CDM

Draft Technical Memorandum

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Subject: *2050 Municipal and Industrial Gap Analysis*

The purpose of this technical memorandum is to update the Statewide Water Supply Initiative (SWSI) Projected 2030 Municipal and Industrial (M&I) and self-supplied industrial (SSI) "gap" analysis to 2050. Having an understanding of what the M&I gap is will help the Colorado Water Conservation Board (CWCB), Interbasin Compact Committee (IBCC), and Basin Roundtables focus on what portfolio of strategies are needed to fill the M&I gap.

Background

In SWSI, the CWCB worked with water providers and users, interest groups, organizations, and individuals throughout Colorado to identify solutions to address the state's future M&I and SSI demands. As part of the SWSI Phase 1 study, the CWCB:

- Cataloged and characterized specific water management solutions being contemplated around the state.
- Identified the amount of water, by basin and sub-basin, that would be produced by projects or processes that were expected to move forward in the future with a reasonable degree of certainty by 2030. These projects and processes were called Identified Projects and Processes (IPPs).
- Estimated the amount of water needed (the "gap" in supply) in each basin to meet 2030 needs, assuming each of the IPPs completely met its goals.
- Considered the potential implications if a portion of the IPPs were not successfully implemented.

The CWCB, IBCC, and Basin Roundtables have continued to discuss the gap and IPPs since the conclusion of SWSI Phase 1. As part of the "Water for the 21st Century Act," each Basin Roundtable is to identify their consumptive needs and identify projects and methods to meet their needs. The purpose of this memorandum is to update the gap analysis to a planning horizon of 2050 and to incorporate updated information on the IPPs that the CWCB collected working with the Basin Roundtables and water providers.

Section 1 of this memorandum discusses the methodology utilized to estimate the 2050 M&I and SSI gap. Specifically, Section 1 provides a general description of the required calculations and detailed descriptions of variations on the general methodology depending on the availability of quantifiable data in each basin. Section 2 summarizes the quantified IPPs and the estimated M&I/SSI gap on a statewide and basin basis. The results of extensive investigations into water providers' IPPs are categorized by type of project or process and presented in tables and graphs. Likewise, the results of the M&I/SSI gap estimate calculations are shown in both tabular and graphical form for specified low, medium, and high gap scenarios. Section 3 summarizes the conclusions of the M&I/SSI gap analysis and outlines next steps for moving toward final revisions and study completion in early 2011.

The gap numbers presented in this memorandum are average annual values; in some years the actual gap may be more or less than the average. 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, delivery, and treatment. Raw water needs may therefore be greater than the gap values presented in this memorandum.

This information will be reviewed with the Basin Roundtables and will be incorporated to an update of the SWSI report that is scheduled for completion in January 2011. Additionally, the information contained herein will be compiled into basin-specific reports in early 2011 to serve as Basin Needs Assessments, if approved by the Basin Roundtables.

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Section 1 – 2050 M&I Gap Methodology

The estimation of future municipal and industrial (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 identified projects and processes (IPPs). Statewide, these analyses were performed at a county or regional basis and aggregated by Basin Roundtable area, as shown in Figure 1-1.

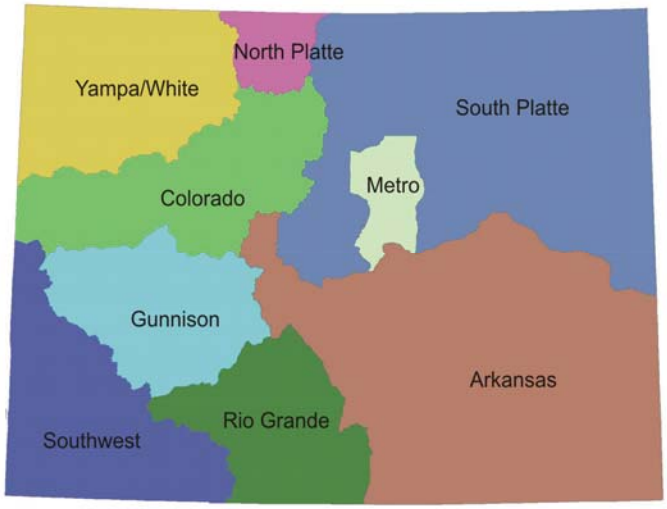


Figure 1-1. Colorado's Nine Basin Roundtables

The M&I gap analysis was completed on a regional basis for the Front Range where the majority of population growth is expected to occur over the next 40 years. As part of the Statewide Water Supply Initiative (SWSI) Phase I study, an M&I gap analysis was completed on a regional basis as shown in Figures 1-2 and 1-3.The regions defined in SWSI 1 were used for this updated gap analysis and are described as follows:

- Arkansas (Figure 1-2)
  - Upper Arkansas (Chaffee, Custer, Fremont, Lake, Teller)
  - Urban Counties (El Paso, Pueblo)
  - Lower Arkansas (Bent, Crowley, Otero, Prowers)
  - Eastern Plains (Baca, Cheyenne, Elbert, Kiowa, Lincoln)
  - Southwestern Arkansas (Huerfano, Las Animas)
- South Platte (Figure 1-3)
  - 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)
- Metro (Figure 1-3)
  - Denver Metro (Adams, Broomfield, Denver, Jefferson)
  - South Metro (Arapahoe, Douglas, Elbert)

Note that several counties (Cheyenne, Elbert, Lincoln, Teller) are split between two basins, with a pro-rata share of current and future demands accounted for in each basin. This approach is consistent with the South Platte and Metro Basin needs assessment work.

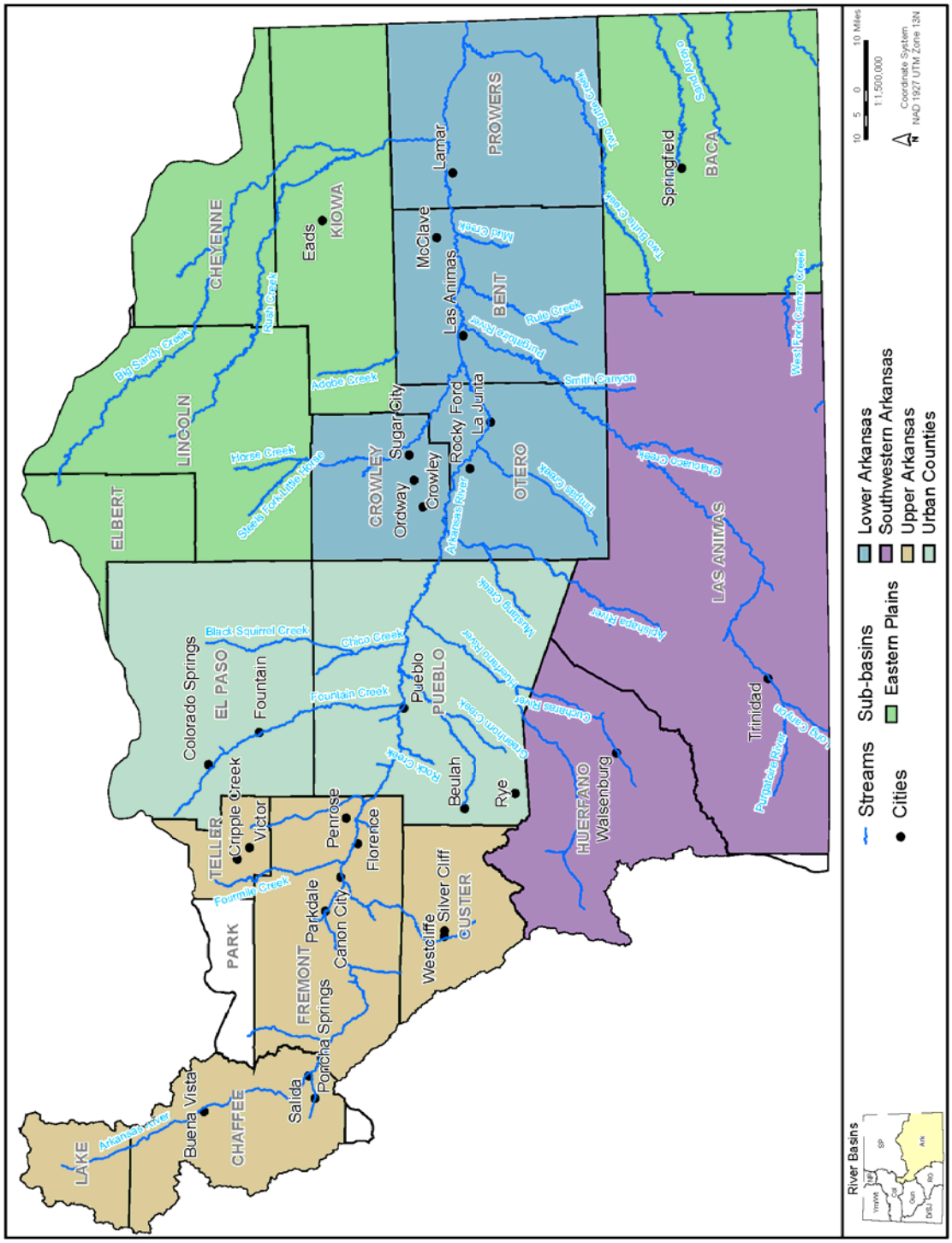


Figure 1-2
Arkansas Basin Location Map

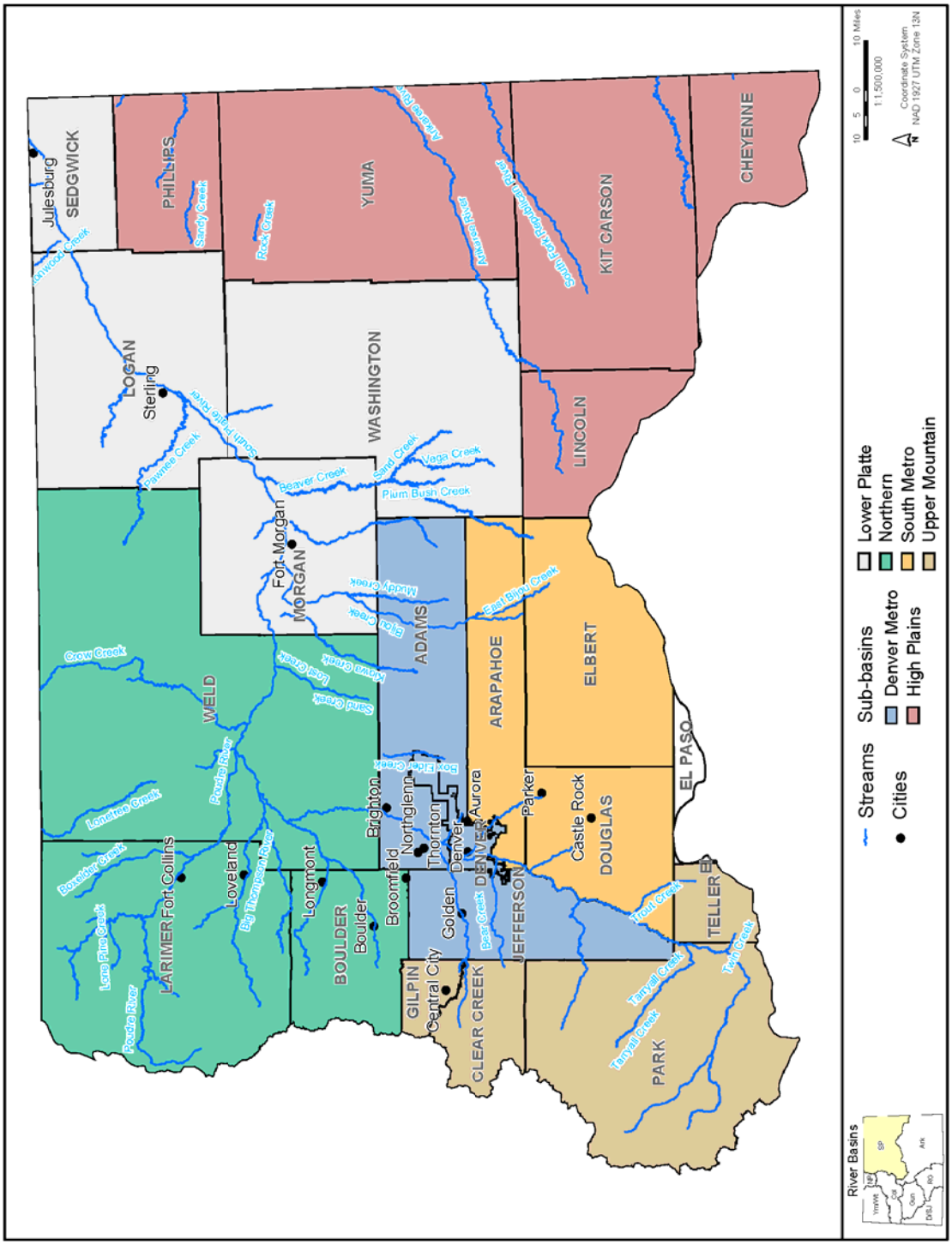


Figure 1-3
South Platte Basin Location Map

1.1 2050 Total New Demands

The first part of the M&I gap analysis is to calculate 2050 total new water needs. Updated 2008 (current) and 2050 (future, with low/medium/high growth scenarios) demands for M&I and self-supplied industrial (SSI) water use for each Colorado county were published in the July 2010 report *State of Colorado 2050 Municipal & Industrial Water Use Projections* (Colorado Water Conservation Board [CWCB] 2010); this report is referred to in this document as the "Demands to 2050 Report." Specifically, Section 3 of the Demands to 2050 Report addresses M&I water use, and Section 4 covers SSI water use. This data serves as the foundation for the gap analyses described herein.

The future M&I demand forecasts utilized in this study are based on the implementation of high levels of passive conservation. Section 3.2 of the Demands to 2050 Report explains the basis for this data:

> 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 [gallons per capita per day].The upper range of these savings were applied to the county level baseline estimates…to assess what the 2050 demands would be on a low, medium, and high basis with passive conservation.

Section 3.2 goes on to specify "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 and ages of individual types of commercial properties were not available.

The general approach to the 2050 net new water needs calculation is as follows:

- Calculate 2050 net new M&I water needs as 2050 low/medium/high M&I demand (with high passive conservation) minus current M&I use
- Calculate 2050 new SSI water needs as 2050 low/medium/high demand SSI minus current SSI use
- Calculate total 2050 total net new water needs (gross gap) as sum of M&I and SSI needs

The M&I and SSI net new water needs are calculated separately for ease of use in later steps when IPPs may be available to meet future M&I demands, but not SSI demands.

1.2 2050 Identified Projects and Processes

The second part of the 2050 M&I/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 provider, all relevant information was compiled to create the most complete picture of known available water supplies in the county. This IPP yield is then subtracted from the 2050 net new water needs 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 not available for redistribution to other counties unless otherwise noted.

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

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

CWCB staff conducted outreach interviews in 2010 to most municipal water providers with deliveries of 2,000 acre-feet/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

The categorized IPP data presented in this memorandum is based on information provided by the interviewed water providers. Although not explicitly quantified herein, it is likely that the true yield anticipated from agricultural water transfers is higher, but that 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 to be growth into existing supplies.

Based on these efforts IPP data were updated for 75 providers (listed in Appendix A) covering approximately 80 percent of the population in Colorado. In addition, updated per capita water use estimates were collected for 214 water providers covering 87 percent of the population in Colorado. Many of the quantified IPPs specified by the interviewed M&I water providers are identified in Appendix B.

Note that passive conservation is not included in the categorized IPPs as it was already factored into the 2050 demand forecasts. Active conservation measures are being examined in a separate effort by CWCB and will be included in the final report that will serve as an update to SWSI, scheduled for completion in January 2011.

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 Phase 1 report, which tallied IPPs by county or sub-basin, but generally did not categorize yields from specified types of IPPs.

In addition, 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 was applied to each IPP category relevant to that county or sub-basin. For example, total quantified IPPs for the interviewed providers in a particular county exceed 50,000acre-feet (AF), but IPPs required to meet 2050 net new water needs range from 18,000 AF to 30,000 AFAR percentage of the total 50,000 AF yield 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 developed. 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.

1.3 2050 M&I and SSI Gap Scenario Summary for the State of Colorado and the Basin Roundtables

To assess the range of the 2050 M&I and SSI Gap, CWCB developed three potential scenarios to bracket the range of the M&I and SSI gap for low to high scenarios. For the low gap scenario, 2050 water needs were estimated by subtracting the 2008 M&I and SSI demands from the low scenario of 2050 M&I and SSI demands (CWCB 2010, and presented in Section 2). Next, it was assumed that 100 percent of the low IPPs (see Section 2) could be applied to the 2050 water needs. The difference between the 2050 water needs and the IPPs is the low gap.

For the medium and high gap estimates, a similar approach was utilized using the 2050 medium and high M&I and SSI needs. However, the yield of the IPPs was assumed to be varied based on discussions from the Interbasin Compact Committee (IBCC), CWCB, and Basin Roundtables. For the medium scenario, it was assumed that the medium IPP yield (see Section 2) would be reduced based on percent success rates discussed by IBCC in their scenario discussions and that the high IPPs yield would be reduced based on the percent success rates as defined in the status quo portfolio that has been discussed by the IBCC. The percent success yield rates for the medium and high scenarios are presented in Table 1-1.

Table 1-1 Medium and High Gap Scenario IPP Success Rates

Basin	Medium Gap Scenario (IBCC Working Portfolio IPP Yield Success Rates)	High Gap Scenario (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%

1.4 2050 M&I/SSI Water Supply Gap

The M&I/SSI water supply gap is defined as follows:

M&I/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

Note that the 2050 M&I/SSI gap is referred to in the results tables (see Section 2) as the "information/real" gap. The "real" gap is based on known numerical data from the Demands to 2050 Report, water provider interviews/data, SWSI Phase 1, and other sources. Based on this information, 2050 M&I/SSI demand forecasts exceed the 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 sub-basins.

The preceding description represents the general approach to the M&I gap analyses, with the yields of IPPs based on 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/basin are provided in Appendix C.

1.4.1 Arkansas Basin

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

- The 2050 total water needs were calculated based on the Demands to 2050 Report, as described in the general approach.
- The July 2008 Arkansas Basin Roundtable update presents data consistent with SWSI Phase 1, i.e., current conditions = 2000, future conditions = 2030. The gap analysis in the Roundtable update is based on meeting 2030 demands.
- Provider-specified gaps were identified in SWSI Phase 1 and the Basin Roundtable updates. In most cases, this information was retained as a "real" gap.
- Arkansas Basin IPPs were generally calculated as 2030 demand minus 2000 demand (both values from SWSI Phase 1) minus specific provider gaps identified in SWSI Phase 1 and the Basin Roundtable updates.
- Colorado Springs Utilities (CSU) and the Pueblo Board of Water Works (PBWW) were both interviewed by CWCB. For each county, specific IPP information was substituted for the general calculation where available, either from these interviews or known information for projects such as the Southern Delivery System (SDS), Arkansas Valley Conduit (AVC), and the Eagle River Joint Use Project. The allocation of AVC water to various Arkansas Basin counties was based on work completed by Camp Dresser & McKee Inc. (CDM) for the pre-National Environmental Protection Agency (NEPA) State and Tribal Assistance Grant (STAG) report, which is in the process of being finalized at the time of this writing.
- After accounting for known IPPs, the information/real gap was generally calculated as 2050 net new water needs minus IPPs (for low/medium/high growth scenarios).
- If the available IPPs exceeded the 2050 water needs for a particular county, the IPPs were reset equal to the 2050 water needs. Sometimes this occurs for all three growth scenarios, sometimes for only low or low/medium. It is generally assumed that one provider's or one county's surplus IPPs would not be reallocated to another.

1.4.2 Colorado Basin

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

- The 2050 net new water needs were calculated based on the Demands to 2050 Report as described for the general approach.

- Provider-specified gaps were quantified based on CWCB interview data.

- IPPs for Colorado Basin counties were assessed based on a combination of CWCB interview data (although numerous interviews were conducted with water providers in the Colorado Basin, quantification of specific IPPs was limited); quantified 2030 IPPs presented for each county in Section 6 of the SWSI Phase I report (CWCB 2004); incremental changes in interviewed providers' 2035 demands and 2050 firm yields; and/or the calculated differences between 2050 total water needs and known 2050 gaps.

- The information/real gap was assessed based on provider-specified gaps and/or the difference between 2050 total water needs and IPPs.

- Initial IPPs and information/real gap estimates were adjusted as necessary such that IPPs plus information/real gap equals 2050 net new water needs.

1.4.3 Gunnison Basin

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

- The 2050 net new water needs were calculated based on the Demands to 2050 Report as described for the general approach.

- Delta County included provider-specified gaps based on CWCB interview data. Delta County and Ouray County included additional gaps for specific providers identified in SWSI Phase 1. Delta, Mesa, Montrose, and Ouray Counties included a gap for unincorporated areas equal to 5 percent of 2050 M&I water needs, also based on SWSI Phase 1. For these four counties, the information/real gap was calculated as the sum of known gaps.

- IPPs for Delta, Mesa, Montrose, and Ouray counties were calculated as the difference between 2050net new water needs and the information/real gap. The Project 7 Water Authority was assumed to meet the full Tri-County Water Conservancy District demand in Delta, Montrose, and Ouray counties.

- The Gunnison County and Hinsdale County IPPs were based on CWCB interview data. The anticipated yield from Lake San Cristobal (950 AF) meets all of Hinsdale County's 2050 water needs; the amount available above Hinsdale County's needs was applied to Gunnison County.

- Based on the IPPs exceeding 2050 net new water needs, Hinsdale County has no 2050 water supply gaps. Calculated as 2050 net new water needs minus IPPs, Gunnison County has 2050 gaps for the medium and high growth scenarios.

1.4.4 Metro Basin

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

- The 2050net 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.

- 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 land area 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 Combined Service Area (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 (Greg Fisher, personal communication 06/15/2010):
  - Denver County – 100 percent
  - Arapahoe County – 35percent
  - Jefferson County – 54percent
  - Douglas County – 5percent
  - Adams County – 10percent

- The yield associated with the Chatfield Reallocation Project was distributed based on participant storage ratios (Browning 2007) 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 anticipated 8,500 AF project yield.

- 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 county-wide IPPs appear to exceed 2050 new water needs.

1.4.5 North Platte Basin

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

- The 2050 net new water needs were calculated based on the Demands to 2050 Report as described for the general approach.

- For Jackson County, the SWSI Phase 1 report states that "it is anticipated that [the] increase in demand will be met primarily via the application of existing supplies and water rights." Therefore, IPPs were set equal to 2050 net new water needs, and the information/real gap for Jackson County is zero.

1.4.6 Rio Grande Basin

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

- The 2050 net new water needs were calculated based on the Demands to 2050 Report as described for the general approach.

- CWCB conducted interviews of the Cities of Alamosa and Monte Vista in Alamosa County. IPPs were not quantified in the interview summaries, but it was determined that adequate supplies are available to meet 2050 M&I needs. Therefore, Alamosa County IPPs were set equal to 2050 net new M&I needs, and the information/real gap was set equal to the 2050 new SSI water needs.

