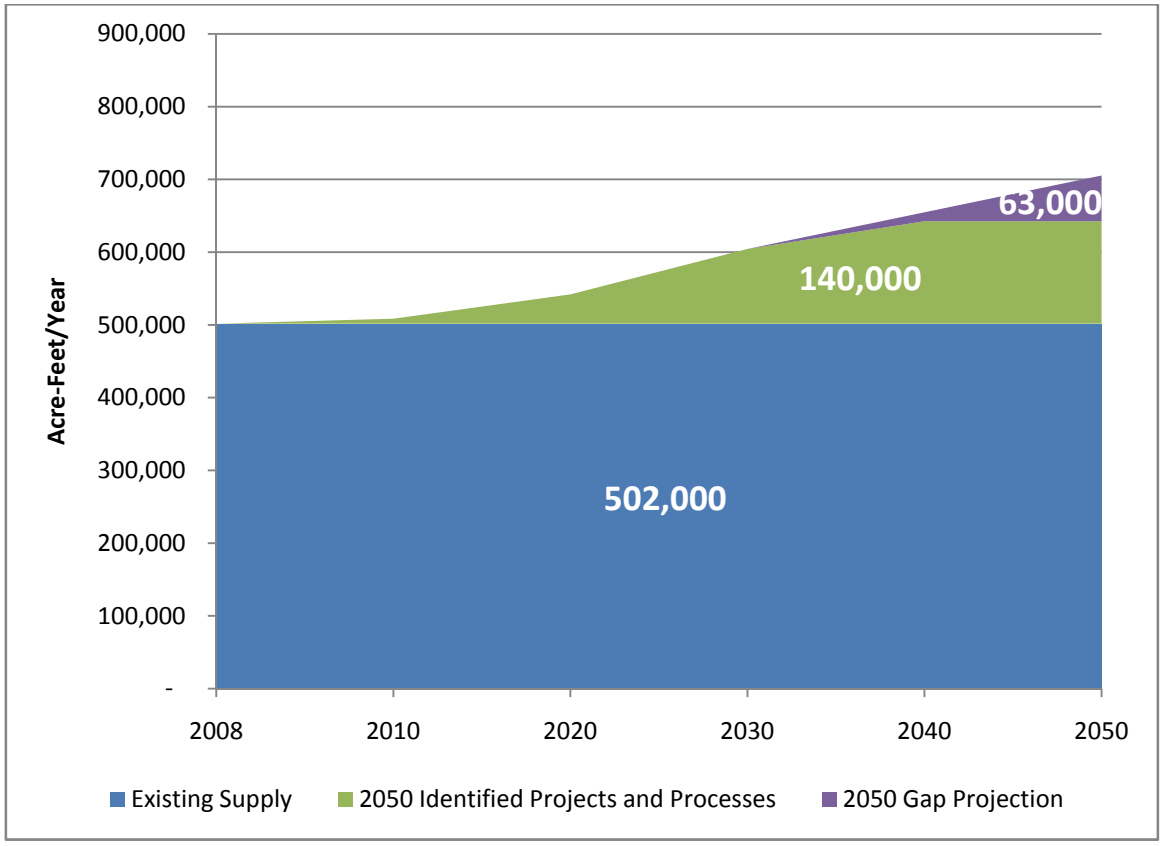

Figure 5-7 Metro Basin M&I and SSI Gap Summary Low Scenario (IPPs at 100% Success Rate)

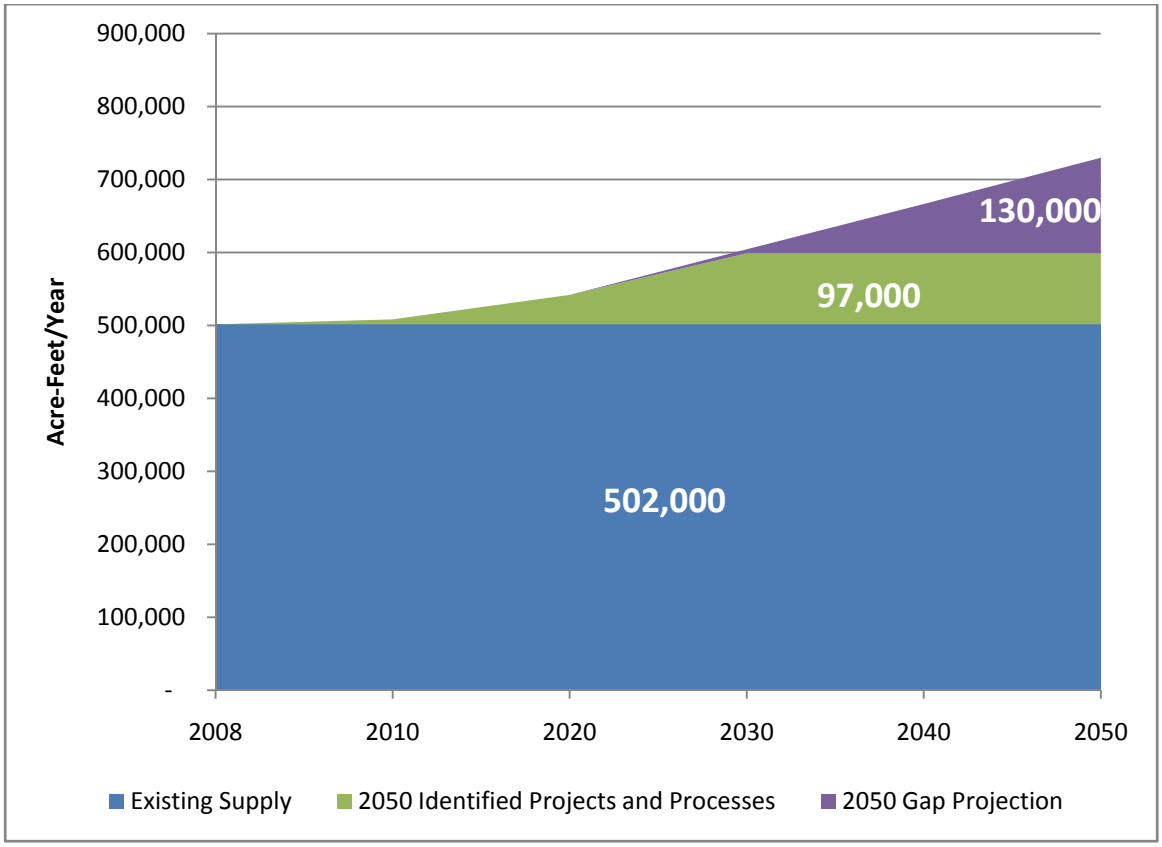

Figure 5-8 Metro Basin M&I and SSI Gap Summary Medium Scenario (IPPs at 60% Success Rate)

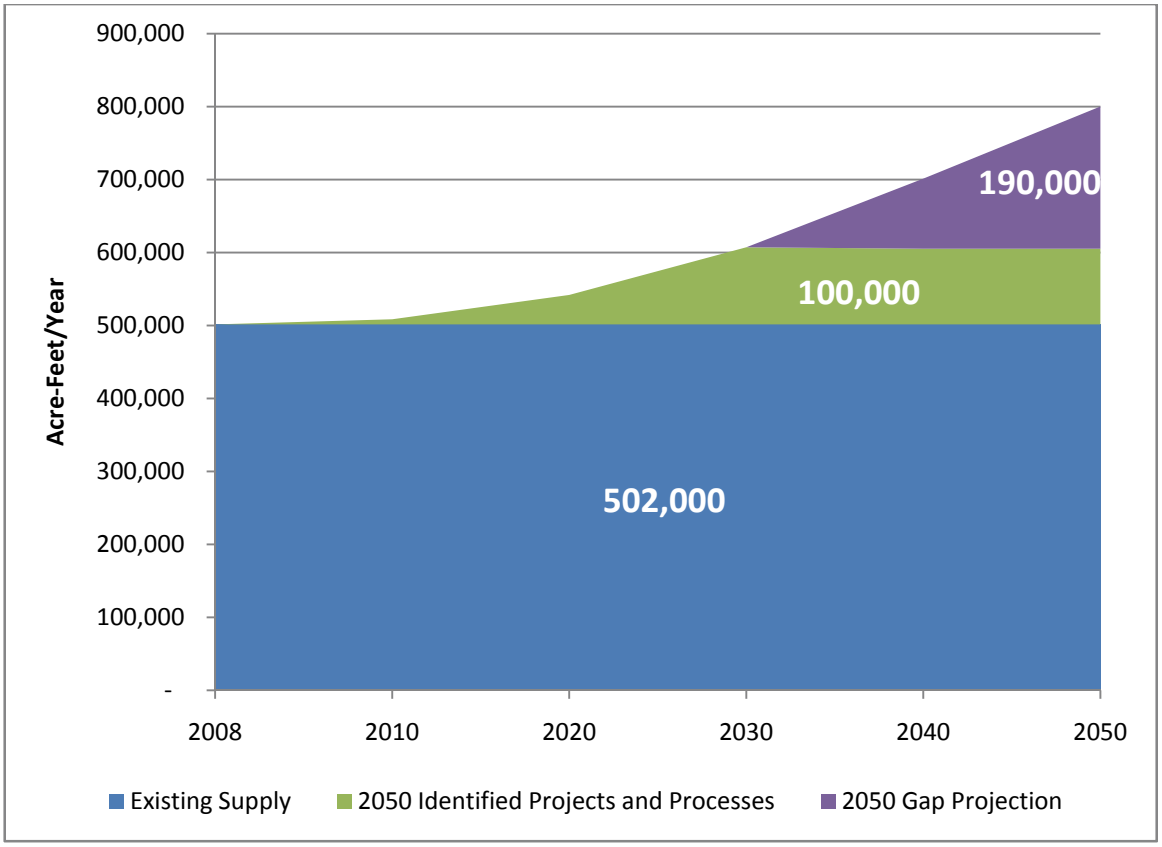

Figure 5-9 Metro Basin M&I and SSI Gap Summary High Scenario (IPPs at 50% Success Rate)

Note that these basinwide gap results include 20,850 AFY of gap—in addition to the differences between 2050 M&I and SSI demands and IPPs—to account for the replacement of nonrenewable groundwater supplies.

5.3.3.3 South Platte Basin

Table 5-7 summarizes the estimated 2050 increases in M&I and SSI demands, the amount of that increase met by the IPPs, and the estimates of the 2050 water supply gap for each region in the South Platte Basin. Figure 5-5 in Section 5.3.3.1 illustrates the importance of projects undergoing NEPA evaluation to the successful development of IPP yield in the basin. The existing supply, which remains constant through 2050 and across all gap scenarios, is estimated to be 234,000 AFY. Under the low gap scenario (100 percent IPP success), the gap is about 36,000 AFY by 2050. For the medium gap scenario (60 percent IPP success), maximum IPP development is 78,000 AFY and the corresponding gap is approximately 110,000 AFY by 2050. Under the South Platte high gap scenario, 58,000 AFY of IPPs are developed (based on a 40 percent success rate), resulting in a gap of 170,000 AFY in 2050. This information is shown graphically in **Figures 5-10 through 5-12**. From a regional perspective, the largest gaps occur in the Northern region, consistent with the high levels of current and future demands and urbanization in Boulder, Larimer, and Weld Counties.

Table 5-7 South Platte 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 (60%)	Status Quo IPP Success Rate (40%)	Gap at 100% IPP Success Rate	Gap at Alternative IPP Success Rate (60%)	Gap at Status Quo IPP Success Rate (40%)
	Low	Med	High	Low	Med	High	Low	Med	High
High Plains	1,400	2,300	3,400	1,400	1,400	1,400	0	900	2,100
Lower Platte	19,200	23,800	30,100	9,600	7,100	6,000	9,600	16,600	24,000
Northern	131,200	151,400	184,900	105,800	65,500	47,300	25,500	85,900	137,700
Upper Mountain	5,500	6,800	8,300	5,000	3,700	3,000	600	3,100	5,300
Total[1]	**160,000**	**180,000**	**230,000**	**120,000**	**78,000**	**58,000**	**36,000**	**110,000**	**170,000**

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

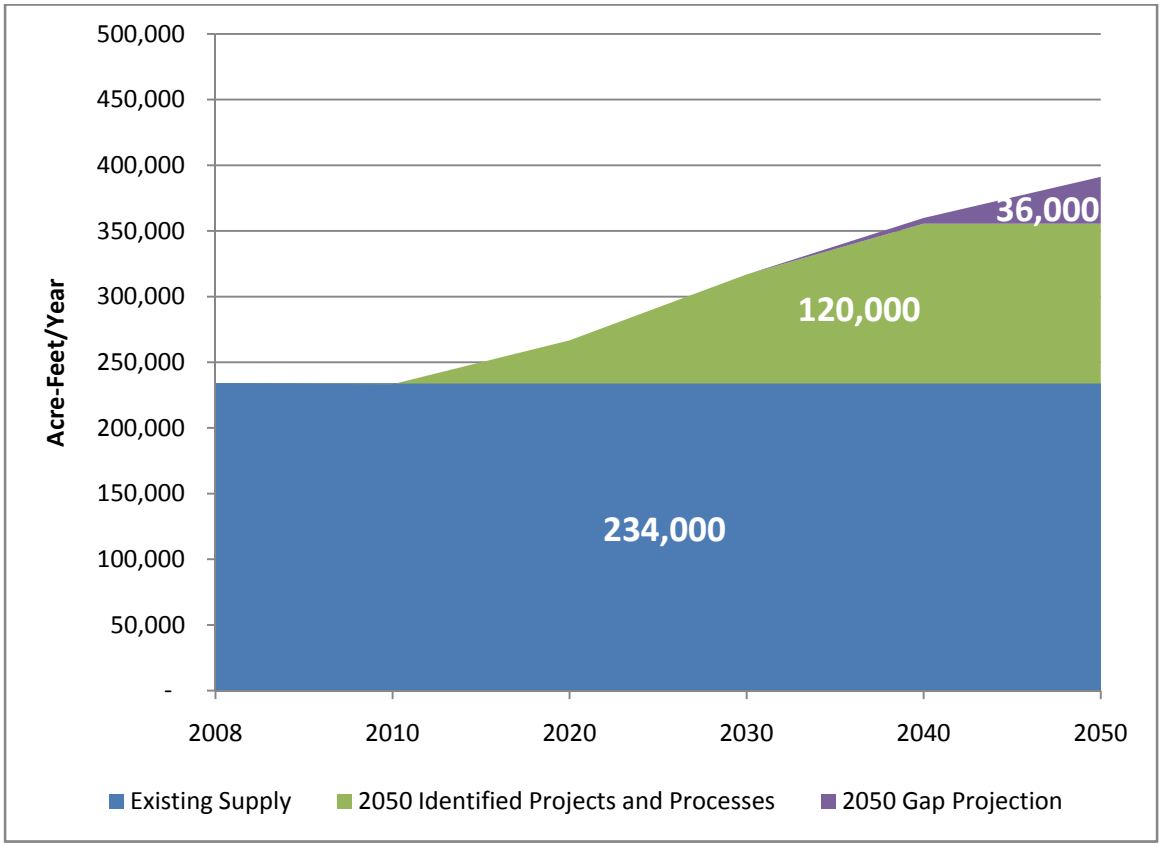

Figure 5-10 South Platte Basin M&I and SSI Gap Summary Low Scenario (IPPs at 100% Success Rate)

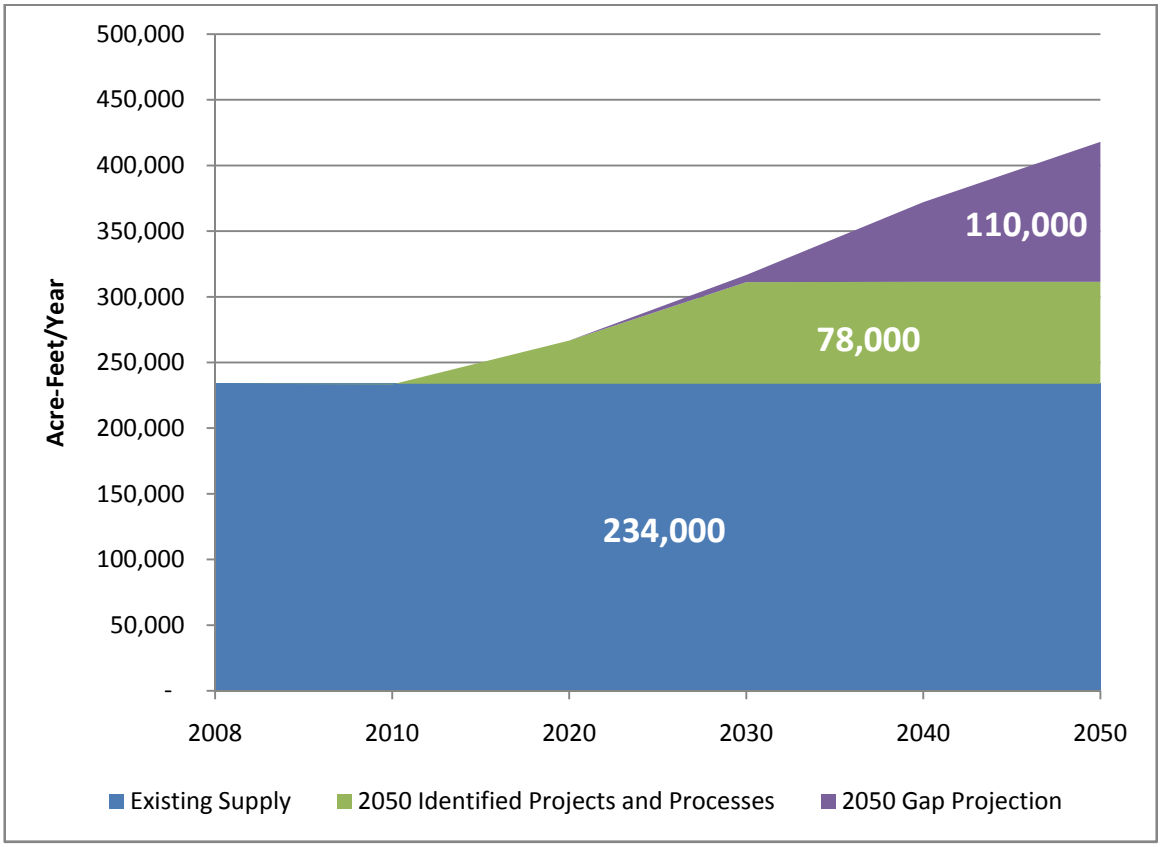

Figure 5-11 South Platte Basin M&I and SSI Gap Summary Medium Scenario (IPPs at 60% Success Rate)