- For all other Rio Grande counties, IPPs were based on SWSI Phase 1 information. Conejos County and Mineral County were identified as having adequate water supplies to meet future needs beyond 2030; IPPs were therefore set equal to 2050 total water needs and the information/real gaps were zero. No IPPs were identified for Costilla County; the information/real gap was set equal to 2050 total water needs. SWSI Phase 1 quantified IPPs for Rio Grande County and Saguache County based on estimated yield from existing water rights, groundwater, and augmentation plans. The same values were applied as IPPs for the present gap analysis, and the information/real gap for these two counties was calculated as 2050 net new water needs minus IPPs.

1.4.7 South Platte Basin

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

- The 2050 net new water needs were calculated based on the Demands to 2050 Report as described for the general approach.

- For the South Platte Northern Counties, the IPPs were generally based on provider data from CWCB interviews. A portion of the yield from the Northern Integrated Supply Project (NISP) and Windy Gap Firming Project (WGFP) was added to the IPPs based on project participants located in those counties. Information/real gaps for Northern Counties were calculated as 2050 net new water needs minus IPPs (low/medium/high); Boulder County appears to have no 2050 water supply gaps.

- For the South Platte Upper Mountain Counties, SWSI Phase 1 assumed that adequate supplies are available to meet 90 percent of future needs, so the IPPs were set equal to 90 percent of 2050 net new water needs (low/medium/high). This assumption was deemed valid at the time of this writing, but may be revised in the future based on the forthcoming Upper Mountain Counties Water Needs Assessment and Water Supply Analysis. A small amount of the Chatfield Reallocation Project was assumed to be included in Park County's IPPs (42 AF for Center of Colorado Water Conservancy District).

- For the Lower Platte Counties, SWSI Phase 1 assumed that 50 percent of future needs would be met with known sources, so the IPPs were set equal to 50 percent of 2050 net new water needs (low/medium/high). Morgan County IPPs were assumed to include 4,900 AF of NISP yield.

- For the High Plains Counties, SWSI Phase 1 assumed that 100 percent of future M&I/SSI needs would be met by the high plains aquifer, so the IPPs were set equal to 2050 net new water needs (low/medium/high).

1.4.8 Southwest Basin

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

- The 2050 net new water needs were calculated based on the Demands to 2050 Report as described for the general approach.

- Archuleta, Dolores, La Plata, Montezuma, Montrose, and San Miguel Counties were assumed to have a gap for unincorporated areas equal to 5 percent of 2050 net

new M&I water needs. For Archuleta, Dolores, La Plata, and Montezuma Counties, this represents the entirety of the information/real gap.

- IPPs for Archuleta, Dolores, La Plata, and Montezuma County were estimated based on CWCB interview data. For all four counties, the aggregate IPPs exceed the countywide 2050 net new water needs, but were reduced to account for the unincorporated areas 5 percent M&I gap.

- IPPs for Montrose County and San Miguel County were assumed to be the same as those identified in Section 6 of the SWSI Phase 1 report. The information/real gap for these counties was calculated as 2050 net new water needs minus IPPs.

- San Juan County was found to have no gap in SWSI Phase 1. This was assumed to remain accurate, and IPPs were set equal to 2050 net new water needs.

1.4.9 Yampa-White Basin

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

- The 2050 net new water needs were calculated based on the Demands to 2050 Report as described for the general approach.

- IPPs for Moffat County were quantified based on CWCB interview data, and were assumed to meet all 2050 M&I needs. The information/real gap was set equal to the 2050 net new SSI water needs.

- The CWCB interviewed the Town of Rangely in Rio Blanco County, but IPPs were not quantified. For the gap analysis, Rio Blanco County IPPs were assumed to be equal to those identified in Section 6 of the SWSI Phase 1 report. The information/real gap for Rio Blanco County was calculated as 2050 net new water needs minus IPPs.

- IPPs for Routt County were estimated based on CWCB provider interview data, with the majority of the IPPs yield applied toward meeting 2050 M&I demands. The information/real gap was calculated as 2050 net new water needs minus IPPs.

Section 2 – Basin Level Summary of 2050 IPPs and Gap

The catalog of IPPs and resulting water supply gaps were summarized by sub-basin (region) or county. Tabulated results are presented in the following sections. In addition, figures in these sections illustrate the gap analysis from 2008 to 2050 for the low, medium, and high gap scenarios on a statewide and Basin Roundtable level.

The calculations described in Section 1.3 are best demonstrated by example. The Colorado Basin has an existing (2008) demand of 68,000 AF and a 2050 low growth demand of 132,200 AF, representing an increase of 64,200 AF. IPPs associated with the Colorado Basin low growth scenario are 42,100 AF (at 100 percent implementation), leaving a 2050 supply gap of 22,100 AF under the low gap scenario. The Colorado Basin has a 2050 medium growth demand of 149,600 AF, representing an increase of 81,600 AF over the existing demand. Medium growth IPPs total 54,200 AF at 100 percent yield, but based on Table 1-1, only 90 percent (49,000 AF) are assumed to be developed under the medium gap scenario (Figure 2-11). The result is a gap of 32,600 AF in 2050. High growth scenario demands are 179,300 AF, which is an increase of 111,300 AF over the existing scenario. High growth IPPs total70, 400 AF at 100 percent yield, but under the high gap scenario, again only 90 percent (63,400 AF) are applied. Thus, the Colorado Basin high gap is about 47,900 AF.

A similar process is utilized for the other basins. For the medium and high statewide analyses, the success rates in Table 1-1 are applied to each basin prior to calculating the overall gaps on an aggregate basis.

2.1 Statewide

A broad range of water management solutions with varying levels of supply are planned for each of the basins. Many water providers are pursuing multiple projects and will need to pursue all of these identified projects to meet their increased demand. This is due to the reality that each of the IPPs has risk associated with them and that they may not yield all of the anticipated water supply. Many of these projects and processes 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.

As described in the general IPPs methodology in Section 1, the IPPs were grouped into seven primary categories. Table 2-1 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 values shown. Where values do not change from low to high, a single value is shown rather than a range. Figure 2-1 shows the data graphically.

Table 2-1 Major Categories of Identified Projects and Processes by Basin (Yields @ 100% Success)

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 (AFY)
Arkansas	9,240 – 11,440	23,000 – 32,020	2,280 – 2,570	37,050 – 37,030	0	6,080 – 7,280	10,150 – 10,560	87,800 – 100,900
Colorado	2,910 – 7,990	540	14,340 – 27,660	13,190 – 15,490	0	11,120 – 18,720	0	42,100 – 70,400
Gunnison	370 – 550	0	1,130 – 1,650	11,620 – 15,400	0	900	0	14,020 – 18,500
Metro	21,220 – 32,480	14,380 – 20,840	51,980 – 86,380	35,740 – 42,280	13,610 – 22,330	820 – 1,290	3,450 – 4,800	141,200 – 210,400
North Platte	0	0	100 – 300	0	0	0	0	100 – 300
Rio Grande	0	0	2,910 – 4,310	0	0	2,980 – 4,290	0	5,890 – 8,600
South Platte	18,880 – 20,490	5,440 – 7,320	20,460 – 29,810	36,850 – 39,430	0	21,820 – 25,780	18,350 – 21,270	121,800 – 144,100
Southwest	0	0	4,940 – 6,790	9,290 – 13,910	0	0	0	14,230 – 20,700
Yampa-White	0	0	3,460 – 4,900	6,640 – 9,000	0	0	0	10,100 – 13,900
Total	**52,620 – 72,950**	**43,360 – 60,720**	**101,600 – 164,370**	**150,380 – 172,540**	**13,610 – 22,330**	**43,720 – 58,260**	**31,950 – 36,630**	**437,240 – 587,800**

Figure 2-1 Statewide - Summary of IPP Categories at 100% Yield

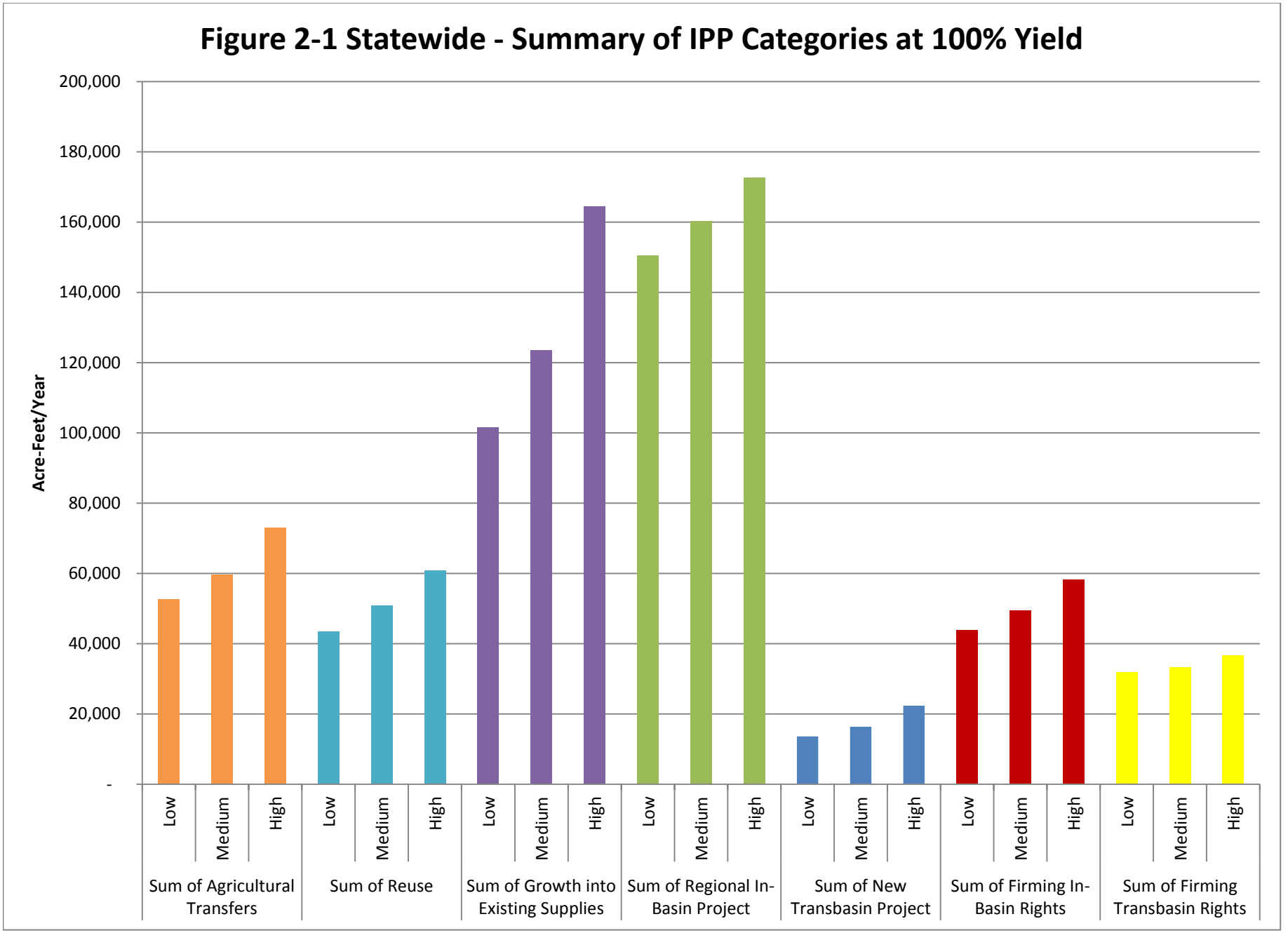


Table 2-2 provides a summary of each basin's increased M&I and SSI demands relative to current conditions (defined for this study as 2008), the amount of that increase met by the IPPs, and the general locations of the gap. In general, the low IPPs plus the low remaining M&I/SSI gap equal the low increase in M&I/SSI demand, with some variation due to rounding. 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 extra gap amounts associated with the replacement of existing non-renewable groundwater sources.

Figures 2-2 through 2-4 illustrate the statewide M&I/SSI existing supply, IPPs, and gap for the low, medium, and high growth scenarios. The statewide existing supply is 1,161,000 AF and is assumed to remain constant through 2050.

Under the low gap scenario, IPPs first begin to come online around 2010 and grow steadily until reaching an upper limit of 437,240AF in 2040. The gap begins to grow starting in 2030, becoming more significant in the 2040-2050 decade as additional IPPs cease to be added, and reaching a maximum of 189,400 AF in 2050.

The existing supply and IPPs begin similarly for the medium scenario, until the IPPs reach a maximum of 353,870 AF in 2030 and remain constant through 2050. The medium gap begins to accrue starting in 2030 and by 2050 surpasses the IPPs at 390,590 AF.

With the high gap scenario, the IPPs grow rapidly through 2030, and then only slightly more during the following decade, reaching a maximum of 354,500 AF in 2040. The gap again appears around 2030, climbing steadily to 628,930 AF in 2050.

The following sections quantify the range of yields expected from each category of IPPs statewide and for each county or region in each basin. 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'. 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.

Table 2-2 Statewide M&I and SSI Gaps in 2050

Basin	Increase in M&I and SSI Demand (AFY)			Estimated Yield of Identified Projects and Processes @ 100% Success (AFY)			Estimated Remaining M&I/SSI Gap after Identified Projects and Processes (AFY)									Location of Gap
							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	Low	Med	High	Low	Med	High	
Arkansas	110,400	135,400	170,800	87,800	94,700	100,900	*36,200*	54,200	83,500	45,000	*63,700*	93,600	58,100	78,000	*108,700*	Upper Arkansas, Urban Counties, and Southwestern Arkansas regions; also Prowers, Elbert, Kiowa, and Lincoln Counties; Additional gap for Urban Counties unsustainable groundwater use.
Colorado	64,500	81,500	111,200	42,100	54,200	70,400	*22,100*	27,200	40,800	26,400	*32,600*	47,900	26,400	32,600	*47,900*	Garfield, Grand, Mesa, Pitkin, and Summit Counties.
Gunnison	16,300	19,100	23,000	14,020	16,000	18,500	*2,480*	3,190	4,400	3,720	*4,730*	6,130	3,720	4,730	*6,130*	Delta and Gunnison Counties; Towns of Ouray and Ridgway and unincorporated areas in Ouray County; Unincorporated areas in Montrose and Mesa Counties.
Metro	183,000	207,400	277,800	141,200	162,400	210,400	*62,600*	65,900	88,200	119,100	*130,800*	172,400	133,200	147,000	*193,400*	Adams, Denver, and Jefferson Counties in Denver Metro area; South Metro area, including unsustainable groundwater use.
North Platte	100	200	300	100	200	300	*0*	0	0	10	*20*	30	10	20	*30*	No gap anticipated.

Table 2-2 Statewide M&I and SSI Gaps in 2050 (cont.)

Basin	Increase in M&I and SSI Demand (AFY)			Estimated Yield of Identified Projects and Processes @ 100% Success (AFY)			Estimated Remaining M&I/SSI Gap after Identified Projects and Processes (AFY)									Location of Gap
							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	Low	Med	High	Low	Med	High	
Rio Grande	7,690	9,900	12,800	5,890	7,100	8,600	*1,800*	2,800	4,200	2,310	*3,620*	5,130	2,310	3,620	*5,130*	Alamosa County (SSI only); Mineral, Rio Grande, Saguache Counties (M&I only).
South Platte	157,300	184,300	226,700	121,800	129,400	144,100	*35,700*	54,900	82,600	84,300	*106,500*	140,200	108,600	132,400	*169,100*	Northern, Upper Mountain, and Lower Platte regions.
Southwest	19,530	24,790	31,200	14,230	17,290	20,700	*5,120*	7,620	10,520	8,810	*11,920*	15,740	8,810	11,920	*15,740*	Archuleta, Dolores, La Plata, and Montezuma Counties (unincorporated areas only); Montrose County (primarily SSI); San Miguel County (M&I).
Yampa-White	33,500	47,500	95,400	10,100	11,900	13,900	*23,400*	35,600	81,500	24,400	*36,700*	82,800	24,400	36,700	*82,800*	Moffat County (SSI only); Rio Blanco and Routt Counties (primarily SSI associated with energy development).
Total	**592,320**	**710,090**	**949,200**	**437,240**	**493,190**	**587,800**	***189,400*[1]**	**251,410**	**395,720**	**314,050**	***390,590*[2]**	**563,930**	**365,550**	**446,990**	***628,930*[3]**	

[1] Low gap = 189,400 AF represented in Figure 2-2.
[2] Medium gap = 390,590 AF represented in Figure 2-3.
[3] High gap = 628,930 AF represented in Figure 2-4.

Figure 2-2 Statewide M&I and SSI Gap Summary Low Scenario (IPPs at 100%Yield)

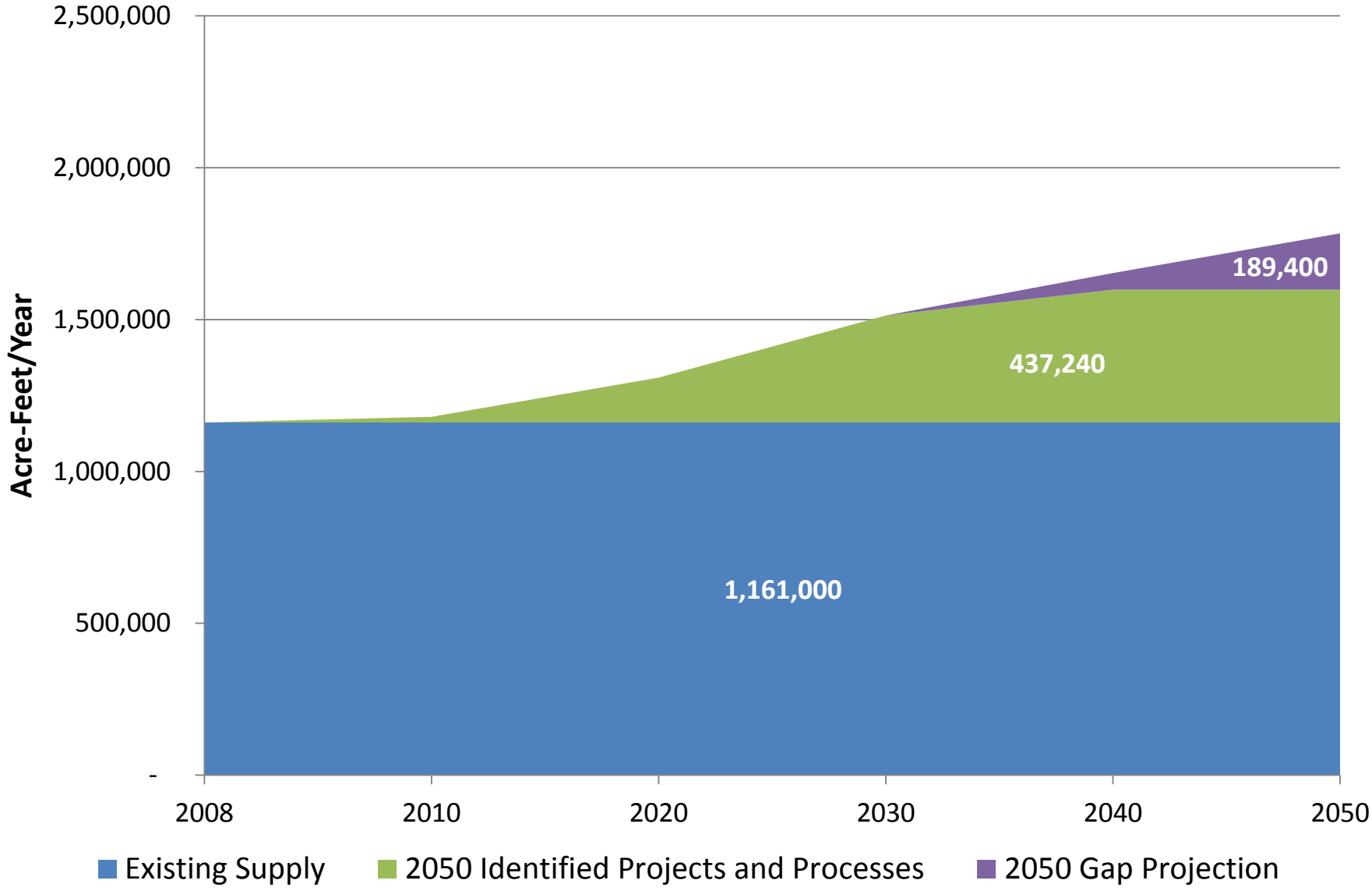


Figure 2-3 Statewide M&I and SSI Gap Summary Medium Scenario (IPPs at 72% Yield)