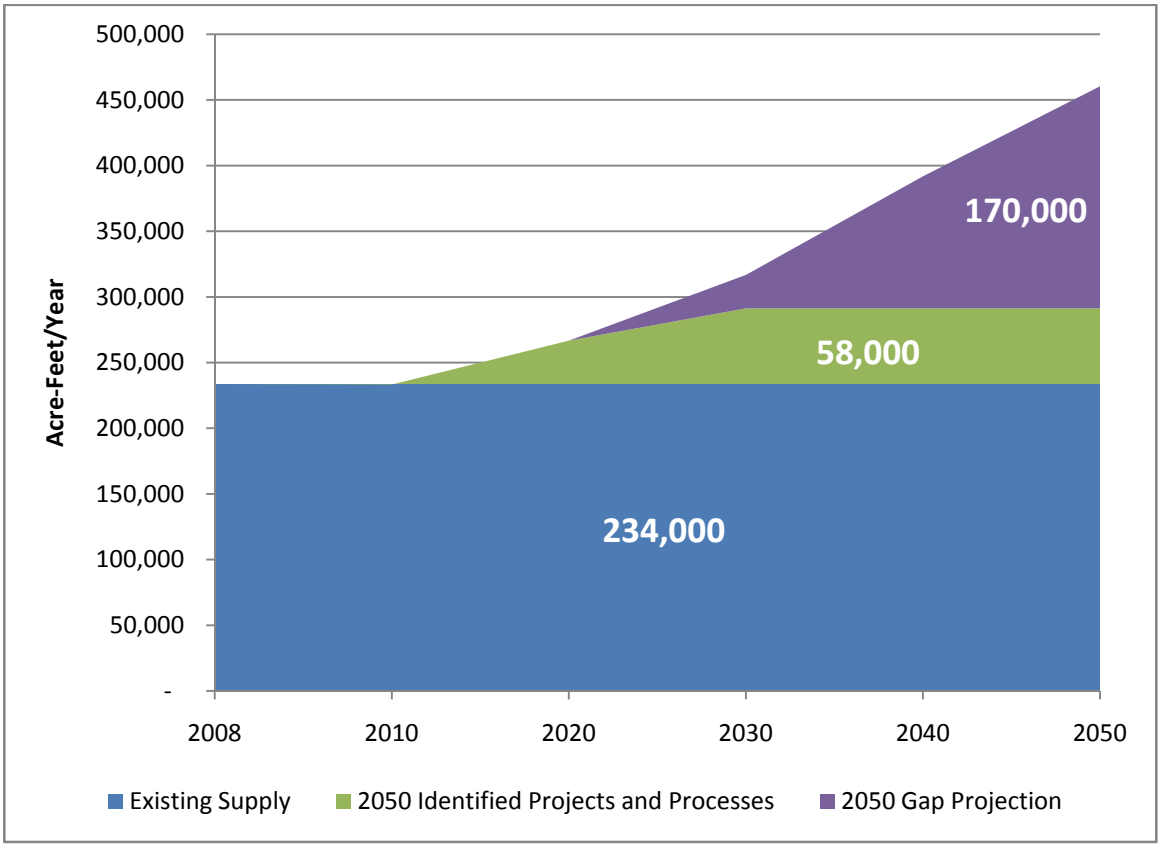

Figure 5-12 South Platte Basin M&I and SSI Gap Summary High Scenario (IPPs at 40% Success Rate)

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Section 6
Metro 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.

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.

6.3.1 South Platte Basin

South Platte River

As part of their needs assessment, the South Platte and Metro Basin Roundtables conducted additional water availability analysis that built upon the SWSI 1 findings. Several water allocation models have been developed to determine legally-available flow at various points throughout the basin. The state of Colorado through the CWCB and the Division of Water Resources is currently developing surface and groundwater models for the South Platte Basin through the South Platte Decision Support System (SPDSS). Since the SPDSS models are not yet completed, older results from Denver Water's model, PACSM, the Northern Integrated Supply Project (NISP) study, and the Lower South Platte River Water Management and Storage Sites Reconnaissance Study (LSPWMSSR) were used to illustrate legally available supplies. These studies use different period of records (PORs), have varying assumptions of the development of existing conditional storage rights, do not reflect the recent change in river administration, and are not directly comparable. However, they are used for illustrative purposes to show limited availability in the Metro and South Platte Basin. **Table 6-2** shows the POR, model,

minimum, median, average, and maximum available flows. **Figure 6-1** shows the location and median amount of legally-available water based on the various models. As noted, there are varying assumptions incorporated into these models and many may not reflect current river administrative practices; therefore, these results should be viewed as illustrative, pending more detailed results. Recent Denver PACSM results for availability at the Henderson and Kersey gages were not available and are not shown in the table or graph.

Table 6-2 South Platte Basin Water Allocation Models Summary

Gage Location	Model	POR (Water Year)	Min (AF)	Median (AF)	Average (AF)	Max (AF)
Near South Platte	PACSM	1950-1980	0	**2,000**	30,452	235,000
Chatfield	PACSM	1950-1980	0	**2,000**	36,000	289,000
Henderson[1]	PACSM	1950-1980	0	**155,000**	196,300	559,000
Kersey[1]	NISP	1950-2001	0	**162,100**	305,500	1,672,500
Sedgwick	LSPWMSSR	1944-1998	0	**70,800**	198,000	1,722,500

[1] Values for Henderson and Kersey are best available estimates pending updated Denver PACSM results

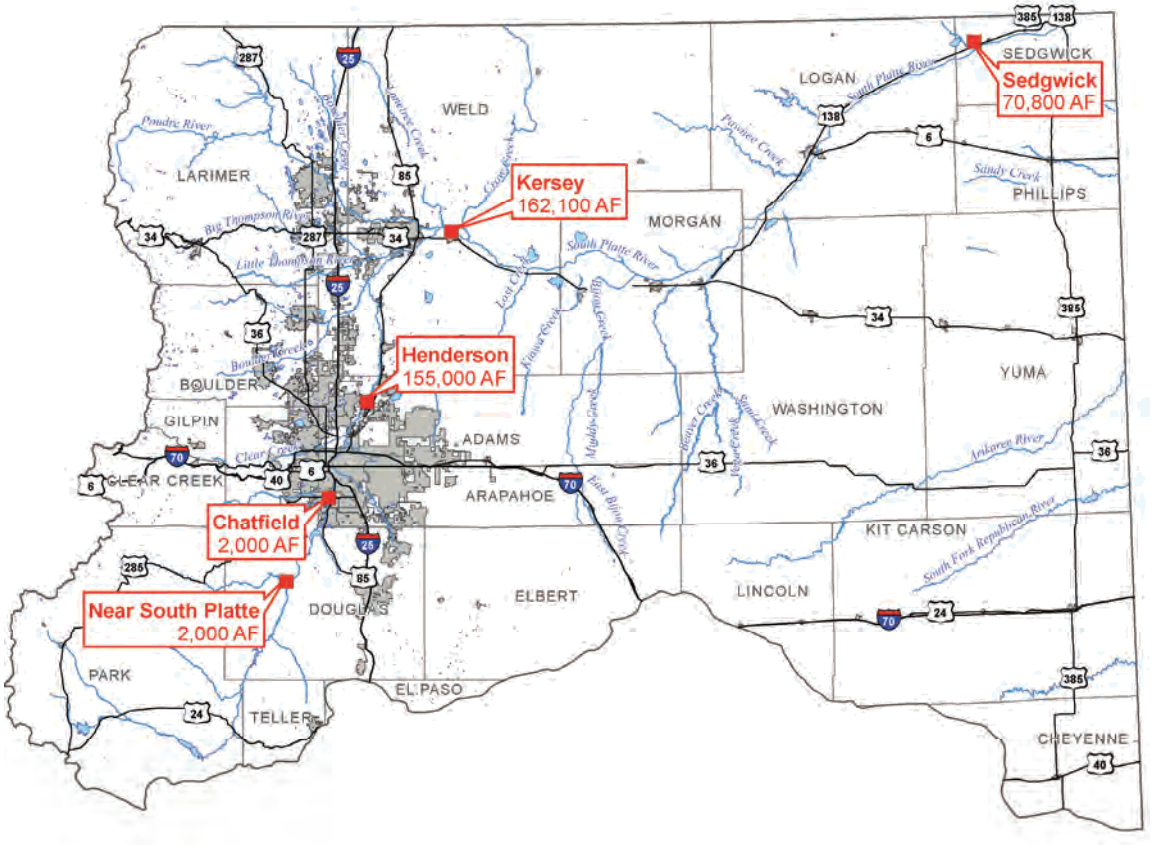

Figure 6-1 Estimated Median Amount of Available Flows in South Platte Basin Based on Various Models

Results from water allocation models can be used to generate firm yield to storage curves (yield curves). The yield curve uses water availability data to determine how much storage is needed to reliably yield a given amount of water assuming no monthly shortages. **Figure 6-2** shows the yield curve for the South Platte River at Chatfield Reservoir. The curve shows storage to yield ratios of approximately 10:1 up to about 4,000 acre-feet per year (AFY) of firm yield. Additional firm yield would require significant additional volumes of storage. For example, 10,000 AFY of firm yield at this location would require nearly 325,000 acre-feet of storage. This may not meet the needs for some users of firm supplies. However, it constitutes a valuable opportunity for users in the southern portions of the Metro Basin that may be able to capture average yields in greater amounts than the firm yields to offset groundwater pumping.

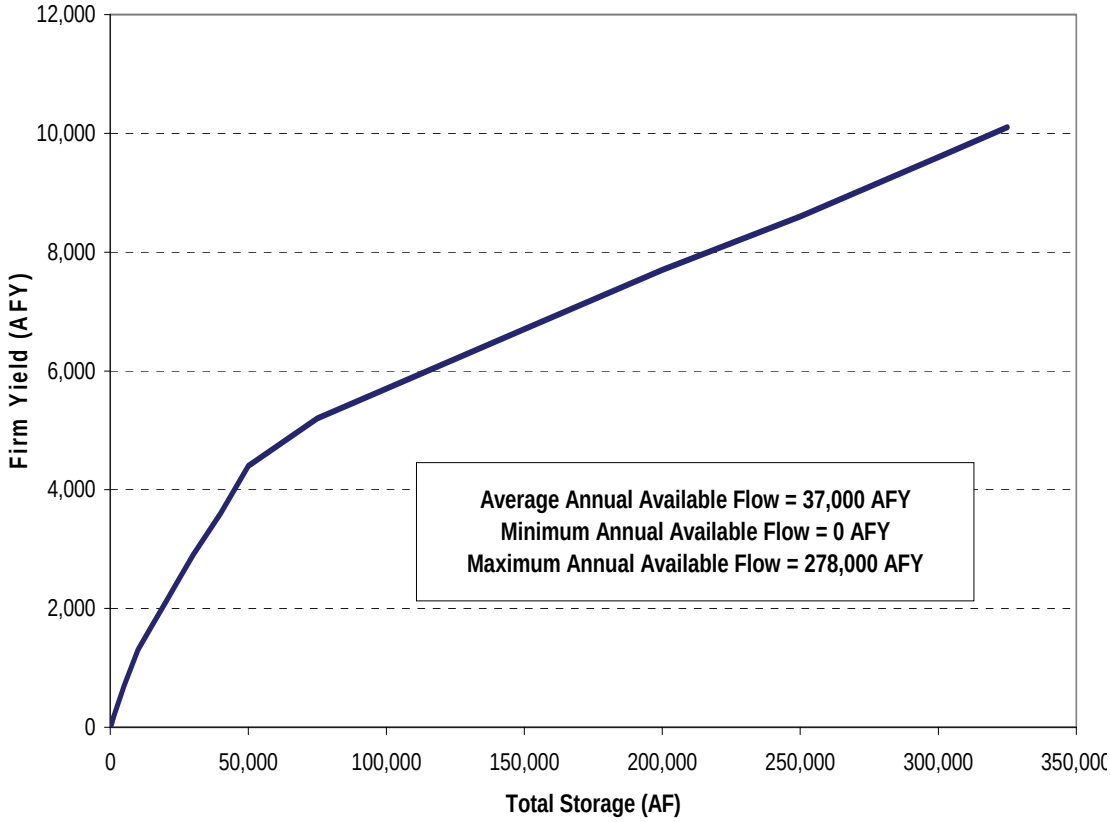

Figure 6-2 Yield Curve, South Platte River below Chatfield

Based on the analyses conducted by the South Platte Basin Roundtable, it was concluded that beyond the implementation of the basin's identified projects and processes, there is little to no unappropriated water remaining in the Metro and South Platte Basins that can produce a firm yield in the upper and lower portions of the South Platte River Basin. A large amount of storage would be required to obtain firm yield from storage in extremely wet years where water may be available for appropriation. This water would have to be carried over in storage over multiple dry years with annual evaporation and seepage losses.

In addition to limited surface water availability, some of the nontributary groundwater supplies in the South Metro area need to be replaced. As was discussed in Section 5 of this report, the Metro Basin Roundtable anticipates that 20,850 AFY of nontributary groundwater will need to be replaced in the South Metro area.

6.3.2 Upper Mountain Counties Aquifer Sustainability Study

The Metro and South Platte Basin have jointly funded the Upper Mountain Counties (UMC) Aquifer Sustainability Study through the CWCB's Water Supply Reserve Account Program. The UMC study area is the 1,400-square-mile region west of Denver, Colorado that consists of Clear Creek County, Gilpin County, and the portion of Park County east of Kenosha Pass, and the mountainous portion of Jefferson County. The objective of the UMC Water Needs Assessment and Water Supply Analysis are to identify water needs, available water supplies, and any shortages that may exist in the region. This assessment will also identify projects and/or actions that may be needed to address shortages in areas serviced by community water supplies or areas where depletions of the aquifer systems may be occurring or expected to occur.

The UMC study addressed concerns of the unique climate, geography, and water supply needs for the four counties west of Denver. The study revised population projections through 2050. Water demands were revised to include recreation and tourism. Existing improved and unimproved lots were used to estimate water demand based upon build-out assumptions. An evaluation of the long-term water supplies and water sustainability based on recharge estimates from local geology and precipitation data. A unique approach of using a demand/recharge ratio in a specific area was implemented to assess the sustainability. Since locations of future development are uncertain, the three alternative development densities, based on assumed minimum lot sizes, were applied to all remaining developable lands in order to provide decisionmakers with information to assess sustainability issues.

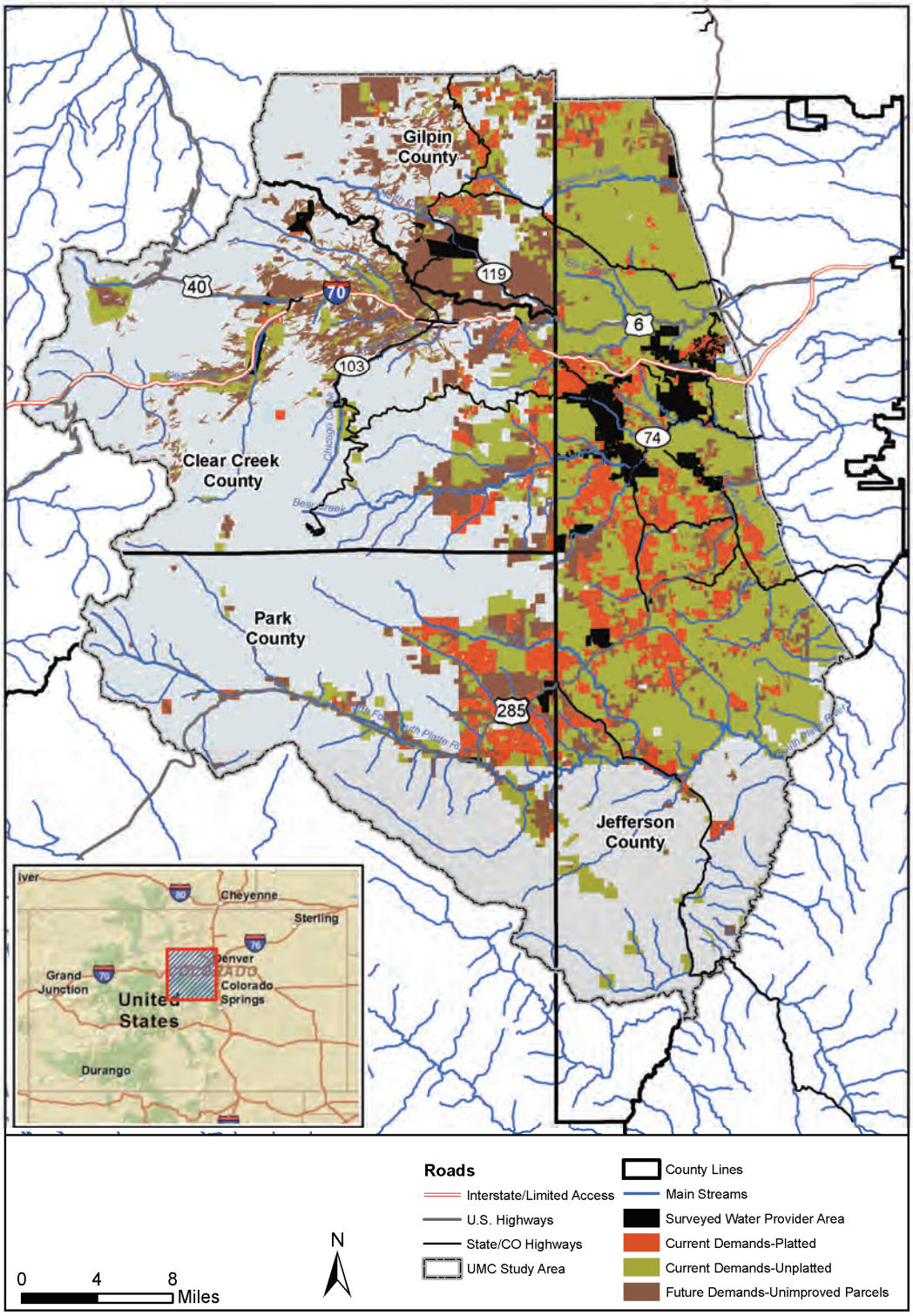

Figure 6-3 Current and Future Demands for UMC Study Area; UMC Water Needs Assessment Water Supply Analysis

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Section 7
Metro Basin Strategies

7.1 Overview

The Colorado Water Conservation Board (CWCB) and Interbasin Compact Committee (IBCC) are in the process of a continuing dialogue regarding Colorado's Water Supply Future. During the past year, their discussions have focused on how Colorado will meet its 2050 municipal and industrial (M&I) demands, agricultural demands, and environmental and recreational water needs. The IBCC and CWCB have agreed that a range of strategies are needed to help meet our state's future water needs. Strategies could include conservation, reuse, agricultural transfers, regional coordination strategies, or development of additional Colorado River System supplies. As part of the technical work completed to assist the CWCB, IBCC, and basin roundtables in their discussions, CWCB developed reconnaissance level cost estimates for several large-scale concepts focusing on coordinated agricultural transfers and development of additional Colorado River System supplies. **Figure 7-1** below shows the geographic extent for the following concepts—agricultural transfers from the lower South Platte and Arkansas Basins, Blue Mesa Pumpback, Flaming Gorge Pumpback, Green Mountain Pumpback, and Yampa Pumpback.