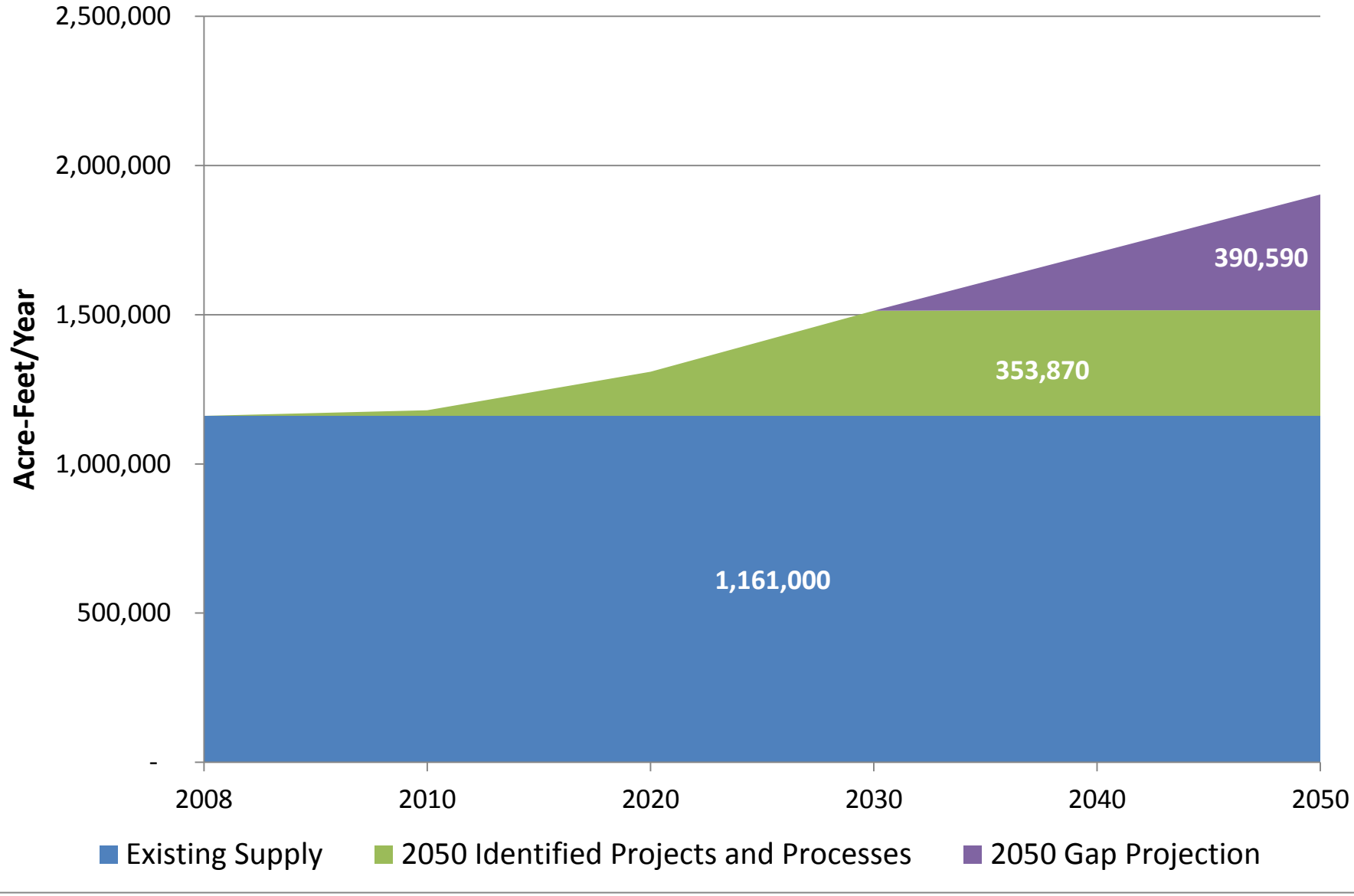
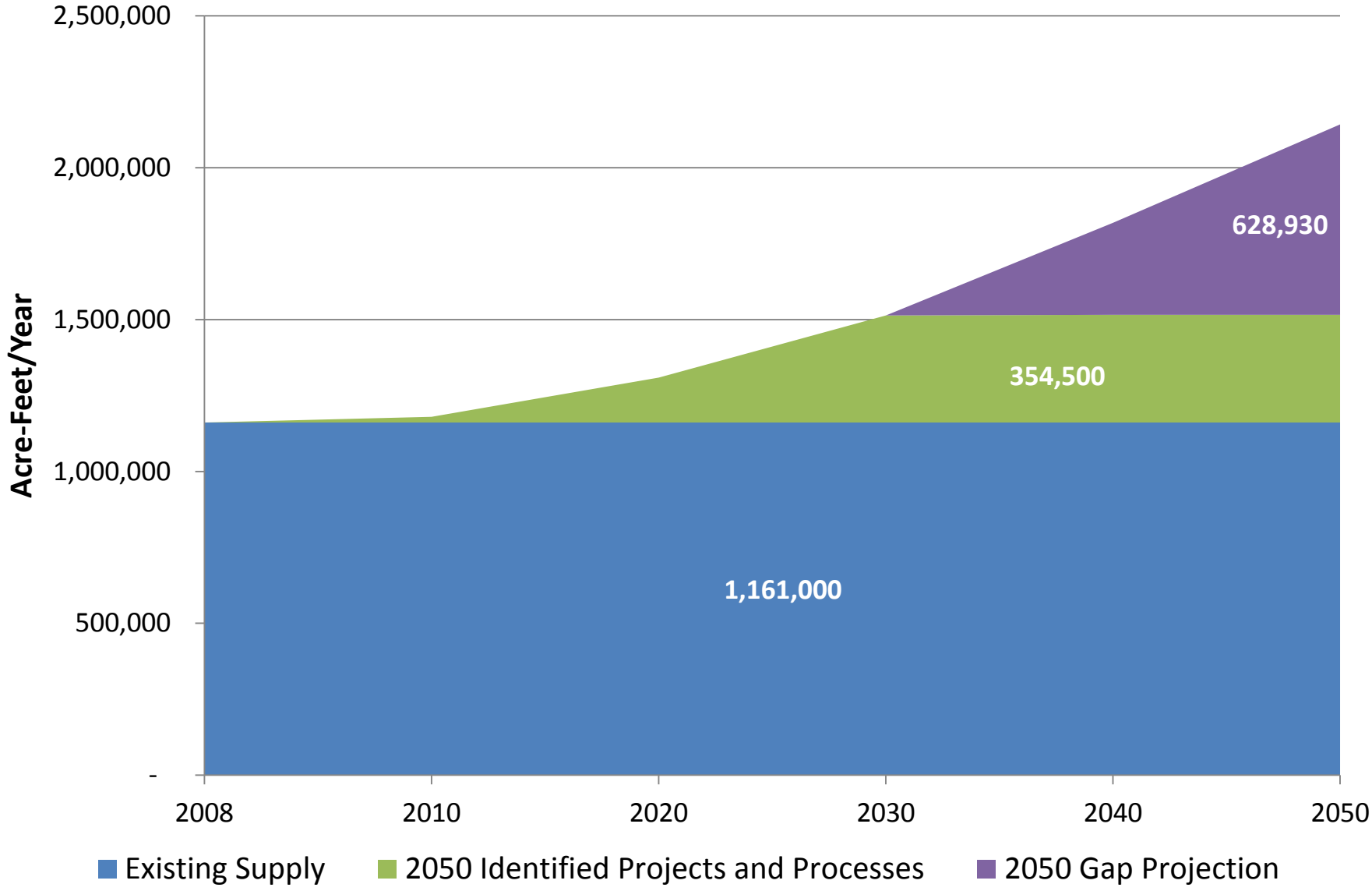


Figure 2-4 Statewide M&I and SSI Gap Summary High Scenario (IPPs at 60% Yield)



2.2 Arkansas Basin

In the Arkansas Basin, most of the major M&I surface water providers reported that they will be able to meet all or part of 2050 needs through existing supplies, projects underway, and future plans and projects. Reuse is being pursued by most providers that have reusable supplies. In most cases in Colorado, reuse is limited to non-native water such as transbasin diversions, non-tributary groundwater, and the unused first use portion of the consumptive use (CU) portion of transfers of agricultural rights. Most of the entities that are planning reuse projects in the Arkansas Basin anticipate using one or more of the following components:

- Augmentation Plans
- Exchanges
- Non-potable use for irrigation of parks and golf courses
- Groundwater recharge
- Gravel lake storage to regulate consumable return flows for exchange or non-potable reuse

CSU and the PBWW both indicated in recent interviews with CWCB that they have adequate existing water rights or are pursuing new projects to meet 2050 demands and beyond. Their "surplus" supplies are not available for permanent use by others, since these supplies will eventually be needed by CSU and Pueblo PBWW. Given the lack of developable new supplies in the Arkansas Basin, agricultural transfers throughout the basin will continue via purchases, developer donations, and development of irrigated lands.

Providers in the Southeastern Colorado Water Conservation District (SECWCD), including entities in the Upper Arkansas, Urban Counties, and Lower Arkansas regions, are relying heavily on future Fry-Ark Project allocations. The Eastern Plains region will rely on non-tributary groundwater and the Southwestern Arkansas region will rely on augmentation, existing water rights, and agricultural transfers.

Many providers are planning on maximizing the use of their existing transbasin and other fully consumable supplies. Even though there is no developable additional water in the basin, storage is needed throughout the basin to regulate existing and future supplies, firm the yield of agricultural transfers, provide for augmentation releases, and to capture return flows.

Funding for the AVC, which would improve drinking water quality and reduce transit losses for the Lower Arkansas Basin communities, has been authorized by the federal government. Pre-NEPA studies for the project, funded through a STAG, are nearing completion. The towns along the mainstem of the Arkansas River

downstream of the City of Pueblo divert from alluvial wells, non-tributary deep wells, or from tributary surface water supplies. In addition to local water rights, these towns also have access to Fry-Ark Project allocations and return flows from the use of project water. Stream transit losses are assessed from Pueblo Reservoir to the downstream location and water quality is impacted by minerals and salts in the river channel and return flow as the water flows down the Arkansas River.

Fountain and Security are both participating in the SDS with CSU to help meet their future demands. A Final Environmental Impact Statement (EIS) for the project has been published by the Bureau of Reclamation (BOR), and a Record of Decision (ROD) was issued in March 2009.

In contrast, unincorporated northern El Paso County needs renewable sources to meet future demands as it is currently 100 percent on non-renewable, non-tributary groundwater. If that area's existing non-tributary sources fail or become technically or economically infeasible to continue to use as well yields decline, the amount needed ("the gap" between supply and demand) will become significantly larger in the northern portion of the basin. The El Paso County gap shown in Table 2-3 includes an additional 14,000 AF due to the necessary replacement of non-renewable groundwater sources.

The Upper Arkansas Water Conservancy District (UAWCD), which provides augmentation for wells in a portion of the upper basin, will be challenged to develop the CU water rights and storage required to meet the augmentation requirements for these wells. The upper basin, like many headwater areas throughout the state, is projected to experience high growth rates. Augmentation to existing or proposed environmental and recreation water rights, such as CWCB instream flow rights and recreational in-channel diversions (RICDs) and senior agricultural and M&I rights, will likely require the construction of storage in upper areas of tributaries. Economies of scale are generally not present in small reservoir construction and the engineering, permitting, and construction costs will tax the ability to provide for augmentation water at a reasonable cost. The acquisition of agricultural rights will likely be part of the augmentation supplies for the UAWCD due to limits on the availability of Fry-Ark allocations.

Anticipated yields from each category of IPPs at 100 percent success rate are summarized for the Arkansas Basin in Table 2-3 and Figure 2-5.

Table 2-3 Arkansas 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)	IPPs
Eastern Plains	0	0	1,620 – 1,910	0	0	0	80 – 90	• Non-tributary groundwater • Arkansas Valley Conduit
Lower Arkansas	0	0	0	0	0	800 – 2,000	0	• Arkansas Valley Conduit
Southwestern Arkansas	620	0	660	0	0	620	0	• Existing water rights • Augmentation plans • Agricultural transfers
Upper Arkansas	3,620	0	0	0	0	4,660	3,620	• Upper Arkansas WCD Augmentation plan • Other augmentation plans • Agricultural transfers • Use of Fry-Ark M&I allocation directly or for augmentation
Urban Counties	5,000 – 7,200	23,000 – 32,020	0	37,050	0	0	6,450 – 6,850	• Agricultural transfers • Reuse plans • Groundwater • Southern Delivery System • Eagle River Joint Use Project • Arkansas Valley Conduit
Total	**9,240 – 11,440**	**23,000 – 32,020**	**2,280 – 2,570**	**37,050 – 37,030**	**0**	**6,080 – 7,280**	**10,150 – 10,560**	**87,800 – 100,900**

Figure 2-5 Arkansas - Summary of IPP Categories at 100% Yield

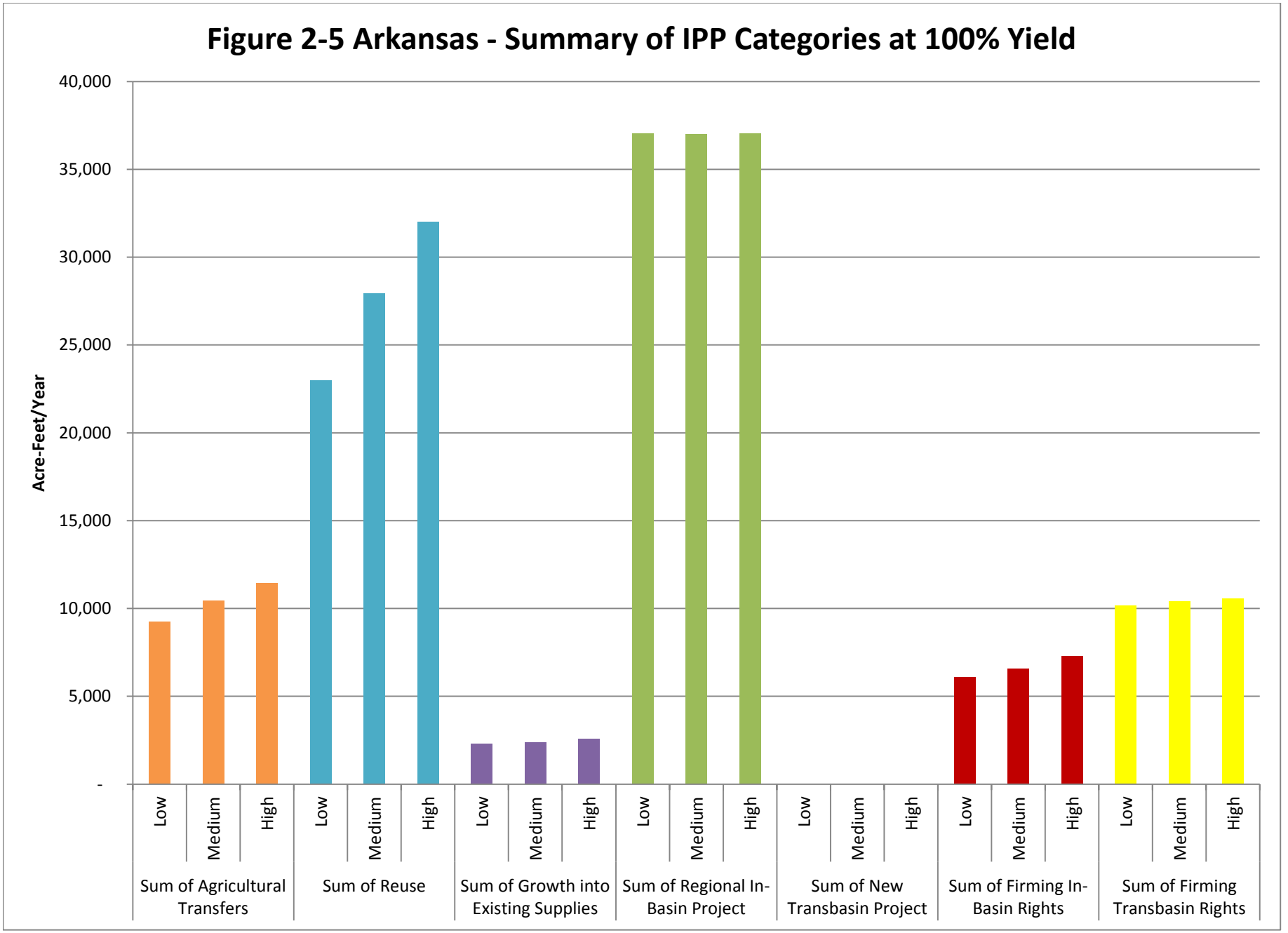


Table 2-4 provides a summary of increased M&I and SSI demands, the amount of that increase provided by the IPPs, and the general locations of the gap for each region in the Arkansas Basin.

Arkansas Basin M&I/SSI existing supplies, IPPs, and gap projections are shown graphically and chronologically in Figures 2-6 through 2-8. The baseline existing M&I/SSI water supply for the Arkansas Basin is 255,000 AF 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 non-renewable groundwater in some areas of the Arkansas Basin. For the low gap scenario, IPPs are developed between 2010 and 2040 to contribute up to 87,800 AF towards new demands. The gap begins to develop starting in 2030, reaching 36,200 AF by 2050. Under the medium gap scenario, 85,300 AF of Arkansas Basin IPPs are developed between 2008 and 2030, and none thereafter. The gap begins to accrue in 2030, growing steadily to 63,700 AF in 2050. For the high gap scenario, Arkansas Basin IPPs are added through 2030, reaching a maximum of 75,600 AF. The gap again begins to develop starting in 2030 and reaches 108,700 AF by 2050.

2.3 Colorado Basin

M&I and SSI needs are expected to increase dramatically in the Colorado Basin by 2050. During the SWSI Phase 1 process in 2003-2004, the Upper Colorado River Study (UPCO) and Eagle River processes were highlighted by Roundtable participants as being critical to meeting the future demands in Eagle, Grand, and Summit Counties. It is expected that augmentation contracts available out of Ruedi and Wolford Reservoirs will be a key part of meeting 2050 demands in the basin. In addition, agricultural transfers will continue from purchases, developer donations, and development of irrigated lands. Existing supplies will be used in all Colorado Basin counties, and agricultural transfers will be part of the future supplies used to meet increased demands in Eagle, Garfield, and Mesa Counties.

Summit and Grand Counties anticipate significant M&I gaps and environmental and recreational shortages as a result of existing transbasin diversions and planned future increases in transbasin diversions as a result of the Denver Water's Moffat Collection System Project and the Northern Colorado Water Conservancy District's (NCWCD) Windy Gap Firming Project. These two projects have water rights that are senior to much of the in-basin M&I rights; both projects are currently undergoing NEPA evaluation under the guidance of the U.S. Army Corps of Engineers (USACE). The UPCO process has outlined potential solutions, but these solutions have a high level of uncertainty and implementation challenges due to lack of physical availability of water and permitting issues for any structural alternatives. As a result, gaps are shown in Grand and Summit Counties (Upper Colorado River Study2003).

Table 2-4 Arkansas 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 if 100% success rate (AFY)			Estimated Remaining M&I/SSI Gap after Identified Projects and Processes (AFY)								
							Gap at 100% IPP Success Rate			Gap at Alternative IPP Success Rate (90%)			Gap at Status Quo IPP Success Rate (75%)		
	Low	Med	High	Low	Med	High	Low	Med	High	Low	Med	High	Low	Med	High
Eastern Plains	2,300	2,700	3,200	1,700	1,800	2,000	*600*	900	1,300	800	*1,100*	1,500	1,100	1,400	*1,700*
Lower Arkansas	900	1,400	2,100	800	1,300	2,000	*100*	100	100	200	*200*	300	300	400	*600*
Southwestern Arkansas	3,000	3,700	4,600	1,900	1,900	1,900	*1,100*	1,800	2,700	1,300	*2,000*	2,900	1,600	2,300	*3,200*
Upper Arkansas	19,000	22,100	25,900	11,900	11,900	11,900	*7,200*	10,300	14,000	8,400	*11,500*	15,200	10,100	13,300	*17,000*
Urban Counties[1]	85,200	105,500	135,000	71,500	77,800	83,100	*27,200*	41,100	65,400	34,300	*48,900*	73,700	45,000	60,600	*86,200*
Total	**110,400**	**135,400**	**170,800**	**87,800**	**94,700**	**100,900**	***36,200***[2]	**54,200**	**83,500**	**45,000**	***63,700***[3]	**93,600**	**58,100**	**78,000**	***108,700***[4]

[1] Urban Counties Gap includes an additional 13,500 AF for replacement of non-renewable groundwater.
[2] Low gap = 36,200 AF represented in Figure 2-6.
[3] Medium gap = 63,700 AF represented in Figure 2-7.
[4] High gap = 108,700 AF represented in Figure 2-9.

Figure 2-6 Arkansas Basin M&I and SSI Gap Summary Low Scenario (IPPs at 100% Yield)

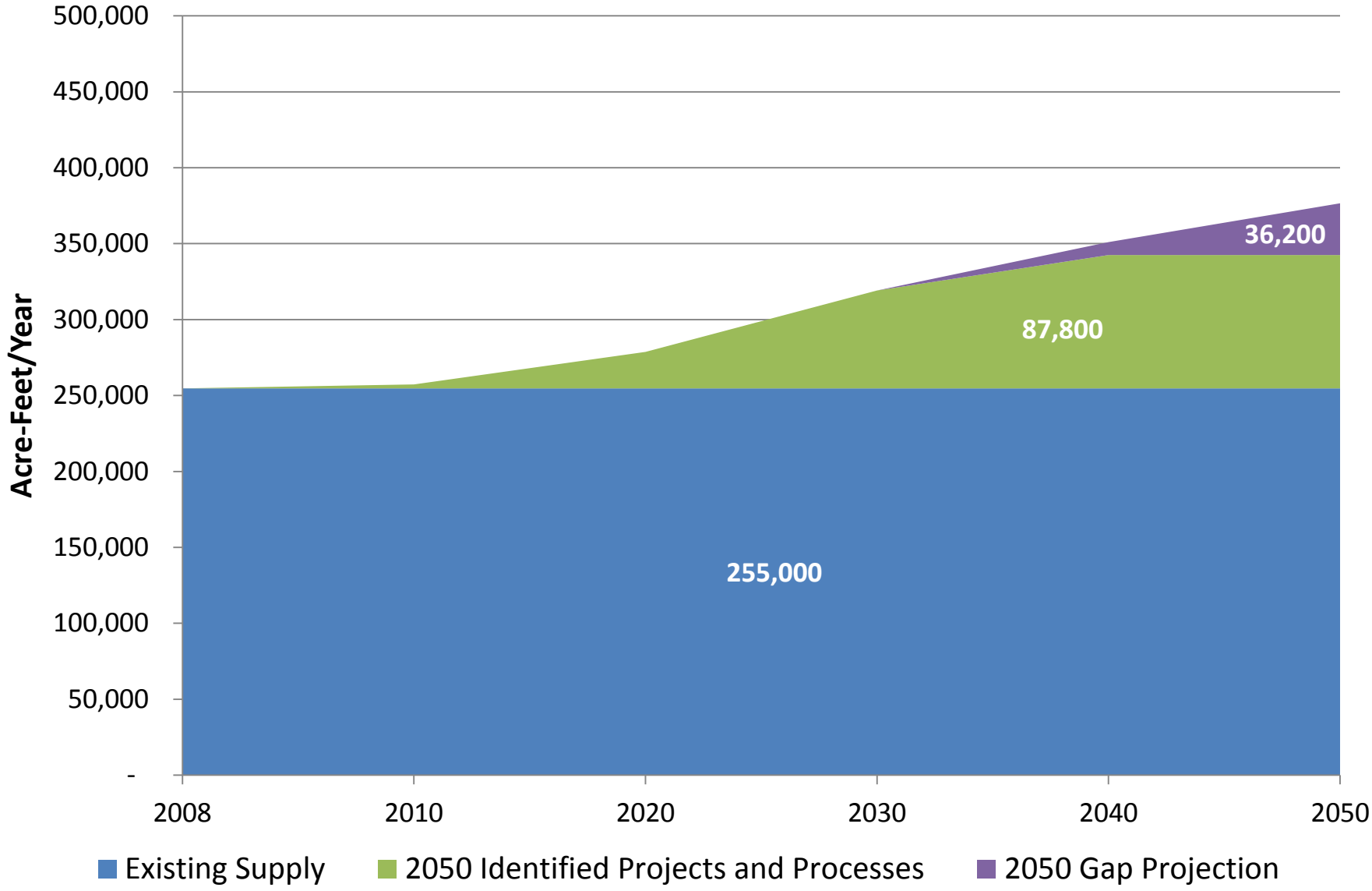


Figure 2-7 Arkansas Basin M&I and SSI Gap Summary Medium Scenario (IPPs at 90% Yield)