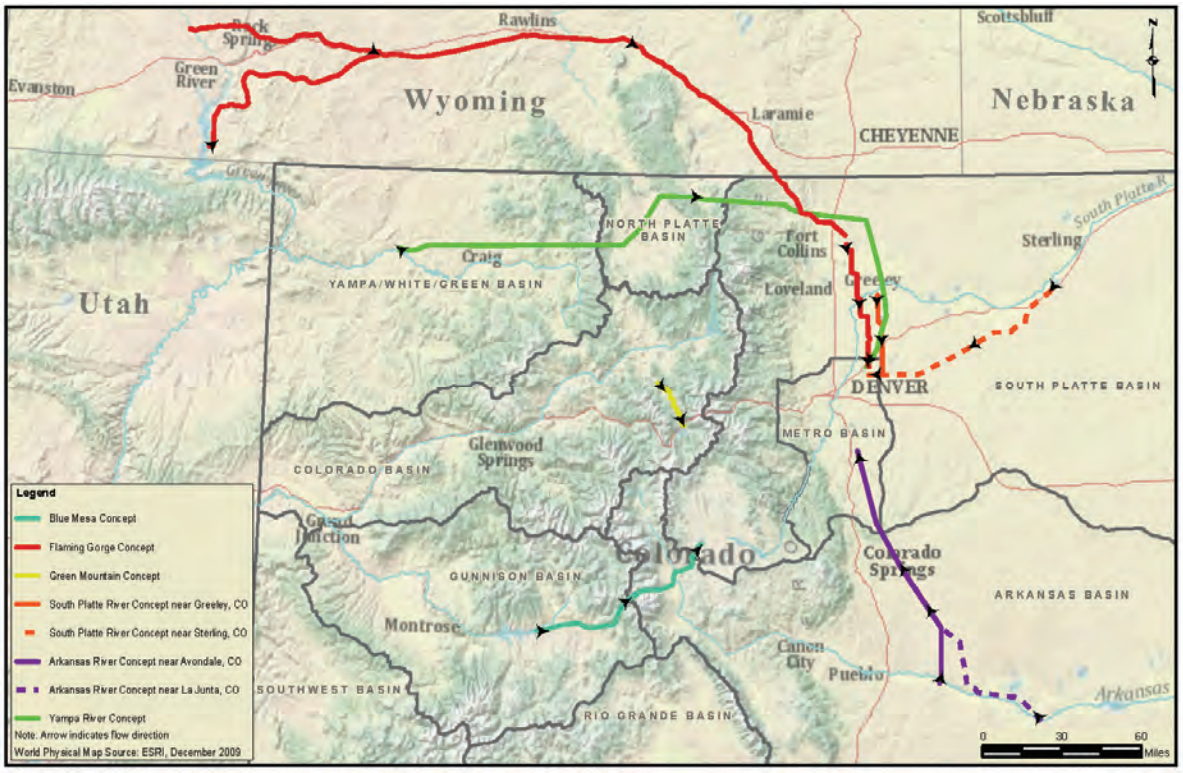

Figure 7-1 Overview of New Supply Development and Agricultural Transfer Concepts

The basic attributes of each of the concepts shown on Figure 7-1 are presented in **Table 7-1** below. For each concept, the table describes the water source, conveyance and storage, and water quality and treatment considerations. For the Lower South and Lower Arkansas concepts, the cost of water rights will likely decrease the further downstream the diversion is from urban areas; however, conveyance and treatment costs will increase accordingly. For the Flaming Gorge and Blue Mesa concepts, water supply would be acquired through the U.S. Bureau of Reclamation (BOR) marketable pool for each reservoir. For the other new supply development concepts the water supply would be a new acquisition. For both the Lower South Platte and Lower Arkansas concepts, reverse osmosis or advance water treatment would be required due to source water quality. The new supply development concepts would not require advanced water treatment.

Table 7-1. New Supply Development and Agricultural Transfer Concept Attributes

Concept	Water Source/ Water Rights	Conveyance and Storage	Water Quality and Treatment Costs
Lower South Platte	• South Platte agricultural rights	• 36 to 84 mile pipeline with static pumping requirement of 700 to 1,300 feet • Firming storage required	• Reverse osmosis (RO) or advanced water treatment will be required
Lower Arkansas	• Arkansas agricultural rights	• 96 to 133 mile pipeline with static pumping requirement of 3,100 to 3,600 feet • Firming storage required	• RO or advanced water treatment will be required
Green Mountain	• Blue River water in the Colorado River basin as well as new South Platte water rights	• 22 mile pipeline with static pumping requirement of 1,100 feet • Firming storage required	• Conventional treatment technology
Yampa	• New water rights appropriation	• 250 mile pipeline with static pumping requirement of 5,000 feet • Firming storage required	• Conventional treatment technology
Flaming Gorge	• Contract with BOR for water from the Flaming Gorge marketable pool	• 357 to 442 mile pipeline with static pumping requirements of 1,400 to 3,100 feet • Firming storage required	• Conventional treatment technology
Blue Mesa Reservoir	• Contract with BOR for water from the Aspinall marketable pool	• 81 mile pipeline with static pumping requirement of 3,400 feet • Firming storage required	• Conventional treatment technology

7.2 Major Findings and Next Steps

The Denver Metro Basin Roundtable has reviewed several options for additional renewable water supplies. We are of the firm opinion that, in addition to conservation and reuse, these supplies will be needed in the future. Of particular interest to the roundtable at this time is a joint project with Wyoming municipalities to bring Colorado River water to the Front Range of both states. This water will be accounted for as Colorado River Compact allocations that both states are entitled to use. The estimated project size and alignment has yet to be determined as the BOR has yet to identify the potential yield. Base upon the most recent hydrologic determination, however, a rough estimate could be in the range of 150,000 to 250,000 acre-feet (AF).

Other projects of interest are first, the Blue Mesa Pumpback for which the Water and Power Development Authority was legislatively directed to study in the early 80s; second, the Yampa River Pumpback studied in the early 2000s by the Northern Colorado Water Conservancy District; and third, some sort of agriculture transfer project either from the South Platte or the Arkansas River as are now being proposed. It is recognized that without a new water supply source, pressure will continue to be put on supplying Front Range Water needs by dewatering agricultural lands.

7.2.1 Major Findings

- The Metro area has the largest new demand and gap in the State of Colorado. Demand and gap numbers and figures here.
- Continued use of the Denver Basin aquifer is no longer sustainable as a main water supply. Water from the Denver Basin aquifer can be used to help manage risks during times of drought.
- The Metro area is leading Colorado's charge for conservation, reuse, and cooperative infrastructure.
- Despite the Metro area's continued best efforts to conserve, reuse, cooperate, and use native supplies, additional agricultural transfer and West Slope waters will be needed to support the Metro area.
- The Metro area serves a vital role to Colorado's economy across the state through generation of tax dollars, utilization of recreational opportunities throughout the state, and purchase of agricultural products. Likewise healthy agricultural and recreational economies and opportunities are important to the quality of life in the Metro area.
- Aquifer storage recharge is a viable option for managing water supplies.
- South Platte agriculture is important to the Metro area, and alternatives to traditional buy-and-dry have been used effectively and will continue to be viable as part of the solution to meeting the Metro area's needs.
- Additional storage and infrastructure will be needed to maximize the use of water from all sources, including conservation, reuse, native supplies, agriculture, and the West Slope.

7.2.2 Recommendations and Next Steps

1) **Conservation:** Continue implementing Active Conservation practices as outlined in the Water Conservation Plans submitted to CWCB.

2) **Conservation:** Support the IBCC conservation recommendations (see details in IBCC report). These are summarized below:

   a. Develop unified statewide messaging about water and water conservation that is consistent, sustained, and simple.

   b. Adoption of indoor plumbing codes that require water efficiency standards that meet or exceed the U.S. Environmental Protection Agency's (EPA's) WaterSense fixture and appliance specification for all new residential and commercial construction and renovation that requires building permits.

   c. An executive order for all state agencies to reduce their water demand.

   d. Find ways to support water providers with funding and other assistance in pursuing the best available technologies and practices to minimize water loss in conveyance, storage, treatment, and distribution and to design consumers' water bills so that cost, consumption, and rates are clearly displayed.

   e. Adoption of water efficiency standards that meet or exceed EPA's WaterSense product and certification specification in all new landscaping plans and projects requiring supplemental irrigation.

3) **Identified Projects and Processes:** Support the implementation of IPPs, including Chatfield Reallocation, Gross Reservoir expansion, Water Infrastructure and Supply Efficiency partnership, reuse projects and other necessary planned projects. Ask the project proponents if they would like support, such as letters or Water Supply Reserve Account (WSRA) grants.

4) **Alternative Agricultural Transfers:** Meet with the South Platte Roundtable and agricultural entities to discuss how to meet municipal needs while supporting agricultural economies and products.

5) **Nonconsumptive:** Support and move forward nonconsumptive IPPs in the Metro Basin and support the inclusion of nonconsumptive needs in the development of projects outside of the roundtable's geographic area. Ask the project proponents if they would like support, such as letters or WSRA grants.

6) **Storage & Infrastructure:** Support above-ground storage, aquifer storage recharge, and cooperative infrastructure projects, as storage will be needed for maximizing conservation, reuse, native, agricultural, and West Slope water supplies. Seek funding to assess additional storage and infrastructure opportunities through a WSRA grant.

7) **New Supply:** Work to preserve opportunities for new supply development on the west slope for future use.

8) **New Supply:** The Metro Basin Roundtable would like to work with other roundtables and/or appropriate stakeholders to determine the best way forward, so as not to put undue pressure or risk on agriculture, the environment, or current water users. This should involve specific conversations with the Gunnison, Colorado, and Yampa-White Basin Roundtables as well as supporting the Flaming Gorge Task Force. The Metro Basin Roundtable will also consult with the South Platte and Arkansas Basin Roundtables to determine their interest.

7.3 Agricultural Transfer

This section summarizes information about agricultural transfers as one of the strategies in addressing the M&I gap in the Metro Basin.

7.3.1 General Interest in Alternative Agriculture Transfers

Traditional agricultural water transfers have been and will continue to be an important part of water providers' plans for meeting their future water demand as long as there are farmers and ranchers willing to sell their water rights. Realizing this, there is a concern that some water transfers may have negative third-party effects such as impacts to the agricultural supply, service, and processing sectors that are fundamental to agriculture-based rural economies. It is also understood that there are other factors contributing to the reduction of farming and ranching in Colorado. For example, CWCB, in its assessment of 2050 irrigated acres, took into account the following factors in addition to agricultural to municipal water transfers:

- Urbanization of existing irrigated lands
- 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

To better understand and to help address this trend, the CWCB investigated alternatives to traditional purchase and transfer of water from irrigated lands to new uses in the Statewide Water Supply Initiative (SWSI) 2 Report. This report examined trends in irrigated acreage, dynamics leading to agricultural transfers, economic and social consideration, and a discussion of five alternative methods to permanent transfers of water rights for M&I purposes. As the SWSI 2 report states, "The goal of the alternative transfer is to minimize the impact on the local economy, provide other funding sources to the agricultural user, and optimize both the agricultural and nonagricultural benefits of the remaining lands." Listed below are the alternative agricultural transfer methods (ATMs) identified and discussed in the report:

- Interruptible Supply Agreements (ISAs)
- Rotational fallowing (short- and long-term)
- Water banks
- Reduced crop consumptive use (CU)
- Purchase and lease-back

While some of these alternative methods have been implemented in Colorado to a limited extent, traditional water transfers continue to dominate the market in Colorado. As stated in the SWSI 2 report, "It is not the intent to interfere with or criticize traditional transfers of agricultural waters since these are a property right and…are needed to meet the [2050] M&I water needs. It is the intent, however, to illustrate how and when alternatives to traditional agricultural transfers may present benefits to not only the parties to the transfer, but other third party beneficiaries."

Furthermore, "[w]hile any transfer method is likely to reduce agricultural production (yield or number of irrigated acres), exploration and implementation of alternative transfer methods may lessen the effect of the transfer within a defined geographic location and may help sustain agriculture by providing additional

revenue sources to the agricultural user." Clearly, as municipal water demands continue to increase, irrigators will continue to see an increased interest in their water rights from cities. Moreover, as the demand for a limited amount of water increases, it will be necessary for all water users to optimize the use of a limited resource.

Historically, cities have often relied upon temporary watering restrictions on residential landscaping to reduce demands and provide for emergency reserves in case of continued drought. Through the implementation of ATMs, the irrigators may begin to view their water rights as another "crop" to be marketed and cities may begin to view the cornfields as "reservoirs" holding much-needed water supplies in times of shortage. While possible, most municipal and domestic water providers will probably not be interested in selling taps for homes that rely on a 20-, 30-, or 40-year water lease agreement that could potentially not be renewed (recognizing that permanence may be achieved through methods such as ISAs, transferring a portion of a water right, etc.). Even with the potential for renewal of long-term lease arrangements, water providers have concerns regarding the uncertainty of the long-term lease costs. More likely, alternative methods that are temporary in nature such as rotational fallowing and water banking may be best applied to drought mitigation, drought recovery, an emergency supply, and long-term conjunctive use (i.e., the integrated management of surface water and groundwater supplies). Possibly most important, revenues generated through the various agreements between irrigators and cities can provide much needed capital to invest back into the farm or irrigation systems. Some of the key benefits derived from ATMs include:

- Relationships between irrigators and municipalities—water sharing
- Provides irrigators with needed capital to upgrade farm or irrigation system equipment or infrastructure
- Provides irrigators with a temporary increased income that may be used for payment of debts or increased disposable income
- Helps to optimize the use of a limited water resource
- Sustain rural agricultural communities and economies
- Preserve productive agriculture open spaces
- Provide for greater food security
- Provides wildlife habitat

7.3.2 Pure Cycle Agricultural Transfer System

The Fort Lyon Canal Company is one of the largest and most diversified irrigation systems in Colorado with annual deliveries ranging from 250,000 to 360,000 acre-feet per year (AFY). Having senior water rights decreed in 1884, and with major additional decreed rights from 1887 and 1893, the Fort Lyon Canal Company diverts up to about 933 cubic feet per second (cfs) of water from the lower Arkansas River. Pure Cycle Corporation owns nearly 18,000 acres of irrigated farm land and 21,500 shares of the Fort Lyon Canal Company; which represents about 22 percent of the canal company.

The Fort Lyon system is unique in that it has two diversion points on the river. The "storage canal" diverts from the Arkansas River at a point approximately 6 miles upstream from Rocky Ford and transports large quantities of water (at a rate of up to about 900 cfs) to the two storage reservoirs: Horse Creek Reservoir (with a storage capacity of 28,000 AF), and Adobe Creek Reservoir (with a storage capacity of 87,000 AF). The "main canal" diverts from the river approximately 30 miles downstream from the storage canal and

supplies water to approximately 100,000 acres of irrigated farm land. The Fort Lyon Canal, being the largest and last river diversion before John Martin Reservoir, is uniquely positioned to work cooperatively with the other six major canal systems situated between Pueblo Reservoir and John Martin Reservoir to develop alternate agricultural transfer projects. By not requiring exchanges of water up the river, water quality and quantity protection to existing water users is maintained. Cooperative alternate transfer projects, such as rotational fallowing, will provide additional income opportunities for agricultural water owners as well as new water supplies for Front Range communities and can benefit both Arkansas Valley and Front Range interests.

7.3.3 The Lower Arkansas Valley Super Ditch Company, Inc.

Creation of the Super Ditch established an organization that can negotiate on behalf of irrigators to make water available to other water users through long-term leases, interruptible water supply agreements, and water banking. Shareholders of the Rocky Ford High Line Canal, Oxford Farmers Ditch, Otero Canal, Catlin Canal, Holbrook Canal, and the Fort Lyon Canal (later joined by the Bessemer Ditch) met in Rocky Ford on May 7, 2008 to incorporate the company. Over 80 percent of valley farmers have expressed an interest in leasing (February 2011).

In June 2010, the Super Ditch inked an agreement with six members of the Pikes Peak Regional Water Authority (PPRWA), including Fountain, Monument, and Cherokee Metropolitan District. The 40-year lease with a right to renew carries a base price of $500 per acre-foot per year. A pilot program involving Fountain will begin deliveries in 2012 at 500 AFY. Deliveries to other PPRWA members will begin in 2016, concurrent with completion of Colorado Springs' Southern Delivery System and rise to 8,000 AFY by 2030. The Super Ditch signed a similar agreement with Aurora, for up to 10,000 AFY, in October 2010. Negotiations continue with other potential lessors.

Farmers with 125,000 acres of irrigated land and 165,000 AFY of water rights are backing the Super Ditch, which expects to lease up to 24,000 AF in a dry year, 50,000 AF in an average year, and 80,000 AF in a wet year. And, in an exceptionally dry year like 2002—when there wasn't enough water to farm—the Super Ditch could also lease 80,000 AF. The basis for leases will be AF of transferable consumptive use, in the form of stock in ditch and reservoir companies. The Super Ditch plans to deliver water into Pueblo Reservoir via an adjudicated exchange (Case No. 10CW4 pending in Div. 2 Water Court). Lessees will be responsible for transporting the water for their use from Pueblo Reservoir...

The amount of foregone irrigation under various hydrological conditions (wet, dry, and average years) will be matched with lease demands, which are also expected to vary from lease to lease. For example, some municipalities need additional water in a dry year; some need water to recover after a drought, while still others need to reduce groundwater pumping in average and wet years to extend the lives of the aquifers they currently tap.

Although the Super Ditch will negotiate uniform terms and conditions with each new user, leases will be signed by individual farmers to avoid double taxation of lease payments. It will be up to individual farmers to decide whether, and to what extent, they want to participate. And if there is more interest in leasing than demand for some leases, the amounts will be prorated proportionately. An irrigator will be able to transfer his lease to another irrigator, so long as the municipal lessee receives the same amount of water. Leases will constitute a legal encumbrance upon the ditch company shares leased by the irrigators to the Super Ditch Company, and constitute a continuing obligation of the owner, assignor, or successor of the ditch company shares. In this manner, lessees will have certainty of supply.

Irrigators may fallow land in rotation or on some other basis, and will be responsible for weed and erosion control on their fallowed land. All irrigated land included in each lease will be fallowed the same percentage of the time over the life of the lease.

An ongoing controversy over the Super Ditch idea involved anti-trust questions raised by municipalities. Analysis of the issue by Colorado's leading anti-trust attorney put that issue to rest, however, when he concluded the notion would likely withstand legal challenge.

Super Ditch leases that transfer more than 1,000 AF of water from agricultural to municipal use, will trigger 1041 permitting requirements in Bent, Otero, Prowers, and Pueblo counties. The Super Ditch Company will handle the permitting.

Shareholders of some ditch companies will need to amend their articles of incorporation or bylaws to permit leasing. The Fort Lyon, Bessemer, and Catlin have recently joined the High Line and Holbook canals to permit leasing.

To avoid undermining the Super Ditch, a condition of leasing water is expected to be a voluntary agreement not to transfer irrigation water rights out of the Lower Valley while someone is leasing water. And while lessees would not be expected to forgo purchasing additional water rights, they would be expected to make those water rights available for lease just like any other water right owner.

7.3.4 South Platte Co-op

The Lower South Platte Co-op concept being studied by the Colorado Corn Growers Association (CCGA) addresses the ability to exchange water from the lower South Platte reach to municipal growth areas upstream. Augmentation plans on the Lower South Platte River often generate excess recharge credits that accrue to the river and leave the state. This alternative transfer proposal would facilitate the exchange of these excess credits, alternative transfer, senior rights, etc. to upstream agricultural and M&I users who are in need of augmentation supplies.

The water users involved in the Lower South Platte Co-op to date are located in Districts 1 and 64. Thus, without the pooling of resources and investment in infrastructure, marketing water to Denver-area water providers would be difficult. However, the demonstration project showed significant potential to exchange water from the downstream end of District 1 to the mouth of the Poudre River, where it could be potentially marketed to several water providers.

No legislative or regulatory changes are needed to implement the Lower South Platte Co-op. The Lower South Platte Co-op is based upon contractual relationships and a series of administrative exchanges to facilitate delivery of water. Though the organizational structure of the Co-op has not been determined yet, there are a number of viable options open to it, and Colorado law would allow an entity of this sort to enter into contracts with end users for the delivery of water via exchange. Exchanges are recognized by the 1969 Water Rights Determination and Administration Act. They may be operated administratively, without water court approval, or they may be adjudicated to achieve a priority date.