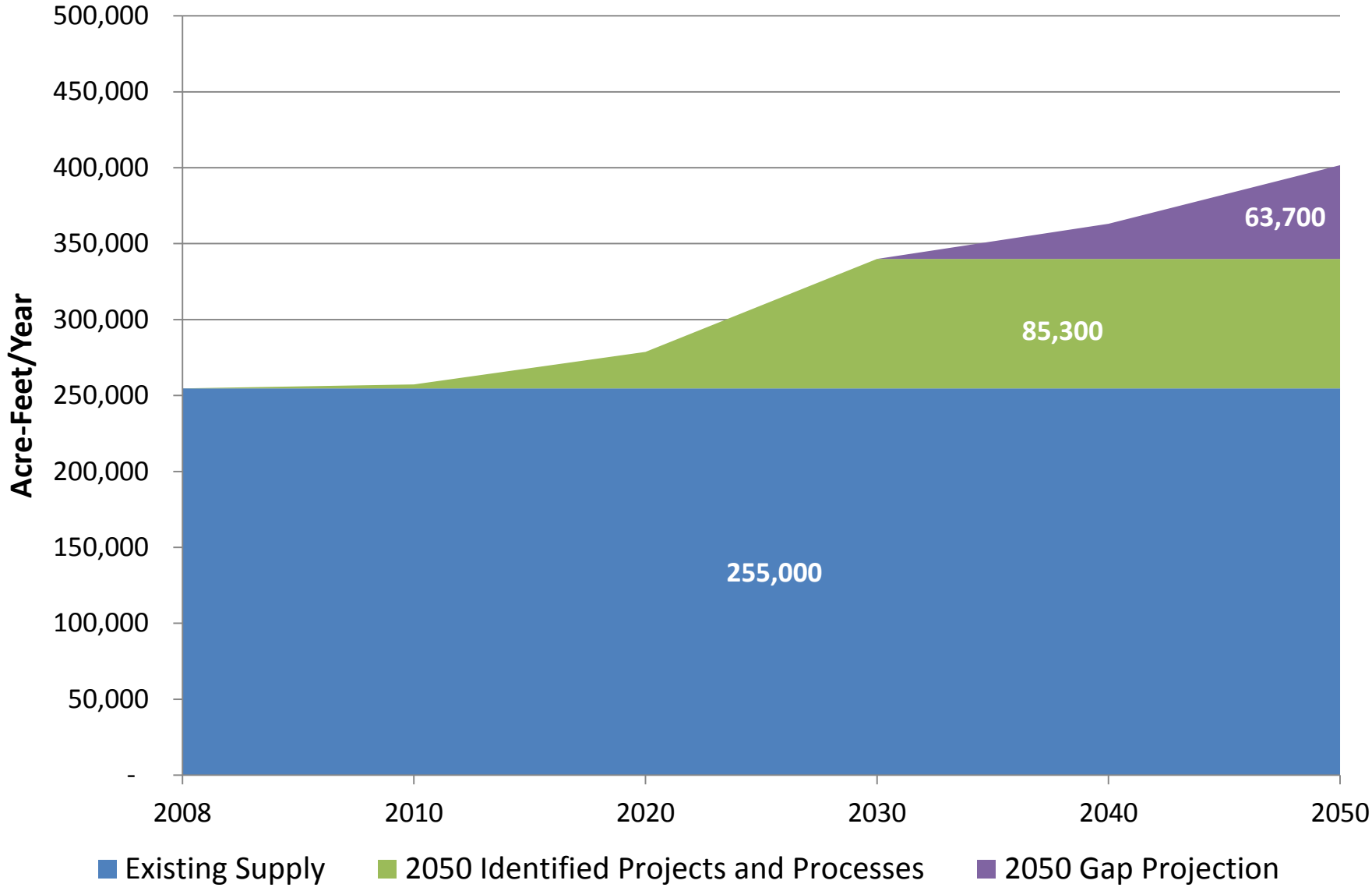
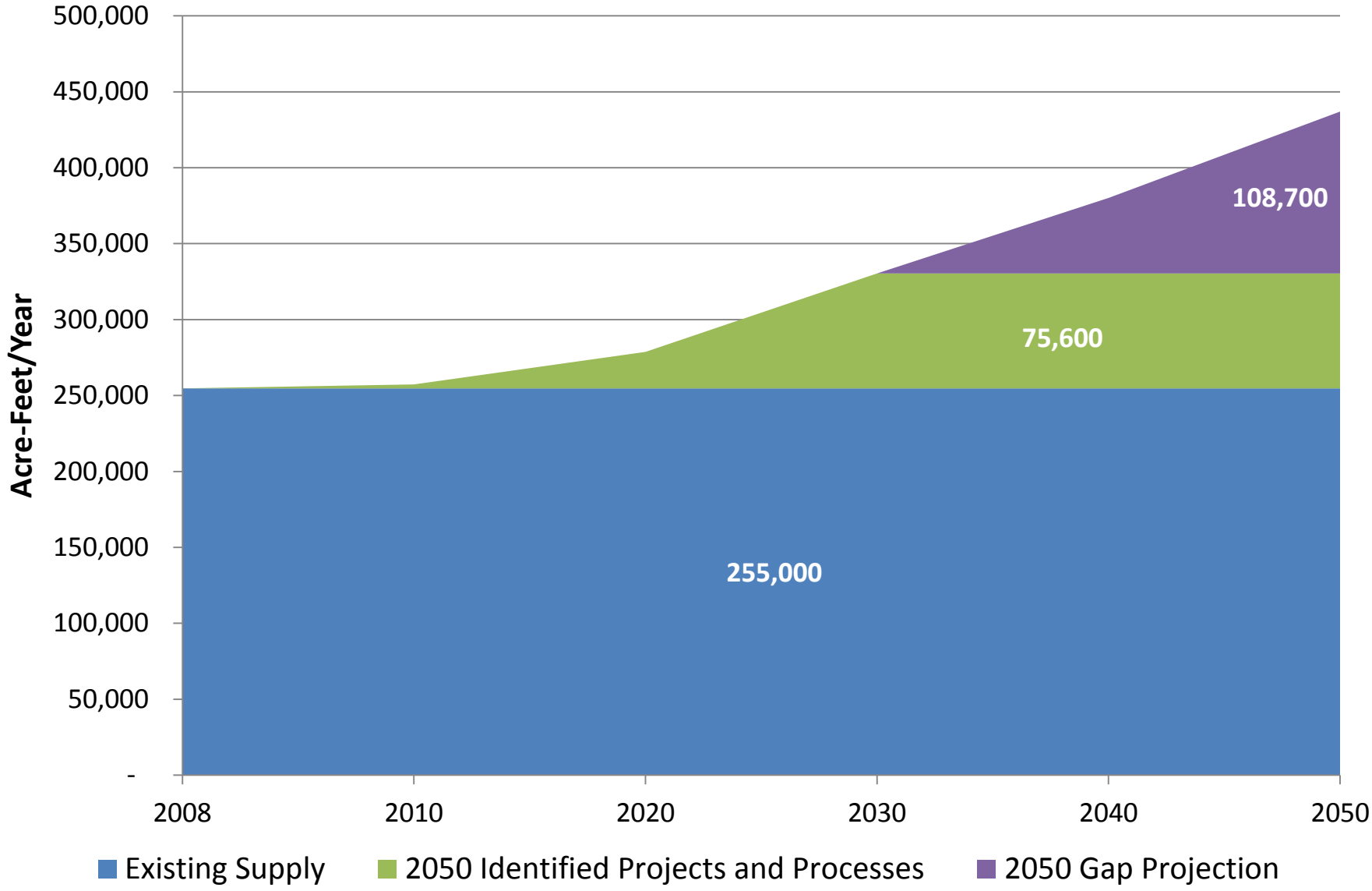


Figure 2-8 Arkansas Basin M&I and SSI Gap Summary High Scenario (IPPs at 75% Yield)



Other key IPPs identified in the Colorado Basin include the Hunter Reservoir enlargement (Ute Water Conservancy District) in Mesa County and the West Aspen Reclaimed Water Project in Pitkin County. Additionally, the Eagle River Joint Use Project will provide up to 10,000 AF of dry year firm yield for entities in Eagle County. Anticipated yields from each category of IPPs at 100 percent success rate are summarized for the Colorado Basin in Table 2-5 and Figure 2-9.

Table 2-6 provides a summary of increased M&I and SSI demands, the amount of that increase provided by the IPPs, and the general locations of the gap for each region in the Colorado Basin.

Figures 2-10 through 2-12 show the M&I/SSI existing supply, IPPs, and gap for the Colorado Basin. The basin's existing M&I/SSI supply is 68,000 AF and is assumed to remain constant through 2050; future demands and supplies will increase above this amount. For the low gap scenario in the Colorado Basin, major IPP development occurs between 2010 and 2030, with some additional expansion to 42,100 AF in 2040.The gap begins to grow during the last decade of IPPs development, reaching 22,100 AF in 2050. For the medium growth scenario, IPPs are developed through 2040, with somewhat higher growth between 2020 and 2040; a maximum of 49,000 AF is reached in 2040. The gap begins to grow starting in 2030 and totals 32,600 AF by 2050. In the Colorado Basin, the high gap scenario shows a greater rate of IPPs development after 2030, hitting 63,400 AF by 2040. However, the gap is greater, amounting to 47,900 AF in 2050.

2.4 Gunnison Basin

In the Gunnison Basin, much of the M&I and SSI needs will be addressed through existing rights and new regional in-basin projects. The Tri-County Water Conservancy District, which serves much of Montrose, Delta, and Ouray Counties, holds water rights in the Dallas Creek Project. Combined with water from the Project 7 Water Authority, these counties are anticipated to have adequate water supplies through 2050.

The Upper Gunnison River Water Conservancy District (UGRWCD) provides augmentation for wells in a portion of the upper basin. The upper basin, like many headwater areas throughout the state, is projected to experience high growth rates. The Crested Butte area may experience significant growth if adequate water supplies for M&I and snowmaking can be developed. Augmentation to existing or proposed environmental and recreational water rights, such as CWCB instream flow rights and RICDs and senior agricultural and M&I water rights, will likely require the construction of storage in upper areas of tributaries.

Table 2-5 Colorado 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)	IPPs
Eagle County	2,060 – 4,580	0	5,610 – 10,670	370	0	2,060 – 4,580	0	• Existing supplies and planned water rights acquisitions • Eagle River Joint Use Project • Ruedi Reservoir contracts for augmentation • Agricultural transfers
Garfield County	160	0	6,440	3,520	0	6,480	0	• Existing supplies • Ruedi and Wolford Reservoir contracts for augmentation • Agricultural transfers.
Grand County	0	0	300 – 800	2,400	0	0	0	• Growth into existing supplies • Upper Colorado River Basin Study (UPCO)
Mesa County	690 – 3,250	0	1,320 – 6,500	0	0	1,890 – 4,450	0	• Existing supplies • Ruedi and Wolford Reservoir contracts for augmentation • Hunter Reservoir enlargement • Agricultural transfers
Pitkin County	0	540	670 – 3,250	0	0	690 – 3,210	0	• Existing supplies • Reudi Reservoir contracts for augmentation • West Aspen Reclaimed Water Project
Summit County	0	0	0	6,900 – 9,200	0	0	0	• Upper Colorado River Basin Study (UPCO)
Total	**2,910 – 7,990**	**540**	**14,340 – 27,660**	**13,190 – 15,490**	**0**	**11,120 – 18,720**	**0**	**42,100 – 70,400**

Figure 2-9 Colorado - Summary of IPP Categories at 100% Yield

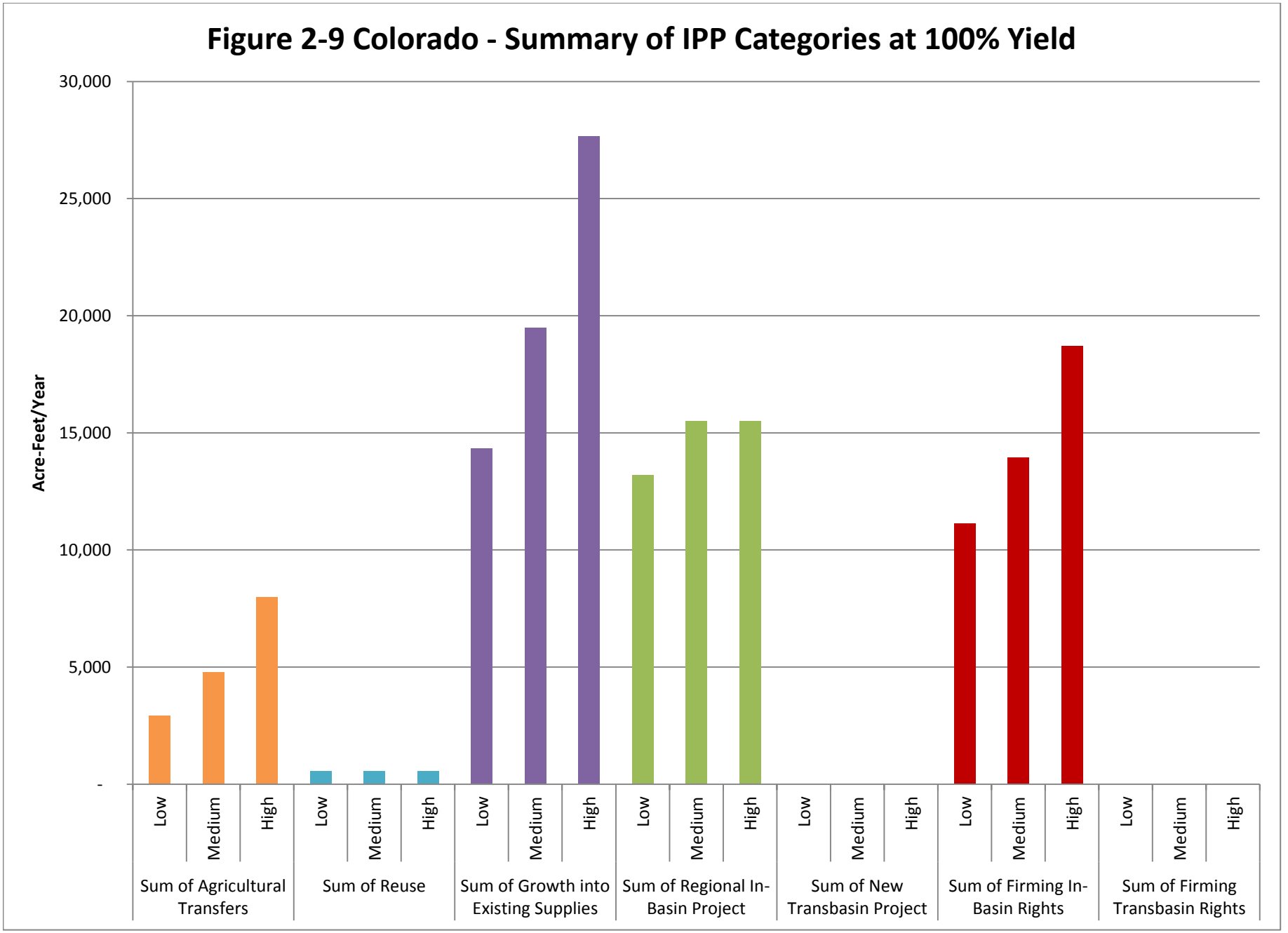


Table 2-6 Colorado Basin M&I and SSI Gaps in 2050

Region or County	Increase in M&I and SSI Demand (AFY)			Estimated Yield of Identified Projects and Processes if 100% success rate (AFY)			Estimated Remaining M&I/SSI Gap after Identified Projects and Processes (AFY)								
							Gap at 100% IPP Success Rate			Gap at Alternative IPP Success Rate (90%)			Gap at Status Quo IPP Success Rate (90%)		
	Low	Med	High	Low	Med	High	Low	Med	High	Low	Med	High	Low	Med	High
Eagle County	10,100	14,000	20,200	10,100	14,000	20,200	*0*	0	0	1,000	*1,400*	2,000	1,000	1,400	*2,000*
Garfield County	22,500	26,000	33,400	16,600	16,600	16,600	*5,800*	9,400	16,800	7,500	*11,000*	18,400	7,500	11,000	*18,400*
Grand County	4,100	5,200	6,700	2,700	3,200	3,200	*1,400*	2,000	3,500	1,700	*2,300*	3,900	1,700	2,300	*3,900*
Mesa County	14,100	17,500	24,300	3,900	7,400	14,200	*10,100*	10,100	10,100	10,500	*10,900*	11,600	10,500	10,900	*11,600*
Pitkin County	4,700	6,700	9,800	1,900	3,800	7,000	*2,800*	2,800	2,800	3,000	*3,200*	3,500	3,000	3,200	*3,500*
Summit County	9,000	12,100	16,800	6,900	9,200	9,200	*2,000*	2,900	7,600	2,700	*3,800*	8,500	2,700	3,800	*8,500*
Total	**64,500**	**81,500**	**111,200**	**42,100**	**54,200**	**70,400**	***22,100***[1]	**27,200**	**40,800**	**26,400**	***32,600***[2]	**47,900**	**26,400**	**32,600**	***47,900***[3]

[1] Low gap = 22,100 AF represented in Figure 2-10.
[2] Medium gap = 32,600 AF represented in Figure 2-11.
[3] High gap = 47,900 AF represented in Figure 2-12.

Figure 2-10 Colorado Basin M&I and SSI Gap Summary Low Scenario (IPPs at 100% Yield)

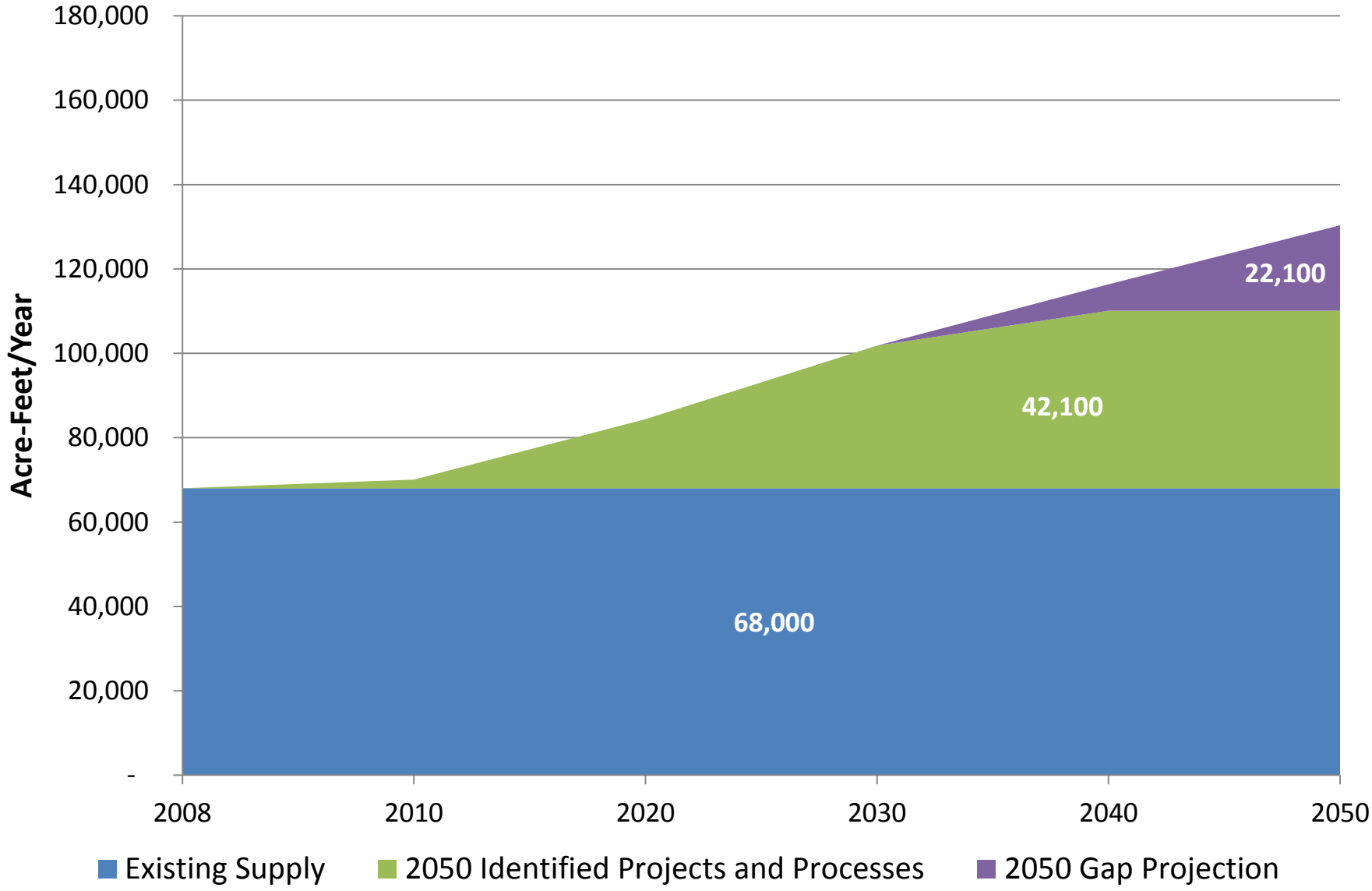


Figure 2-11 Colorado Basin M&I and SSI Gap Summary Medium Scenario (IPPs at 90% Yield)

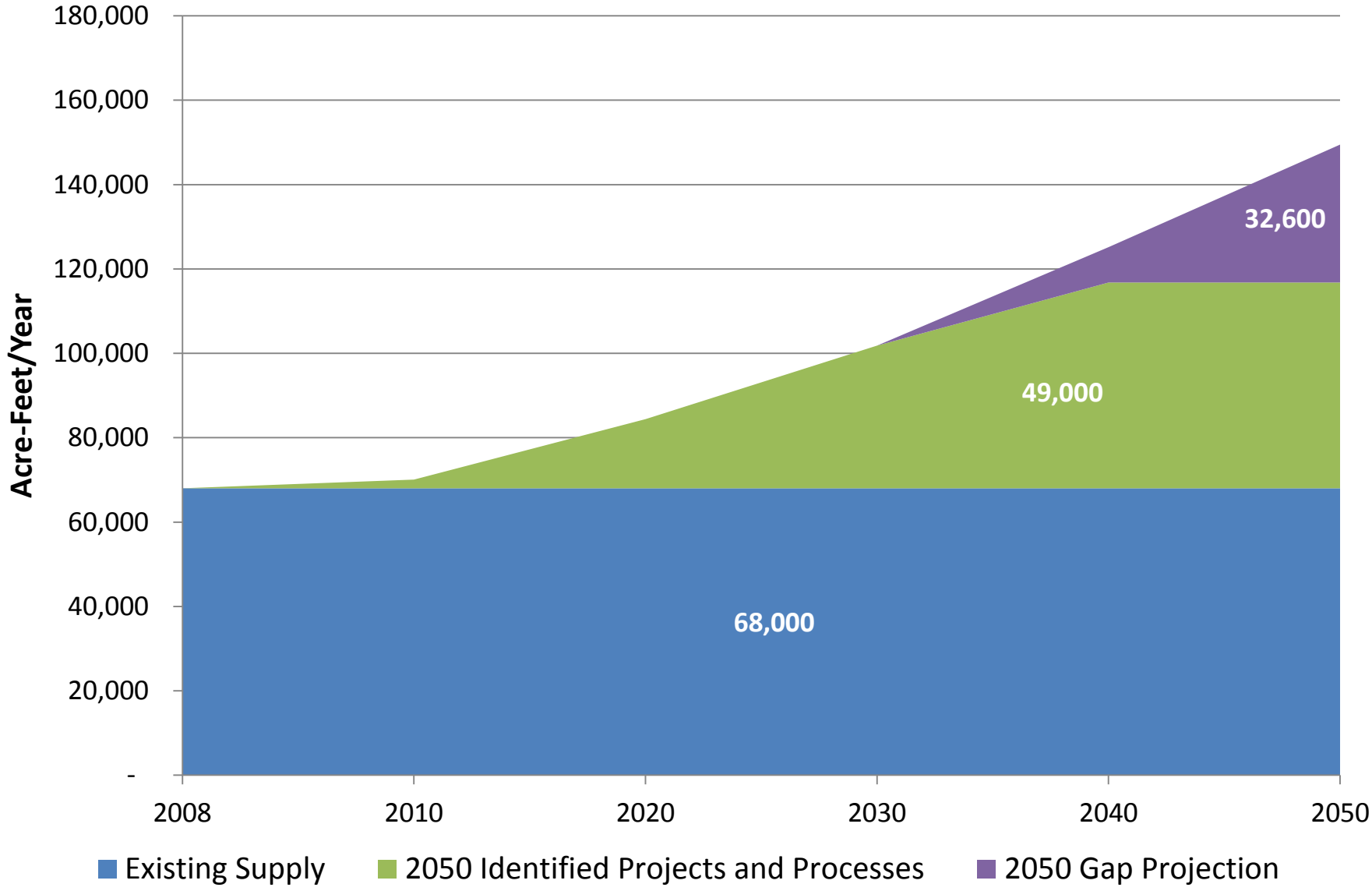
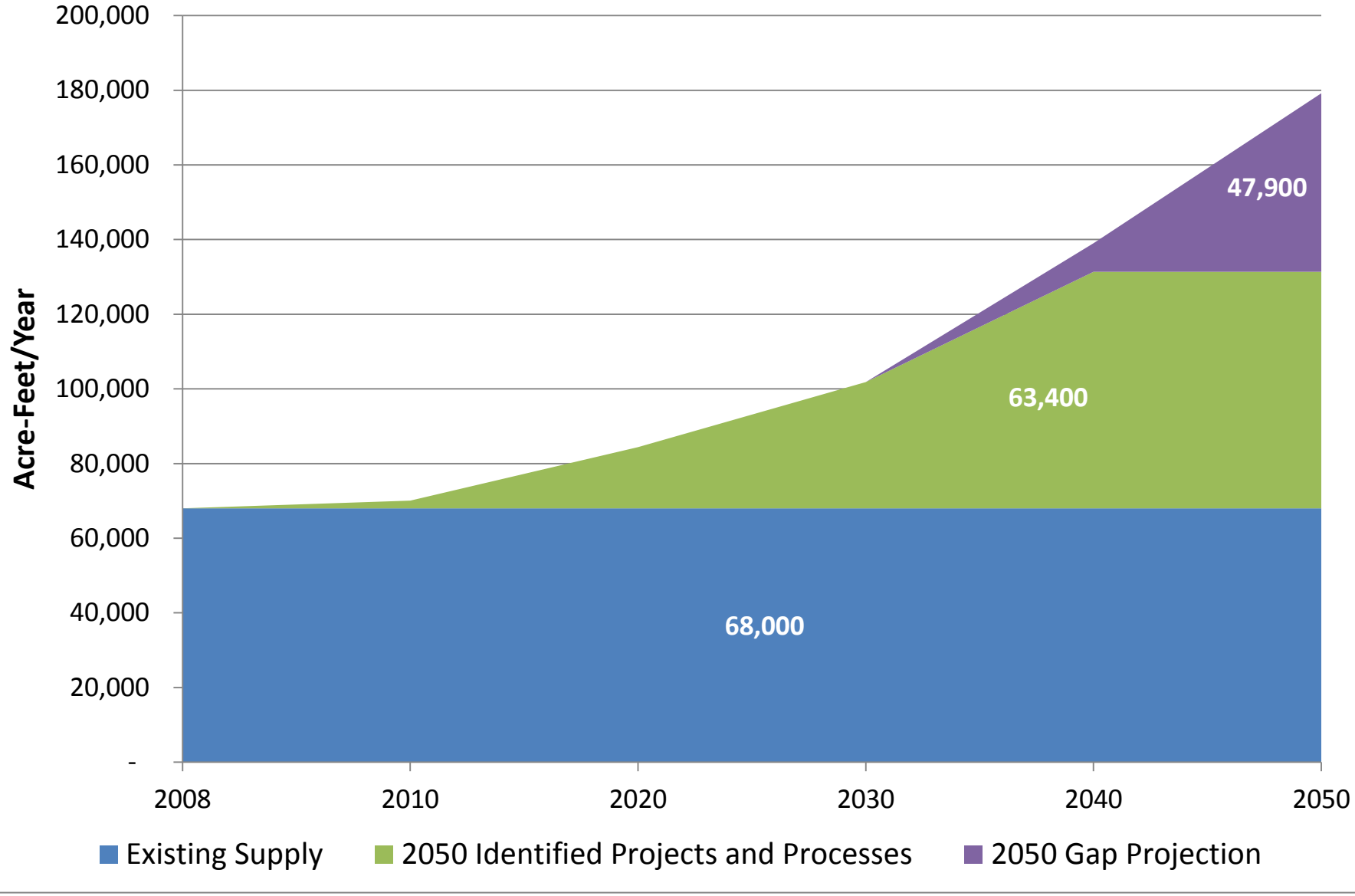


Figure 2-12 Colorado Basin M&I and SSI Gap Summary High Scenario (IPPs at 90% Yield)



Through interviews conducted by CWCB, four projects sponsored by the UGRWCD and others were identified:

- UGRWCD/Hinsdale County Commissioners – Lake San Cristobal enlargement
- UGRWCD/Mt. Crested Butte – Augmentation storage
- UGRWCD – Reservoirs on Cochetopa Creek
- UGRWCD – Augmentation plan for non-agricultural purposes using Aspinall Unit

Regarding this last item, the UGRWCD has a 500 AF pool in Blue Mesa that can be used to replace depletions to downstream calls. The challenge for UGRWCD will be to develop storage to replace depletions to CWCB instream flows, the Gunnison Whitewater Park RICD, and senior agricultural and M&I water rights upstream of Blue Mesa Reservoir. Collectively, these UGRWCD projects meet all or a part of the future water needs in Gunnison and Hinsdale Counties.

Anticipated yields from each category of IPPs at 100 percent success rate are summarized for the Gunnison Basin in Table 2-7 and Figure 2-13.

Table 2-8 provides a summary of increased M&I and SSI demands, the amount of that increase provided by the IPPs, and the general locations of the gap for each region in the Gunnison Basin.

Figures 2-14 through 2-16 illustrate the Gunnison Basin M&I/SSI existing supply, IPPs, and gap projections. The existing supply is estimated to be 21,000 AF and remains constant through 2050. For the low gap scenario, significant growth of IPPs occurs between 2010 and 2040. Maximum IPPs under this scenario are 14,020AF. Between 2040 and 2050, the gap grows from 0 AF to 2,480AF. Very similar trends are observed for the Gunnison Basin medium gap scenario, with 2040 IPPs slightly higher at 14,500 AF and the gap reaching 4,730 AF by 2050. Likewise, Gunnison Basin trends for the high gap scenario are still much like the low and medium scenarios in terms of the timeline. However, the IPPs are somewhat higher at 16,700 AF by 2040, and the 2050 gap is 6,130 AF.

Table 2-7 Gunnison 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)	IPPs
Delta County	0	0	0	3,700 – 4,900	0	0	0	• Project 7
Gunnison County	0	0	0	1,000 – 1,100	0	900	0	• Lake San Cristobal water development • Reservoirs on Cochetopa Creek • Augmentation for non-agricultural purposes using Aspinall Unit • Augmentation storage for Mt. Crested Butte
Hinsdale County	0	0	0	200 – 300	0	0	0	• Lake San Cristobal water development
Mesa County	370 – 550	0	1,130 – 1,650	0	0	0	0	• Existing water rights • Agricultural transfers
Montrose County	0	0	0	6,700 – 8,600	0	0	0	• Project 7
Ouray County	0	0	0	20 – 500	0	0	0	• Project 7
Total	**370 – 550**	**0**	**1,130 – 1,650**	**11,620 – 15,400**	**0**	**900**	**0**	**14,020 – 18,500**

Figure 2-13 Gunnison - Summary of IPPs Categories at 100% Yield

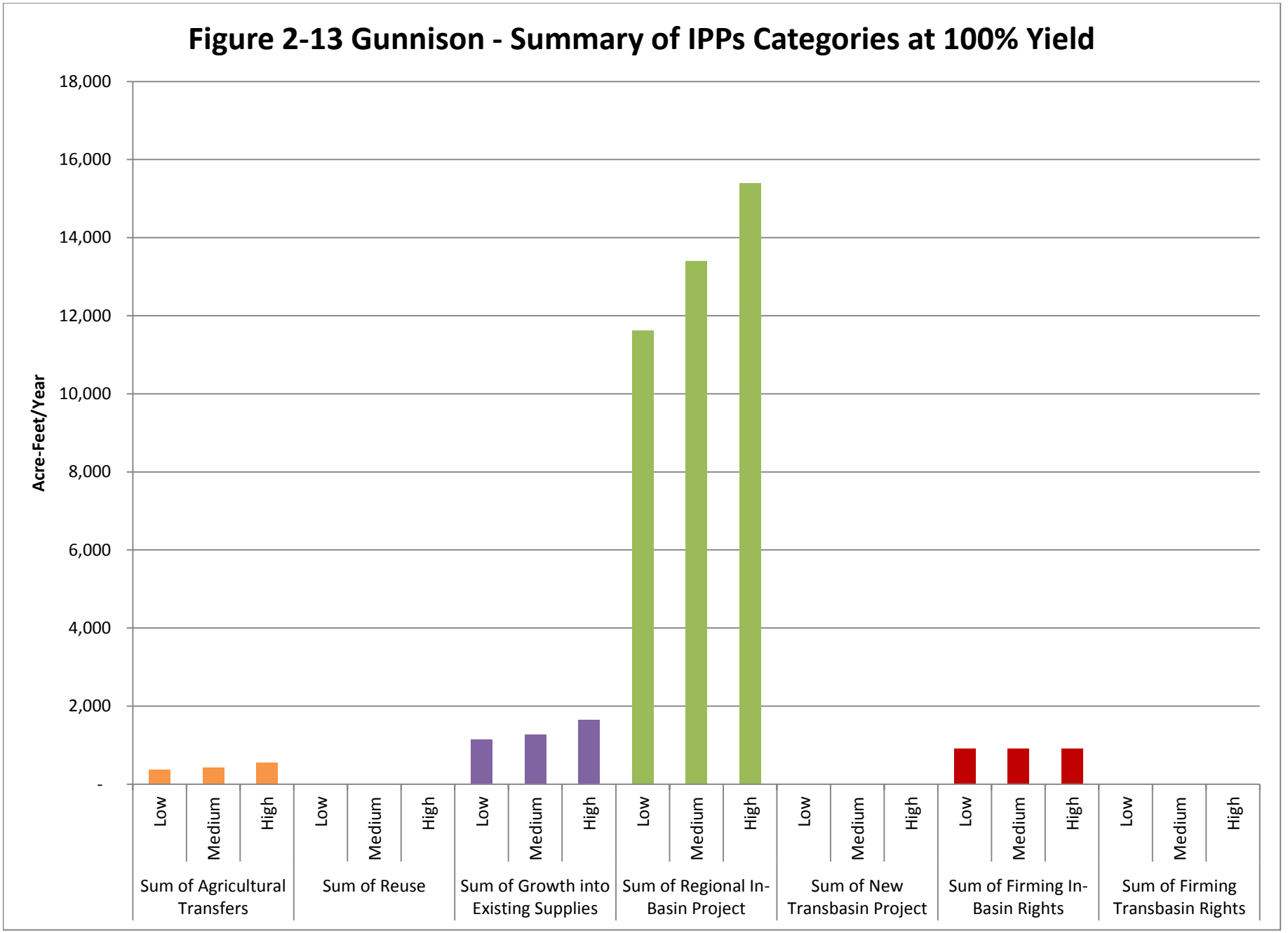


Table 2-8 Gunnison Basin M&I and SSI Gaps in 2050

Region or County	Increase in M&I and SSI Demand (AFY)			Estimated Yield of Identified Projects and Processes if 100% success rate (AFY)			Estimated Remaining M&I/SSI Gap after Identified Projects and Processes (AFY)								
							Gap at 100% IPP Success Rate			Gap at Alternative IPP Success Rate (90%)			Gap at Status Quo IPP Success Rate (90%)		
	Low	Med	High	Low	Med	High	Low	Med	High	Low	Med	High	Low	Med	High
Delta County	5,300	5,900	6,700	3,700	4,200	4,900	*1,700*	1,700	1,700	2,000	*2,100*	2,200	2,000	2,100	*2,200*
Gunnison County	1,900	2,700	3,800	1,900	2,100	2,000	*0*	700	1,800	200	*900*	2,000	200	900	*2,000*
Hinsdale County	200	300	300	200	300	300	*0*	0	0	20	*30*	30	20	30	*30*
Mesa County	1,600	1,800	2,300	1,500	1,700	2,200	*80*	90	100	200	*300*	300	200	300	*300*
Montrose County	7,000	7,900	9,100	6,700	7,500	8,600	*400*	400	500	1,000	*1,100*	1,300	1,000	1,100	*1,300*
Ouray County	300	500	800	20	200	500	*300*	300	300	300	*300*	300	300	300	*300*
Total	**16,300**	**19,100**	**23,000**	**14,020**	**16,000**	**18,500**	***2,480*[1]**	**3,190**	**4,400**	**3,720**	***4,730*[2]**	**6,130**	**3,720**	**4,730**	***6,130*[3]**

[1] Low gap = 2,480 AF represented in Figure 2-14.
[2] Medium gap = 4,730 AF represented in Figure 2-15.
[3] High gap = 6,130 AF represented in Figure 2-16.

Figure 2-14 Gunnison Basin M&I and SSI Gap Summary Low Scenario (IPPs at 100% Yield)

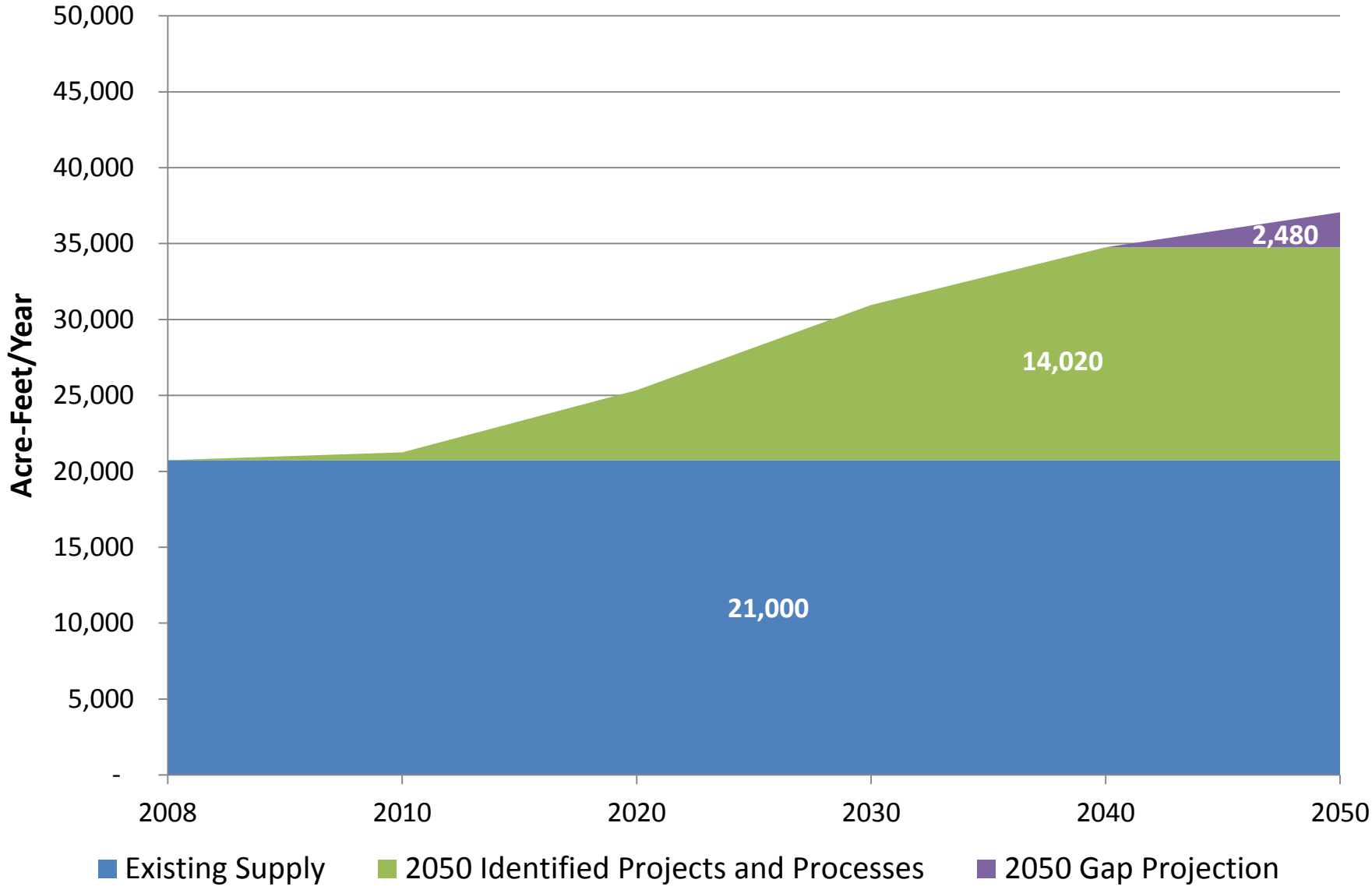


Figure 2-15 Gunnison Basin M&I and SSI Gap Summary Medium Scenario (IPPs at 90% Yield)

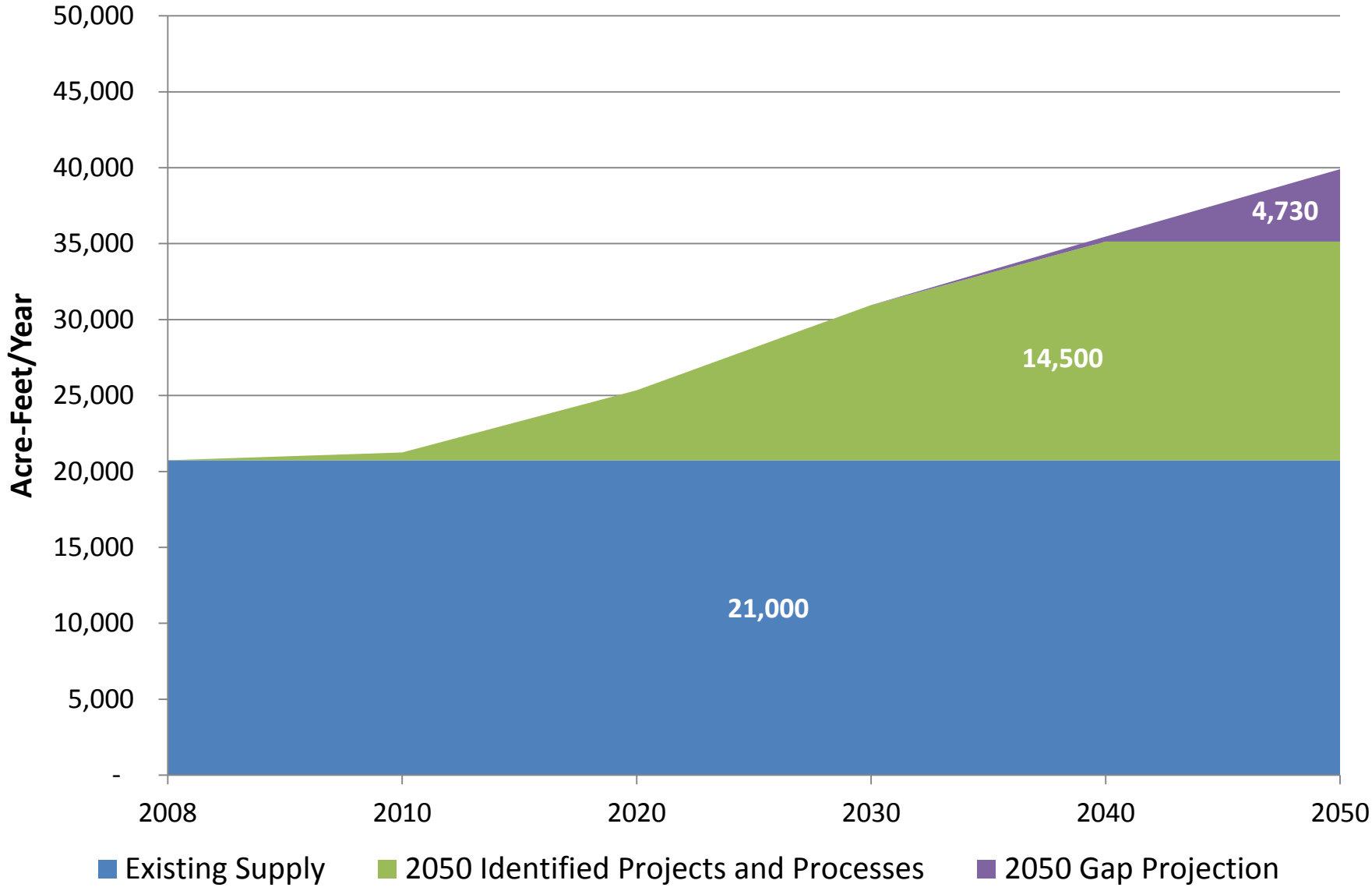
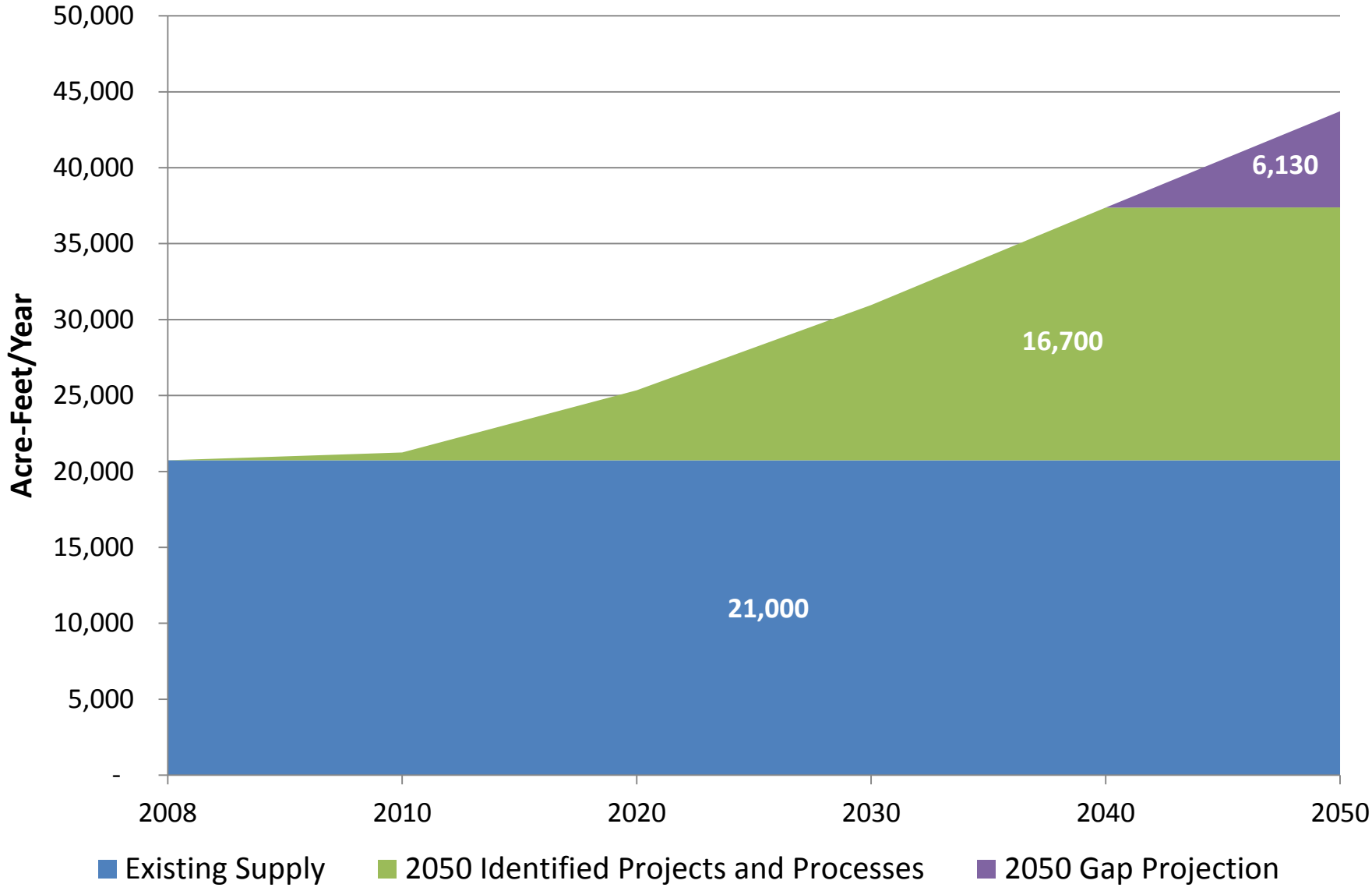


Figure 2-16 Gunnison Basin M&I and SSI Gap Summary High Scenario (IPPs at 90% Yield)



2.5 Metro Basin

In the Metro Basin, reuse is being pursued by almost all cities that own reusable supplies. The trend toward the use of gravel lake 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 non-potable uses such as irrigation of parks and golf courses, though other non-potable 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 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. However, the Chatfield Reallocation Project may be facing some permitting hurdles.