The CCGA study confirmed there is water available to exchange via the Co-op and that exchange capacity is available. The Co-op is investigating the different types and the reliability of the supplies (i.e., excess recharge credits, water provided through alternative transfer methods, senior irrigation rights, etc.) that could be marketed via the Co-op. With the appropriate infrastructure and management, it is possible that the downstream surpluses could be stored or retimed and provided to upstream agricultural and M&I users on a relatively stable basis. Further study is needed to determine how reliable various water sources might be and whether the contemplated exchanges could be established and operated at a cost that is attractive to other water users.

7.3.5 Agricultural Water Transfer Methods Grants Program Summary

As Colorado's population continues to grow in the coming decades, it is likely that increased transfers of agricultural water rights will occur in order to satisfy increased M&I water demands. The CWCB, IBCC, and the Colorado Water Congress have indicated their support of alternatives to traditional transfers resulting in permanent dry-up in order to minimize the negative socioeconomic impacts to rural communities that so often result from such transfers.

One of the outcomes of the SWSI 2 study was the recognition that the State of Colorado might be able to provide incentives for M&I providers to consider alternative methods for their water supply options. In response, the Legislature passed Senate Bill 07-122, which authorized the CWCB to develop a grant program to facilitate the development and implementation of ATMs.

Since its inception in 2007, the CWCB's Alternative Agricultural Water Transfer Methods Grant Program has awarded $1.5 million to various water providers, ditch companies, and university groups for the funding of six unique projects; five of which have been underway during 2009 – 2010. As illustrated in SWSI 2, rotational fallowing, ISAs, water banks, purchase and leasebacks, deficit irrigation, and changing crop type are the kinds of options that are available as alternatives to permanent agricultural transfers.

Table 7-2. Recipients of CWCB Alternative Agricultural Water Transfer Methods Grants

Name	Grant Funding
Parker Water & Sanitation District and Colorado State University (CSU)	$477,500
Colorado Corn Growers Association	$349,650
Lower Arkansas Valley Water Conservancy District Super Ditch Company	$320,000
Farmers Reservoir & Irrigation Company	$202,500
CSU Extension Office	$80,350
High Line Canal Company	$70,000
TOTAL	**$1,500,000**

With the exception of purchase and leasebacks and some limited occurrences of short-term leasing, these ATMs are just beginning to be explored as viable options for meeting M&I water demands in Colorado. While promising, there are technical, legal and institutional, financial, and other issues associated with ATMs. Through the ATM Grant Program, CWCB and others are currently exploring ways to address these issues utilizing incentives to gain greater awareness, interest, and participation from agricultural water users and municipalities with alternative agricultural water transfers.

7.4 Water Supply Reserve Account Grants

Upper Mountain Counties Water Needs Assessment

APPLICANT: Clear Creek County on Behalf of the Upper Mountain Counties Water Needs Consortium

APPROVED: May 2008

STATUS: In Progress

WSRA FUNDS: $174,350 - Joint Application; $43,587 - Metro Basin Account; $130,763 - South Platte Basin Account

MATCHING FUNDS: $8,070

DESCRIPTION:
In March 2008 the four upper mountain counties in the South Platte headwaters (Park, Jefferson, Clear Creek, and Gilpin) formed the Upper Mountain Counties (UMC) Water Needs Consortium. The purpose of the Consortium is to "perform a study to accurately identify water needs, available water supplies, and any shortages that may exist in the UMC and identify projects and/or actions that may be needed to address any shortages." The needs assessment seeks to determine the long-term availability of groundwater in the fractured and faulted bedrock aquifers of the study area and evaluate if the use of groundwater at build-out can be sustained. The study will use historical precipitation data (1950 to present), recharge related to this precipitation, and data on increased groundwater use to analyze hydrologic variation over the period during wet, average, and dry years. The project will provide a more accurate assessment of the water demands in the study area that are highly dependent upon groundwater in fractured and faulted bedrock aquifers.

Solicitation of Stakeholder Input Through a South Platte Edition of Headwaters

APPLICANT: Colorado Foundation for Water Education

APPROVED: July 2008

STATUS: Complete

WSRA FUNDS: $32,038 - Joint Application; $16,019 - Metro Basin Account; $16,019 - South Platte Basin Account

MATCHING FUNDS: $10,900

DESCRIPTION:
This project entails the creation of a special South Platte Edition of Colorado Foundation for Water Education's (CFWE's) Headwaters Magazine to provide a tool for Metro and South Platte Basin Roundtable members to actively solicit input from affected local governments and stakeholders on their needs assessment and proposed projects and methods for meeting those needs. Headwaters magazine is CFWE's most widely available and well-known educational resource, distributed to over 6,000 residents of Colorado and the West. The project is intended to educate basin roundtable stakeholders about the basin's geography, water supply, environmental challenges, water management agencies (including the IBCC and basin roundtables), and water needs. CFWE will provide support to basin roundtable members in their outreach efforts by providing materials and assisting in their distribution, and attending a limited number of speaking engagements on behalf of the basin roundtable to discuss the contents of the issue.

Demonstration of Membrane Zero Liquid Discharge Process for Drinking Water Systems

APPLICANT: Colorado Department of Public Health and Environment, Water Quality Control Division

APPROVED: September 2008

STATUS: Contracting

WSRA FUNDS: $800,000 - Joint Application:
- $25,000 - Arkansas Basin Account
- $25,000 - South Platte Basin Account
- $50,000 - Metro Basin Account
- $700,000 - Statewide Account

MATCHING FUNDS: $325,000

DESCRIPTION:
Membrane treatment for municipal drinking water supply (including RO and nanofiltration) is the best technology for producing potable water from lower quality/impacted sources that will meet, and often exceed, regulatory requirements. Currently, many sources of water in the Arkansas and South Platte River Basins exceed the regulatory water quality requirements and/or have high levels of total dissolved solids that are unacceptable to consumers. Due to the uncertainty about the availability of feasible disposal options for the membrane concentrate in Colorado many utilities have been reluctant to undertake membrane projects. Zero liquid discharge (ZLD) is a sustainable disposal option that represents a long-term solution to concentrate disposal for utilities that need membrane treatment to produce safe drinking water. The proposed project includes two pilot projects at two sites (Brighton and La Junta) with two different water quality issues (nitrate and selenium, respectively). The pilot projects will develop site-specific cost and performance data to help alleviate current technical and financial uncertainties. Deliverables include various technical memorandum, an experimental plan, design drawings, pilot plant equipment, capital and operating costs under multiple conditions, analysis of water samples, analysis of solids sampling, process schematics and water and energy balances, and a final report. Though the Colorado Department of Public Health and Environment (CDPHE) was the original applicant, the application specified that the contracting entity and project management would be provided by the non-profit American Water Works Association Research Foundation (AwwaRF) in addition to $100,000 of matching funds. Due to AwwaRF's funding problems, they are no longer able to participate in the project or provide matching funds. In its place the CDPHE has secured an identical commitment of participation and matching funds from the WateReuse Foundation (WateReuse). WateReuse is an educational, nonprofit public benefit corporation (501(c)(3)) that conducts applied research on behalf of the water and wastewater community for the purpose of advancing the science of water reuse, recycling, reclamation, and desalination.

Lost Creek Aquifer Recharge and Storage Study

APPLICANT: Lost Creek Groundwater Management District

APPROVED: January 2009

STATUS: In Progress

WSRA FUNDS: $160,000 - Joint Application:
$80,000 - Metro Basin Account
$80,000 - South Platte Basin Account

MATCHING FUNDS: $13,000

DESCRIPTION:
This study seeks to compile, collect, and analyze hydrologic, aquifer property, and water quality data to characterize the groundwater resources in the Lost Creek alluvial aquifer. The study will also evaluate geographic, infrastructure, and land ownership/use information for the purposes of assessing the potential for aquifer recharge and storage implementation. To address the needs of in-basin water rights holders and assist the management district in their decisionmaking processes, the study will: 1) characterize the configuration and extent of the alluvial aquifer within the Lost Creek basin; 2) compile and present current and historic groundwater levels and water level trends; 3) characterize the amount of natural recharge and estimate the available storage capacity in the alluvial aquifer; 4) determine hydraulic and storage properties of the alluvial aquifer; 5) present the spatial relationship with the underlying Denver Basin bedrock aquifers; 6) characterize the land use and ownership; and 7) identify the existing water delivery infrastructure.

South Platte River Recreation and Habitat Feasibility Study

APPLICANT: Greenway Foundation

APPROVED: September 2008

STATUS: Complete

WSRA FUNDS: $150,000 (Basin Account)

MATCHING FUNDS: None

DESCRIPTION:
The Greenway Foundation will perform a feasibility study identifying habitat and recreation improvement alternatives associated with future instream flow expectations. The objective of the habitat improvements would be to increase native riparian vegetation and increase the abundance of aquatic life habitat. The location type and quality of existing habitat and riparian vegetation will be identified through field reconnaissance. Proposed improvement options would be developed to complement the existing habitat and vegetation. Biological physical and hydrological characteristics will be examined and improvement options will be identified based on stakeholder input. The feasibility study will also identify required permits to implement the proposed improvements. The study consists of three tasks: 1) data acquisition and site reconnaissance; 2) assessment of opportunities and challenges; and 3) conceptual design for the study area.

South Metro Water Supply Authority Regional Aquifer Supply Assessment

APPLICANT: South Metro Water Supply Authority

APPROVED: July 2008

STATUS: Complete

WSRA FUNDS: $100,540 (Basin Account)

MATCHING FUNDS: Unspecified In-kind

DESCRIPTION:
The purpose for the South Metro Water Supply Authority (SMWSA) Regional Aquifer Supply Assessment study is to more accurately evaluate the likely impacts of continued reliance on the nonrenewable groundwater supplies in the South Metro Denver area and to explore more coordinated regional management of this precious resource. This project intends to develop a better understanding of the aquifer characteristics relevant to well production artificial recharge and conjunctive use within the South Metro area through the collection of additional data from SMWSA providers. This study will also undertake a detailed assessment of aquifer drawdown due to pumping in the South Metro area by evaluating information from previous studies and updating with additional information collected from SMWSA providers. The project will also characterize the unit cost of producing potable groundwater in the South Metro area including costs for pumping water treatment annual operations and maintenance, evaluate whether the unit costs vary geographically, and/or over time through the year, and use this information to assess ways of optimizing operations to increase aquifer sustainability. Finally this project will identify potential locations to conduct a regional aquifer storage and recovery (ASR) demonstration project within the South Metro area.