The South Metro area currently relies primarily on non-tributary, non-renewable groundwater. As noted in the South Metro Study (Black & Veatch et al. 2004), the costs of continued reliance on non-renewable 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 shown for South Metro includes an additional 20,850 AF due to the necessary replacement of existing non-renewable groundwater supplies.

SWSI Phase 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 WISE Project and a nearly 15,000 AF enlargement of Rueter-Hess Reservoir (Parker Water & Sanitation District and others).

Anticipated yields from each category of IPPs at 100 percent success rate are summarized for the Metro Basin in Table 2-9 and Figure 2-17.

Table 2-10 provides a summary of increased M&I and SSI demands, the amount of that increase provided by the IPPs, and the general locations of the gap for each region in the Metro Basin.

The M&I/SSI existing supply, IPPs, and gap projections for the Metro Basin are depicted in Figures 2-18 through 2-20. The existing M&I/SSI supply for the Metro Basin is estimated to be 502,000 AF 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 non-renewable groundwater in some areas of the Metro Basin. Under the low gap scenario, the major period of IPPs development is 2010 through 2040, with 141,200 AF online at the end of that period. The gap appears in 2030 and grows to 62,600 AF by 2050. Under the medium gap scenario for the Metro Basin, IPPs reach 97,400 by 2030; no further IPPs development occurs in the following decades. Between 2020 and 2050, the gap grows from 0 AF to 130,800 AF. Similar trends are observed under the high gap scenario, with IPPs reaching 105,200 AF in 2030. The gap starts to grow starting in 2030; it grows to a total of 193,400 AF by 2050.

2.6 North Platte Basin

The North Platte River headwaters in Colorado are a relatively small portion of the overall North Platte Basin. Farming and ranching are the predominant economic base in the area, which primarily consists of Jackson County. The North Platte Basin is expected to see a relatively small increase in M&I and SSI demands (increase in the range of 100 AF to 300 AF between 2008 and 2050). It is anticipated that this increase in demand will be met primarily via the application of existing supplies and water rights.

Table 2-9 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)	IPPs
Denver Metro	14,150 – 22,090	5,430 – 8,490	33,140 – 61,460	9,070 – 14,170	7,840 – 14,500	820 – 1,290	3,450 – 4,800	• 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 • Moffat Collection System Project • Windy Gap Firming Project • Highway 93 Lakes
South Metro	7,070 – 10,390	8,950 – 12,350	18,840 – 24,920	26,670 – 28,110	5,770 – 7,830	0	0	• Existing supplies • Agricultural transfers • System refinements and modifications • Prairie Waters Project • ECCV Northern Pipeline Project • Chatfield Reallocation Project • Eagle River Joint Use Project • Moffat Collection System Project • Rueter-Hess Reservoir enlargement • WISE • Other reuse projects
Total	**21,220 – 32,480**	**14,380 – 20,840**	**51,980 – 86,380**	**35,740 – 42,280**	**13,610 – 22,330**	**820 – 1,290**	**3,450 – 4,800**	**141,200 – 210,400**

Figure 2-17 Metro - Summary of IPP Categories at 100% Yield

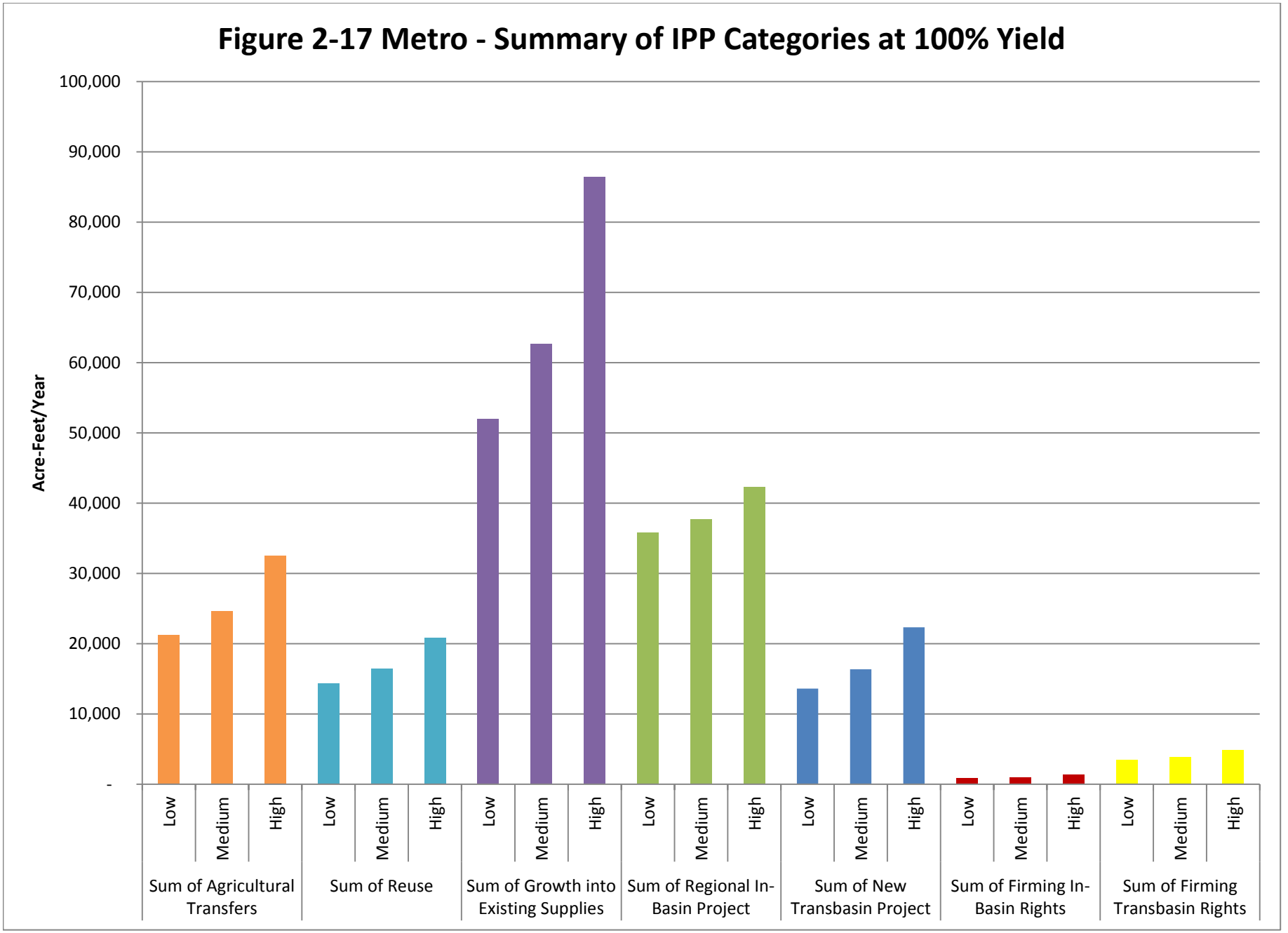


Table 2-10 Metro Basin M&I and SSI Gaps in 2050

Region or County	Increase in M&I and SSI Demand (AFY)			Estimated Yield of Identified Projects and Processes if 100% success rate (AFY)			Estimated Remaining M&I/SSI Gap after Identified Projects and Processes (AFY)								
							Gap at 100% IPP Success Rate			Gap at Alternative IPP Success Rate (60%)			Gap at Status Quo IPP Success Rate (50%)		
	Low	Med	High	Low	Med	High	Low	Med	High	Low	Med	High	Low	Med	High
Denver Metro	97,000	113,100	158,000	73,900	89,600	126,800	*23,100*	23,500	31,200	52,700	*59,300*	81,900	60,100	68,300	*94,600*
South Metro[1]	86,000	94,300	119,800	67,300	72,800	83,600	*39,500*	42,400	57,000	66,400	*71,500*	90,500	73,100	78,700	*98,800*
Total	**183,000**	**207,400**	**277,800**	**141,200**	**162,400**	**210,400**	***62,600***[2]	**65,900**	**88,200**	**119,100**	***130,800***[3]	**172,400**	**133,200**	**147,000**	***193,400***[4]

[1] South Metro gap includes an additional 20,850 AF for replacement of non-renewable groundwater.
[2] Low gap = 62,600 AF represented in Figure 2-18.
[3] Medium gap = 130,800 AF represented in Figure 2-19.
[4] High gap = 193,400 represented in Figure 2-20.

Figure 2-18 Metro Basin M&I and SSI Gap Summary Low Scenario (IPPs at 100% Yield)

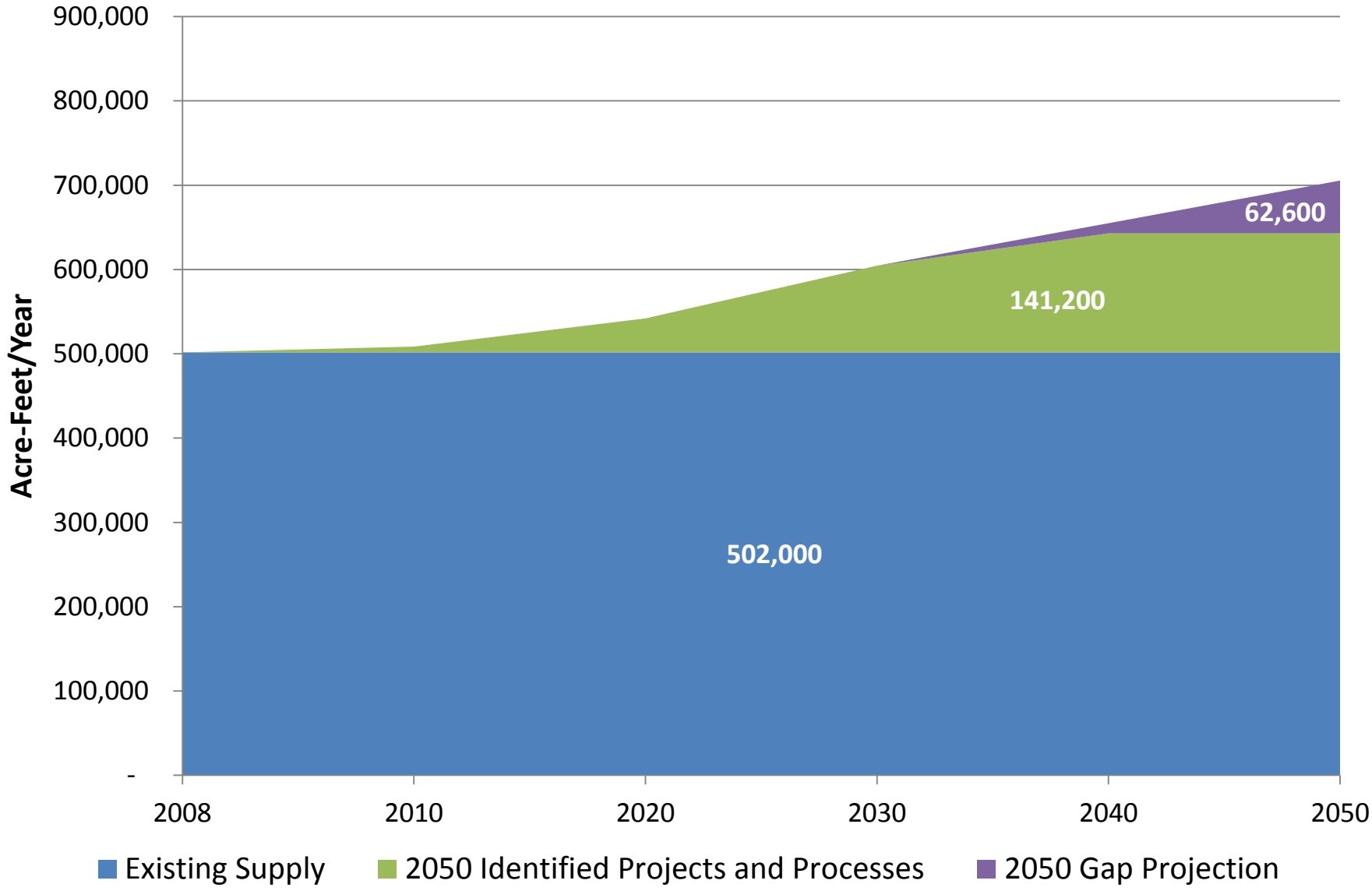


Figure 2-19 Metro Basin M&I and SSI Gap Summary Medium Scenario (IPPs at 60% Yield)

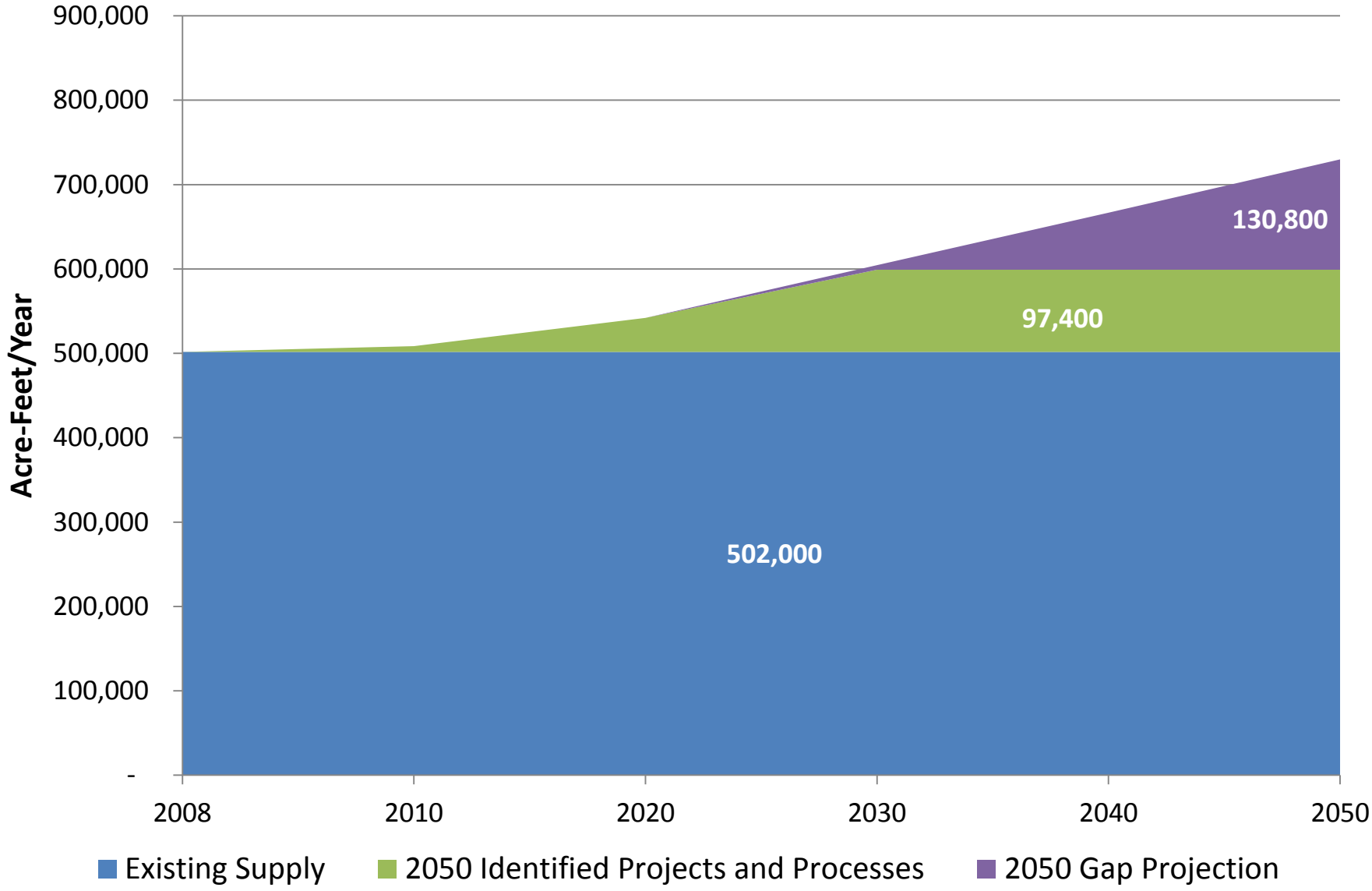
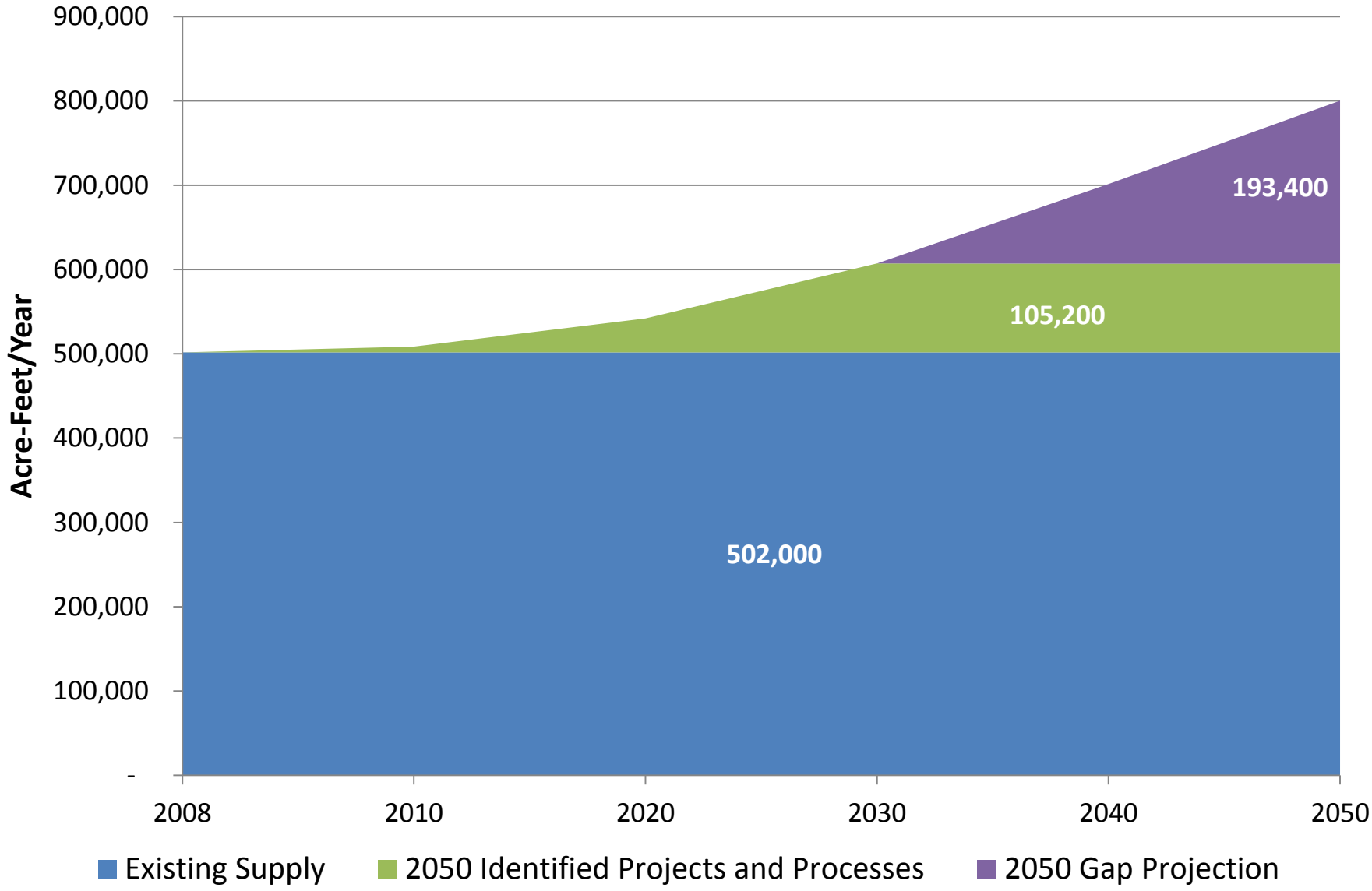


Figure 2-20 Metro Basin M&I and SSI Gap Summary High Scenario (IPPs at 50% Yield)



Anticipated yields from each category of IPPs at 100 percent success rate are summarized for the North Platte Basin in Table 2-11 and Figure 2-21.

Table 2-12 provides a summary of increased M&I and SSI demands, the amount of that increase provided by the IPPs, and the general locations of the gap for each region in the North Platte Basin.

For the North Platte Basin, the M&I/SSI existing supply, IPPs, and gap projections are illustrated in Figures 2-22 through 2-24. For the low, medium, and high gap scenarios, the North Platte existing supply is 500 AF. Under the low gap scenario IPPs grow steadily after 2010, reaching 100 AF by 2050; the gap is zero. For the medium gap scenario, IPPs are added as needed through 2050, reaching 200 AF total; a small gap of 20 AF appears in the final decade. A similar trend is observed for the high gap scenario, with 2050 IPPs totaling 300 AF, and a gap of 30 AF appearing between 2040 and 2050.

2.7 Rio Grande Basin

In the Rio Grande Basin, there is relatively minor growth projected for M&I needs by 2050. New SSI demands are limited to proposed solar power generation facilities in Alamosa County and are anticipated to have demands in the range of 1,200 AF to 2,000 AF per year. It was estimated during the SWSI Phase 1 study that sufficient groundwater is physically available for most anticipated M&I growth, but augmentation of groundwater pumping will be required. All counties will make use of existing water rights and groundwater.

Augmentation will be provided by the San Luis Valley Water Conservancy District and other local water providers. There are no reliable water supplies that can be developed under the Rio Grande Compact, so augmentation of M&I well pumping will be provided from a variety of sources including existing transbasin water rights diverted from the San Juan Basin and existing and future agricultural transfers.

Table 2-11 North 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)	IPPs
Jackson County	0	0	100 – 300	0	0	0	0	• Existing supplies and water rights
Total	**0**	**0**	**100 – 300**	**0**	**0**	**0**	**0**	**100 – 300**

Figure 2-21 North Platte - Summary of IPP Categories at 100% Yield

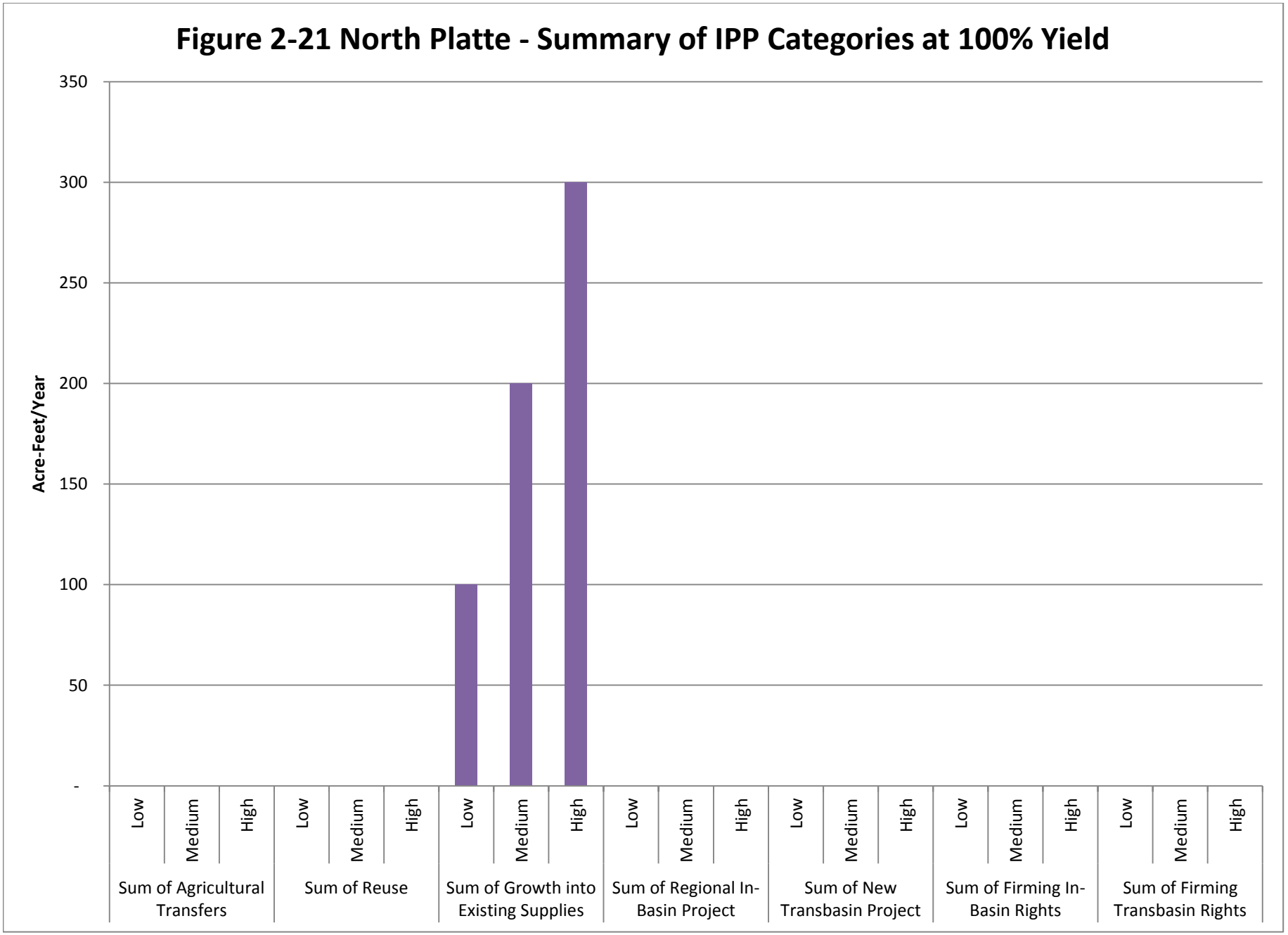


Table 2-12 North Platte Basin M&I and SSI Gaps in 2050

Region or County	Increase in M&I and SSI Demand (AFY)			Estimated Yield of Identified Projects and Processes if 100% success rate (AFY)			Estimated Remaining M&I/SSI Gap after Identified Projects and Processes (AFY)								
							Gap at 100% IPP Success Rate			Gap at Alternative IPP Success Rate (90%)			Gap at Status Quo IPP Success Rate (90%)		
	Low	Med	High	Low	Med	High	Low	Med	High	Low	Med	High	Low	Med	High
Jackson County	100	200	300	100	200	300	*0*	0	0	10	*20*	30	10	20	*30*
Total	**100**	**200**	**300**	**100**	**200**	**300**	***0***[1]	**0**	**0**	**10**	***20***[2]	**30**	**10**	**20**	***30***[3]

[1] Low gap = 0 AF represented in Figure 2-22.
[2] Medium gap = 20 AF represented in Figure 2-23.
[3] High gap = 30 AF represented in Figure 2-24.

Figure 2-22 North Platte Basin M&I and SSI Gap Summary Low Scenario (IPPs at 100% Yield)

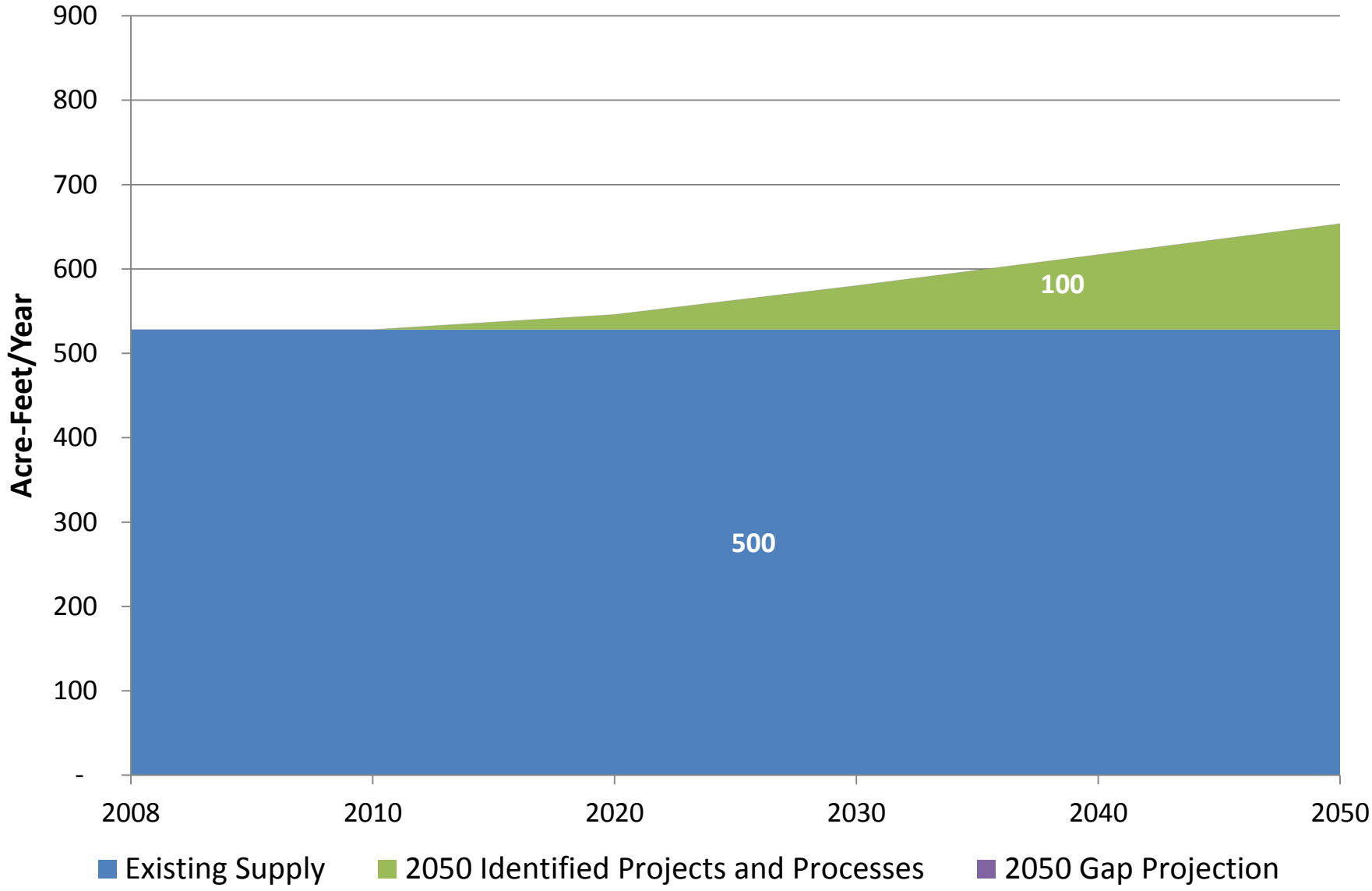


Figure 2-23 North Platte Basin M&I and SSI Gap Summary Medium Scenario (IPPs at 90% Yield)

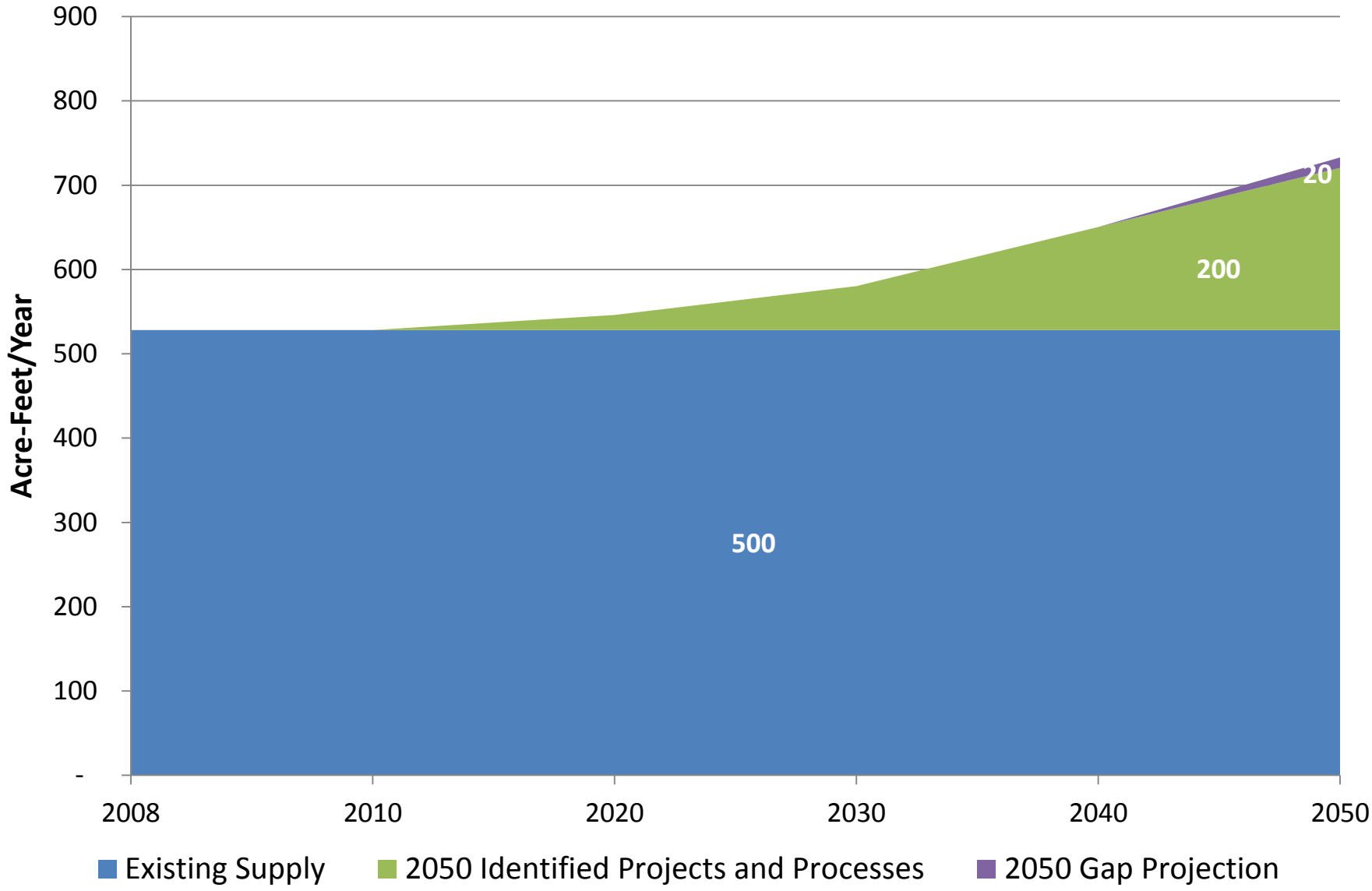
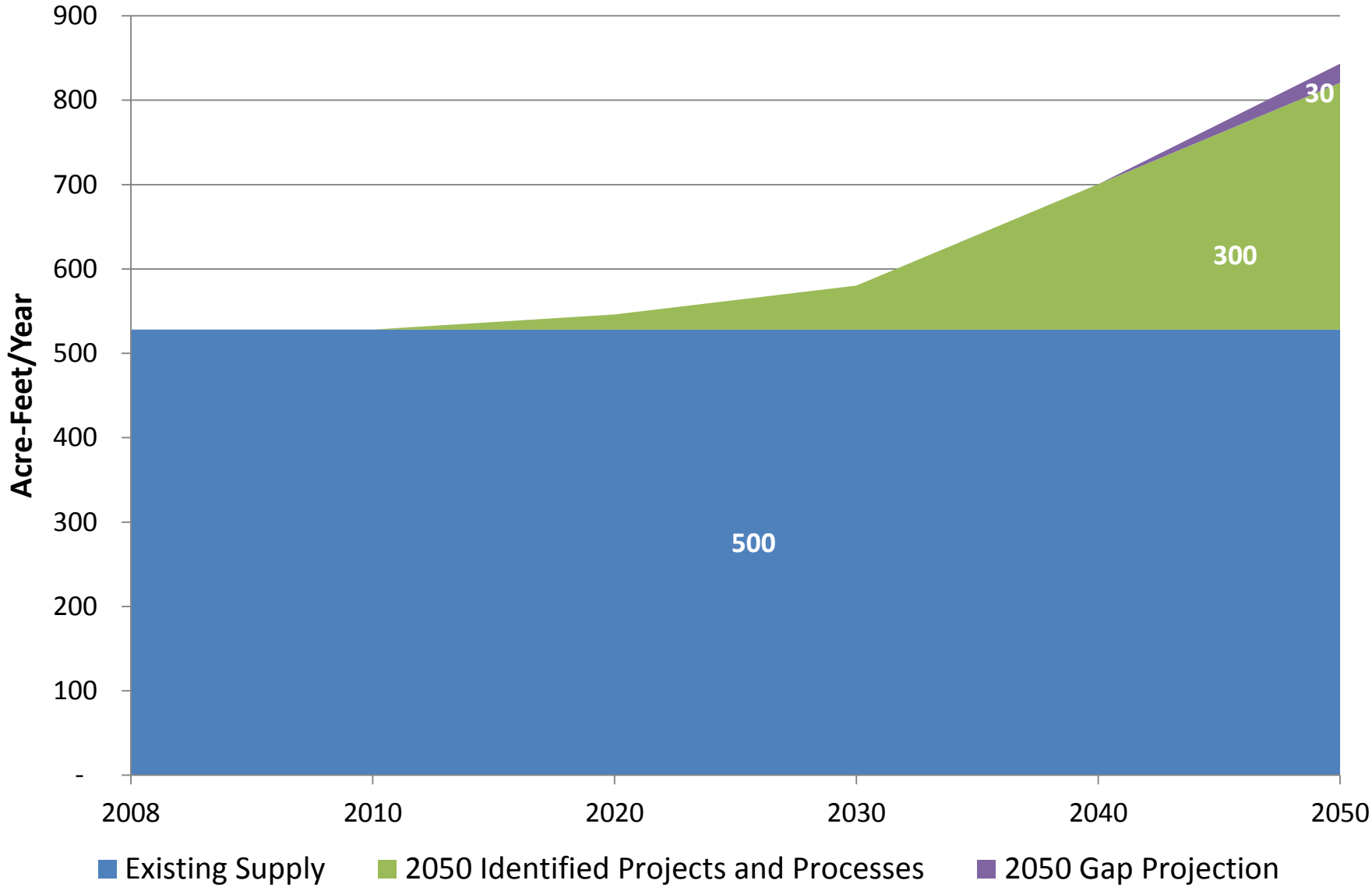


Figure 2-24 North Platte Basin M&I and SSI Gap Summary High Scenario (IPPs at 90% Yield)



Anticipated yields from each category of IPPs at 100 percent success rate are summarized for the Rio Grande Basin in Table 2-13 and Figure 2-25.

Table 2-14 provides a summary of increased M&I and SSI demands, the amount of that increase provided by the IPPs, and the general locations of the gap for each region in the Rio Grande Basin.

Figures 2-26 through 2-28 show the M&I/SSI existing supply (18,000 AF), IPPs, and gap projections for the Rio Grande Basin. Under the low gap scenario, IPPs reach a maximum of 5,890AF in 2040. The gap grows from 0 AF to 1,800 AF between 2040 and 2050. Similar trends are observed for the medium gap scenario. Most of the IPPs development occurs between 2010 and 2040, leading to a total of 6,400AF of IPPs in 2040. The gap starts at 0 AF in 2030 and reaches 3,620 AF by 2050. Under the high gap scenario in the Rio Grande Basin, IPPs are added from 2010 through 2040, reaching a maximum of 7,700AF. The gap begins to accrue in 2030; after 2040 the accrual rate increases, and the gap reaches 5,130 AF in 2050.

2.8 South Platte Basin

Most M&I water providers indicated that they believe they will be able to meet 2030 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 are the NCWCD's NISP, WGFP, and the Halligan and Seaman Reservoir enlargements sponsored 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 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.

Table 2-13 Rio Grande Basin IPP Summary at 100% Success Rate

Region or County	Agricultural Transfer (AFY)	Reuse (AFY)	Growth into Existing Supplies (AFY)	Regional In-Basin Project (AFY)	New Transbasin Project (AFY)	Firming In-Basin Water Rights (AFY)	Firming Transbasin Rights (AFY)	IPPs
Alamosa County	0	0	1,420 – 2,310	0	0	1,480 – 2,290	0	• Existing water rights • Augmentation plans • Groundwater
Conejos County	0	0	600 – 990	0	0	600 – 1,010	0	• Existing water rights • Augmentation plans • Groundwater
Costilla County	0	0	0	0	0	0	0	• Existing water rights • Augmentation plans • Groundwater
Mineral County	0	0	40 – 160	0	0	50 – 140	0	• Existing water rights • Augmentation plans • Groundwater
Rio Grande County	0	0	450	0	0	450	0	• Existing water rights • Augmentation plans • Groundwater
Saguache County	0	0	400	0	0	400	0	• Existing water rights • Augmentation plans • Groundwater
Total	**0**	**0**	**2,910 – 4,310**	**0**	**0**	**2,980 – 4,290**	**0**	**5,890 – 8,600**

Figure 2-25 Rio Grande - Summary of IPP Categories at 100% Yield

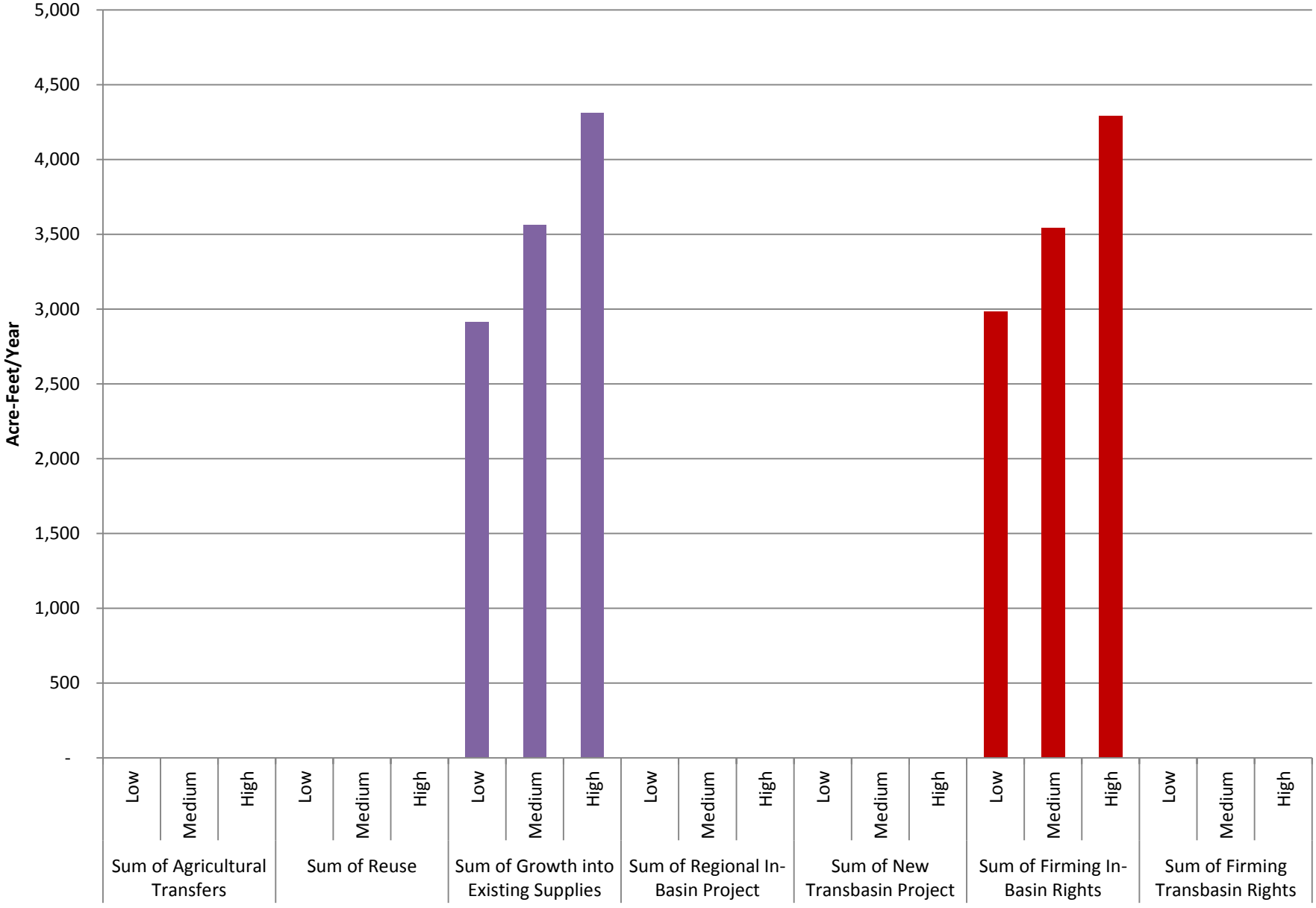


Table 2-14 Rio Grande Basin M&I and SSI Gaps in 2050

Region or County	Increase in M&I and SSI Demand (AFY)			Estimated Yield of Identified Projects and Processes if 100% success rate (AFY)			Estimated Remaining M&I/SSI Gap after Identified Projects and Processes (AFY)								
							Gap at 100% IPP Success Rate			Gap at Alternative IPP Success Rate (90%)			Gap at Status Quo IPP Success Rate (90%)		
	Low	Med	High	Low	Med	High	Low	Med	High	Low	Med	High	Low	Med	High
Alamosa County	4,100	5,100	6,600	2,900	3,600	4,600	*1,200*	1,500	2,000	1,500	*1,900*	2,500	1,500	1,900	*2,500*
Conejos County	1,200	1,600	2,000	1,200	1,600	2,000	*0*	0	0	100	*200*	200	100	200	*200*
Costilla County	100	200	200	0	0	0	*100*	200	200	100	*200*	200	100	200	*200*
Mineral County	90	200	300	90	200	300	*0*	0	0	10	*20*	30	10	20	*30*
Rio Grande County	1,200	1,700	2,400	900	900	900	*300*	800	1,500	400	*900*	1,600	400	900	*1,600*
Saguache County	1,000	1,100	1,300	800	800	800	*200*	300	500	200	*400*	600	200	400	*600*
Total	**7,690**	**9,900**	**12,800**	**5,890**	**7,100**	**8,600**	***1,800***[1]	**2,800**	**4,200**	**2,310**	***3,620***[2]	**5,130**	**2,310**	**3,620**	***5,130***[3]

[1] Low gap = 1,800 AF represented in Figure 2-26.
[2] Medium gap = 3,620 AF represented in Figure 2-27.
[3] High gap = 5,130 AF represented in Figure 2-28.