Parker Water & Sanitation District and Colorado State University Joint Project on the Rural/Farm Model

APPLICANT: Parker Water & Sanitation District

APPROVED: September 2007

STATUS: Complete

WSRA FUNDS: $150,000 (Basin Account)

MATCHING FUNDS: $882,353

DESCRIPTION:
The study is designed to provide additional renewable water supplies to the Parker Water & Sanitation District (PWSD) service area in Douglas County, which is dependent on nonrenewable Denver Basin water. This 3-year study includes a controlled research by Colorado State University (CSU) on a farm in Loan County that is owned by PWSD (Hurst Farm). Various crops will be planted by CSU and these plots will be irrigated in different patterns to assess the crop's ability to thrive under varying irrigation practices, e.g., irrigating alfalfa prior to its first cutting, letting it grow without irrigation through the second cutting, and then irrigating it again prior to the third cutting. In this way, CSU will develop a database on the most efficient irrigation practices for various crops where the crop can still thrive under a lower irrigation volume. The difference between the reduced irrigation volume and the historic irrigation volume related to consumptive use could then be made available for transfer to PWSD for municipal use. Additionally, three to five on-farm demonstrations will be conducted, along with economic studies to assess the potential trickle-down effect from changes in the farm economy.

Zero Liquid Discharge Pilot Study

APPLICANT: East Cherry Creek Valley Water & Sanitation District

APPROVED: September 2007

STATUS: Complete

WSRA FUNDS: $400,000 ($200,000 - Basin Account; $200,000 - Statewide Account)

MATCHING FUNDS: $150,000

DESCRIPTION:
The ZLD pilot plant study will evaluate two RO membrane based technologies to concentrate the residual stream from a typical municipal brackish water RO system. The first technology, called VSEP, uses vibrations at the face of the RO membrane to prevent mineral scales from forming on the membrane, and subsequently preventing the flow of water through the membrane. The second technology uses high pressure seawater RO membranes to reduce the volume of the concentrate, and uses ion exchange to remove ions that would form mineral scales on the membrane face. The study includes disposal options if a water stream is still present. This study will provide information on the technical feasibility, costs, operational consideration, and energy consumption of these two zero liquid discharge processes.

Chatfield Reservoir Reallocation Environmental Impact Statement and Feasibility Report

APPLICANT: The Greenway Foundation

APPROVED: March 2007

STATUS: Complete

WSRA FUNDS: $130,000 - Joint Application:
$103,000 - Metro Basin Account
$27,000 - South Platte Basin Account

MATCHING FUNDS: $206,000

DESCRIPTION:
The purpose of the Chatfield Reallocation Feasibility Study (FS) is to investigate the potential for the reallocation of storage from the flood control to multi-purpose use, to formulate plans of improvement, and to obtain approval of higher U.S. Army Corps of Engineers authority. The FS, which will consist of an environmental impact statement (EIS) and a feasibility report (FR), will include an analysis of existing and alternative operations of Chatfield Reservoir individually, and to the extent necessary for the hydrologic studies, systemically with Cherry Creek and Bear Creek Reservoirs. The FS will estimate potential changes to downstream flows and to reservoir pool elevations as well as the potential consequences to water supplies, flood damages, recreation opportunities, water quality, and fish and wildlife habitat. Historical streamflow records will be utilized to test effects of different flood control and water supply regulation scenarios. The EIS/FR is equally cost shared with the local non-federal sponsor (CWCB) through a FS cost share agreement (FCSA).

Aquifer Recharge Pilot Study

APPLICANT: South Metro Water Supply Authority

APPROVED: September 2009 ($425,000) and September 2010 ($125,000)

STATUS: Contracting

WSRA FUNDS: $550,000 (Statewide Account)

MATCHING FUNDS: $85,000

DESCRIPTION:
This project will determine if aquifer recharge is a viable strategy to help meet municipal and industrial water needs in the South Metro area. Much of the M&I uses for the South Metro area comes from nontributary groundwater supplies found in the Denver Basin bedrock aquifers. Due to population growth, demand on groundwater has led to aquifer water level declines of as much as 30 feet. The applicant will test several aquifer locations by artificially recharging water of varying water quality into the aquifers. The applicant will retrofit existing wells to determine the suitability of that location for ASR. The pilot will help understand the effects differing aquifer attributes and source waters have on ASR. Pilot-scale testing is being requested because aquifers vary significantly in their hydraulic characteristics to accept recharge water and to react chemically with injected water. Such unknowns and costs of pilot-scale field studies have inhibited local water providers from embarking on this activity.

Feasibility Study for Bureau of Reclamation Funding from the National Rural Water Supply Act

APPLICANT: Douglas County Water Resource Authority

APPROVED: September 2009

STATUS: Contracting

WSRA FUNDS: $600,000 ($100,000 - Basin Account; $500,000 - Statewide Account)

MATCHING FUNDS: Up to $1,125,000 (potential 1:1 federal match and $450,000 in local match)

DESCRIPTION:
The proposed project will develop a feasibility study to connect existing water infrastructure of the Douglas County Water Resource Authority members to help with the delivery of surface water to the region. Examples of existing infrastructure include East Cherry Creek Valley Barr Lake and other pipelines, and the infrastructure of Parker, Castle Rock, Castle Pines, Castle Pines North, Centennial, Roxborough, and others. The purpose of the study is to examine alternatives to meet the goals of reducing the region's reliance on Denver Basin groundwater and to meet their growing municipal and industrial needs and to finalize the alignments and specifications of this shared infrastructure project. The FS will include detailed engineering, public participation, alternatives, and environmental consequences.

Flaming Gorge Project Task Force Assessment

APPLICANT: El Paso County Water Authority

APPROVED: May 2010

STATUS: In Progress

WSRA FUNDS: $40,000 - Joint Application:
$20,000 - Arkansas Basin Account
$20,000 - Metro Basin Account

MATCHING FUNDS: None

DESCRIPTION:
This project assesses the viability of forming a task force, similar to the Fountain Creek Vision Task Force, to inform a Flaming Gorge Project. The assessment will review constituent agendas, supply alternatives, demand management, environmental impacts, and project development strategies to determine if a collaborative task force model is viable. Keystone Center will prepare a written Assessment Summary, including a recommendation whether to proceed to the convening of a task force. If the recommendation is not to convene, the summary will identify the obstacles to a successful convening or suggest alternatives to a task force approach. If the recommendation is favorable, Keystone Center will develop a protocol for the task force and convene the preliminary Task Force session.

Rotary Sprinkler Nozzle Retrofit

APPLICANT: Douglas County Water Resource Authority

APPROVED: September 2010

STATUS: Contracting

WSRA FUNDS: $250,000 (Statewide Account)

MATCHING FUNDS: $87,500

DESCRIPTION:
Rotary sprinkler nozzles are 30 percent more efficient in outdoor irrigation activities than traditional spray nozzles commonly in use in the project area. This project proposes to retrofit 1,000 homes with existing spray heads with rotary sprinkler nozzles to reduce water used by the project participants. Accompanying public outreach will create interest in the retrofit project, and this interest can be used to encourage more widespread adoption over time of retrofits as effective, comfortable water resource conservation practices in the project area. High school students will be hired to perform the 1,000 retrofits as part of a summer jobs program in the Memorial Day to Labor Day timeframe over the summer of 2011. Their work will be supervised by adults experienced in this type of work. Not only will the rotary sprinkler nozzles be retrofitted, but they will also be aimed to avoid over-spraying and watering sidewalks. Irrigation controllers will be reset to reflect the proper application rates of the rotary sprinkler nozzles. Impact metrics will be collected to assure proper installation of the rotary sprinkler nozzles. Members of the authority are water providers who can read the meters of the yards receiving the retrofits, and measure and confirm actual water saved through this retrofit program.

Rural Douglas County Groundwater Level Monitoring Network

APPLICANT: Rural Water Authority of Douglas County

APPROVED: September 2010

STATUS: Contracting

WSRA FUNDS: $113,055 ($28,263 - Basin Account and $84,792 - Statewide Account)

MATCHING FUNDS: $60,880

DESCRIPTION:
The primary objective of this study is to establish a county wide groundwater-level monitoring network for the long-term monitoring of the water resources of Douglas County, Colorado. The network will consist of approximately 30 existing wells throughout the county. Water levels will be measured monthly in all wells and five sites will be equipped with pressure transducers for continuous monitoring. Water levels measured from wells in the network will provide an assessment of the current water resource and provide the basis from which to monitor long-term changes of the hydrologic system.

Educating Denver Metro Elected Officials and Decision Makers on Solutions-oriented Water Supply Planning.

APPLICANT: Colorado Foundation for Water Education

APPROVED: January 2011

STATUS: In Progress

WSRA FUNDS: $14,820

MATCHING FUNDS: $2,000

DESCRIPTION:
As part of the Metro Roundtable's Education Action Plan, on March 31 they hosted a reception for decisionmakers titled, "Is There Enough Water?" Approximately 200 people came to hear John Stulp, Special Water Policy Advisor to the Governor; Jennifer Gimbel, CWCB director; John Sanderson, The Nature Conservancy's Colorado water program director; Joe Frank, Lower South Platte Water Conservancy District executive director, and Rod Kuharich, chair of the Metro Roundtable and director of the SMWSA. The speakers had a discussion with the audience on municipal and industrial needs and the 2050 water supply gap, as well as the needs of agriculture and the environment. The roundtable will use the remaining funds to host a follow-up workshop in the fall of 2011.

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