Figure 2-26 Rio Grande Basin M&I and SSI Gap Summary Low Scenario (IPPs at 100% Yield)

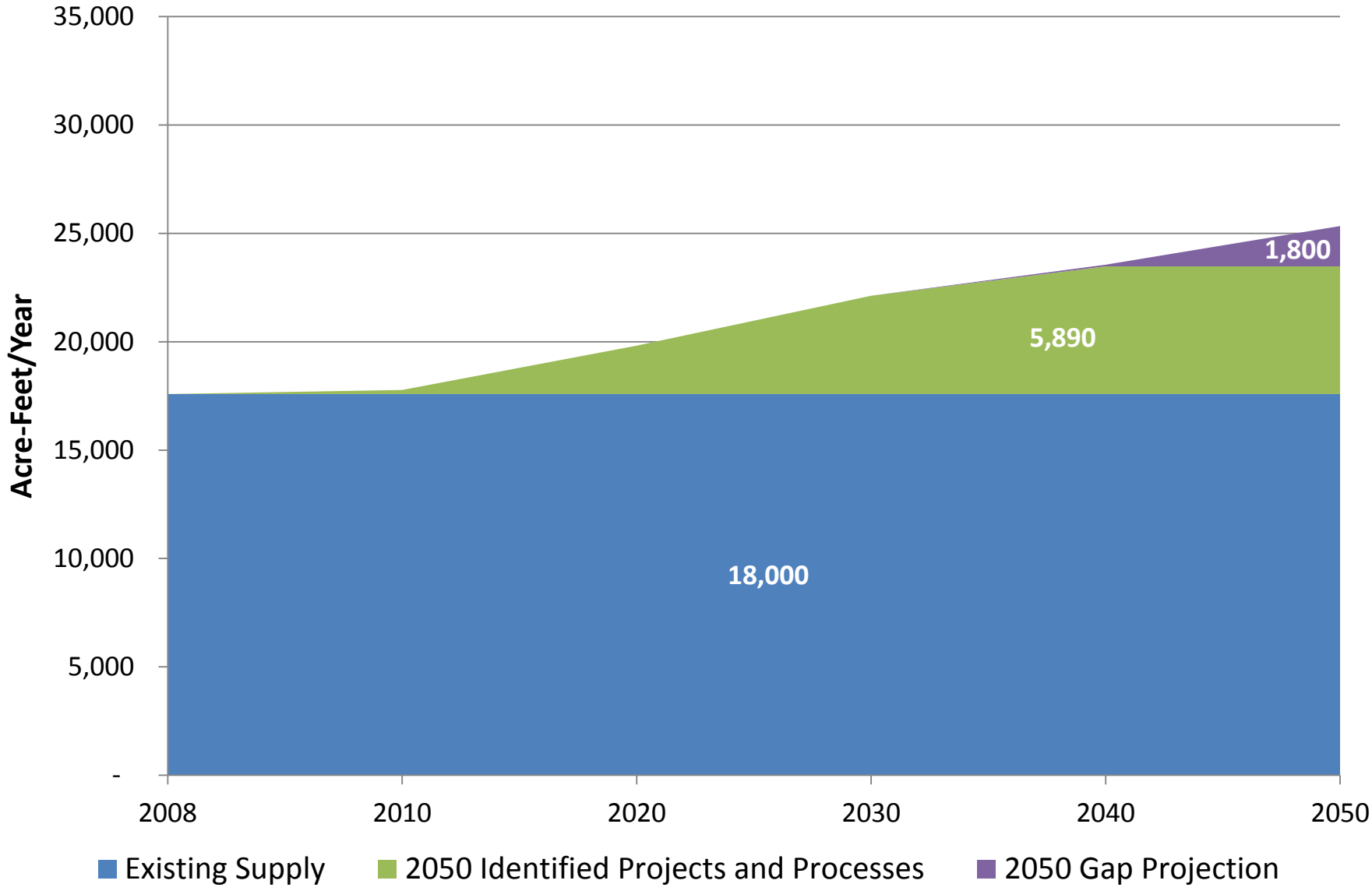


Figure 2-27 Rio Grande Basin M&I and SSI Gap Summary Medium Scenario (IPPs at 90% Yield)

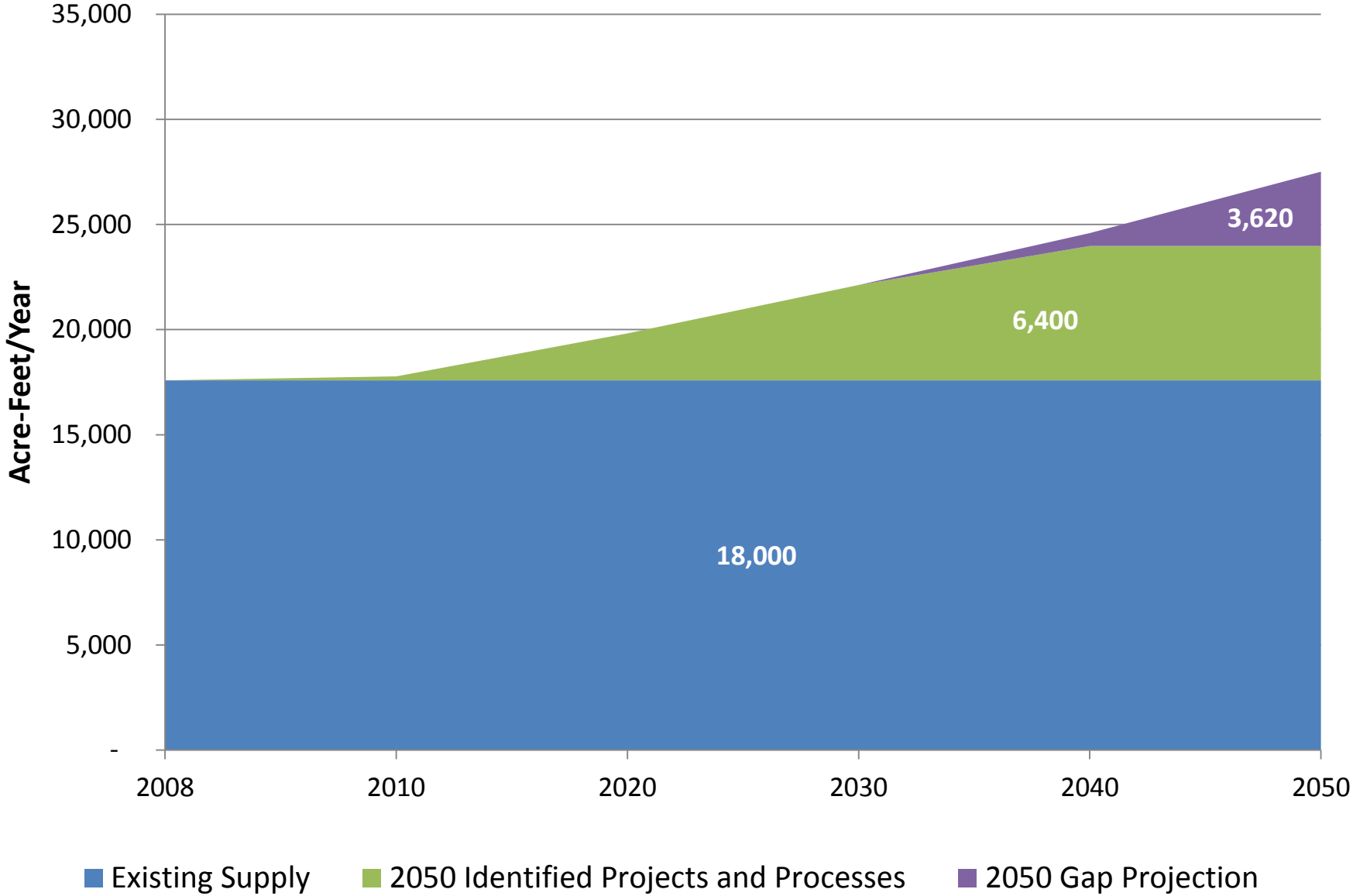
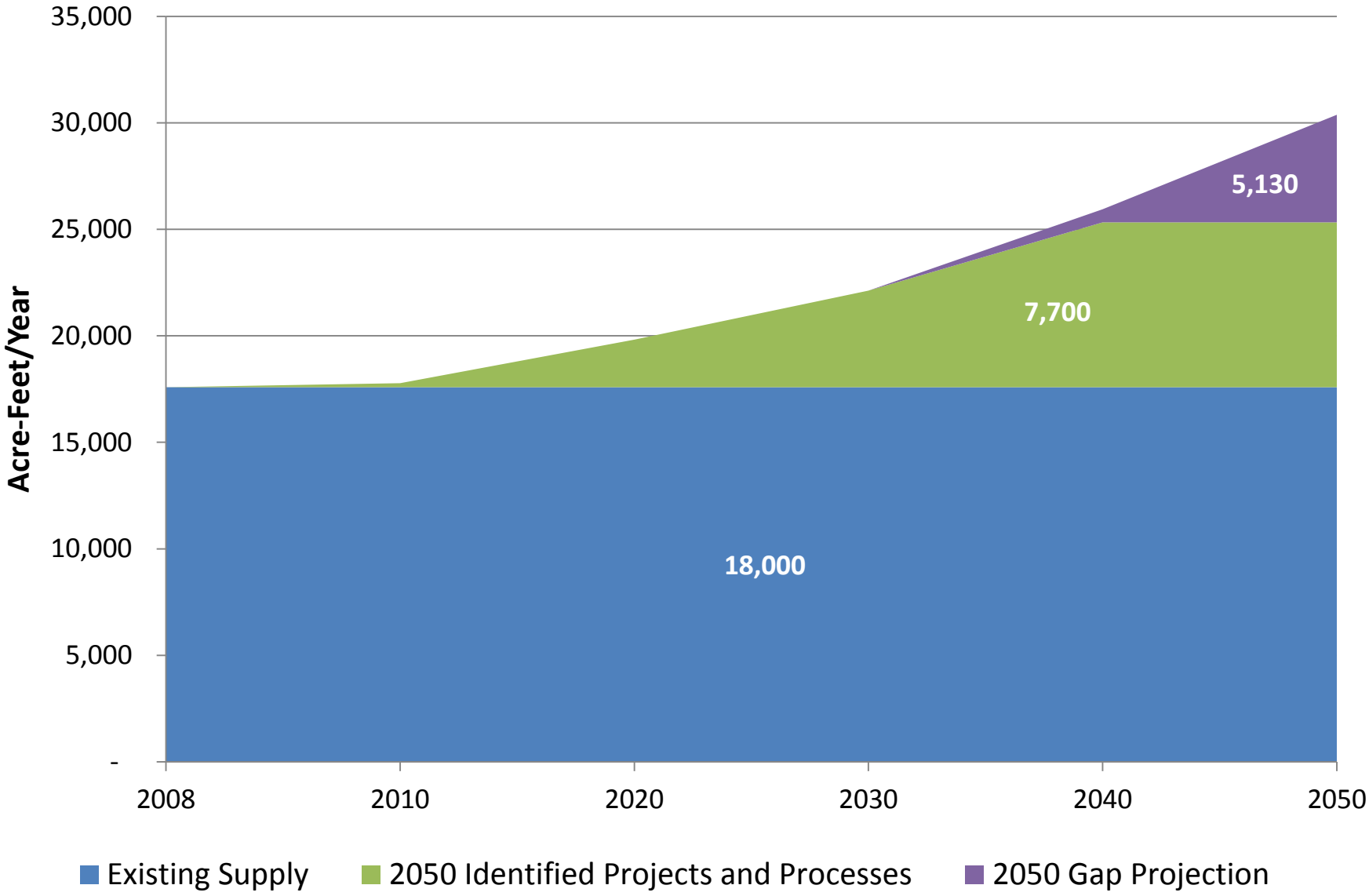


Figure 2-28 Rio Grande Basin M&I and SSI Gap Summary High Scenario (IPPs at 90% Yield)



In the High Plains region, continued reliance on non-tributary 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. 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.

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. Certain areas in the basin may have self-limiting growth due to the lack of sufficient groundwater and the inability to deliver surface water supplies. Many of these areas already experience reduced well production.

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 Water Needs Assessment and Water Supply Analysis is anticipated to be completed in September 2010 and will provide much greater detail on the current and future water needs of this region.

Anticipated yields from each category of IPPs at 100 percent success rate are summarized for the South Platte Basin in Table 2-15 and Figure 2-29.

Table 2-16 provides a summary of increased M&I and SSI demands, the amount of that increase provided by the IPPs, and the general locations of the gap for each region in the South Platte Basin.

The South Platte Basin M&I/SSI existing supply, IPPs, and gap projections through 2050 are shown in Figures 2-30 through 2-32. The existing supply, which remains constant through 2050 and across all gap scenarios, is 234,000 AF. Under the low gap scenario, IPPs total 121,800 AF in 2040. The gap begins to develop in 2030, reaching 35,700 by 2050. For the medium gap scenario, IPP development reaches its maximum of 77,700 in 2030. The gap begins to accrue starting a decade earlier, in 2020, and totals 106,500 AF by 2050. Under the South Platte high gap scenario, 57,700 AF of IPPs are online by 2030. The gap begins to accrue rapidly after 2020, and the rate of accrual increases after 2030. The gap in 2050 is 169,100 AF.

Table 2-15 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)	IPPs
High Plains	0	0	1,400 – 3,400	0	0	0	0	• Non-tributary groundwater
Lower Platte	0	0	2,350 – 5,040	4,900	0	2,350- 5,060	0	• Existing supplies • Augmentation plans • Northern Integrated Supply Project
Northern	18,880 – 20,490	5,440 – 7,320	14,220 – 17,630	31,910 – 34,490	0	17,000	18,350 – 21,270	• Existing supplies • Agricultural transfers • Reclaimed water projects • Union Reservoir enlargement • Northern Integrated Supply Project • Windy Gap Firming Project • Halligan Reservoir enlargement • Milton Seaman Reservoir enlargement • Chatfield Reallocation Project
Upper Mountain	0	0	2,490 – 3,740	40	0	2,470 – 3,720	0	• Existing supplies • Augmentation plans • Chatfield Reallocation Project
Total	**18,880 – 20,490**	**5,440 – 7,320**	**20,460 – 29,810**	**36,850 – 39,430**	**0**	**21,820 – 25,780**	**18,350 – 21,270**	**121,800 – 144,100**

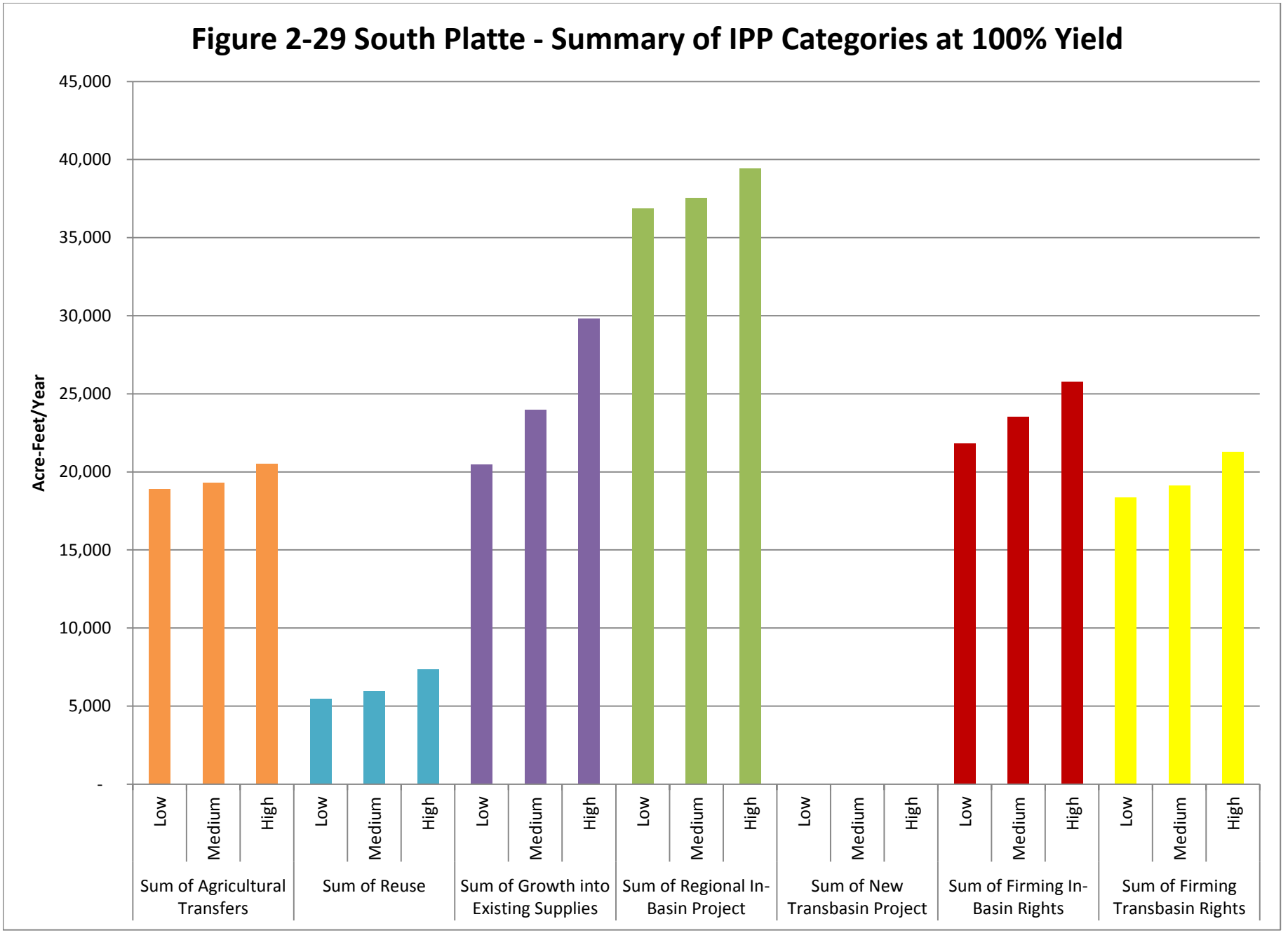


Figure 2-29 South Platte - Summary of IPP Categories at 100% Yield
Acre-Feet/Year
45,000
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
-
Low
Medium
High
Sum of Agricultural Transfers
Sum of Reuse
Sum of Growth into Existing Supplies
Sum of Regional In-Basin Project
Sum of New Transbasin Project
Sum of Firming In-Basin Rights
Sum of Firming Transbasin Rights

Table 2-16 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 if 100% success rate (AFY)			Estimated Remaining M&I/SSI Gap after Identified Projects and Processes (AFY)								
							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	Low	Med	High	Low	Med	High
High Plains	1,400	2,300	3,400	1,400	2,300	3,400	*0*	0	0	600	*900*	1,400	900	1,400	*2,100*
Lower Platte	19,200	23,800	30,100	9,600	11,900	15,000	*9,600*	11,900	15,000	13,400	*16,600*	21,000	15,300	19,000	*24,000*
Northern	131,200	151,400	184,900	105,800	109,100	118,200	*25,500*	42,300	66,800	67,800	*85,900*	114,000	88,900	107,700	*137,700*
Upper Mountain	5,500	6,800	8,300	5,000	6,100	7,500	*600*	700	800	2,500	*3,100*	3,800	3,500	4,300	*5,300*
Total	**157,300**	**184,300**	**226,700**	**121,800**	**129,400**	**144,100**	***35,700*[1]**	**54,900**	**82,600**	**84,300**	***106,500*[2]**	**140,200**	**108,600**	**132,400**	***169,100*[3]**

[1] Low gap = 35,700 AF represented in Figure 2-30.
[2] Medium gap = 106,500 AF represented in Figure 2-31.
[3] High gap = 169,100 AF represented in Figure 2-32.

Figure 2-30 South Platte Basin M&I and SSI Gap Summary Low Scenario (IPPs at 100% Yield)

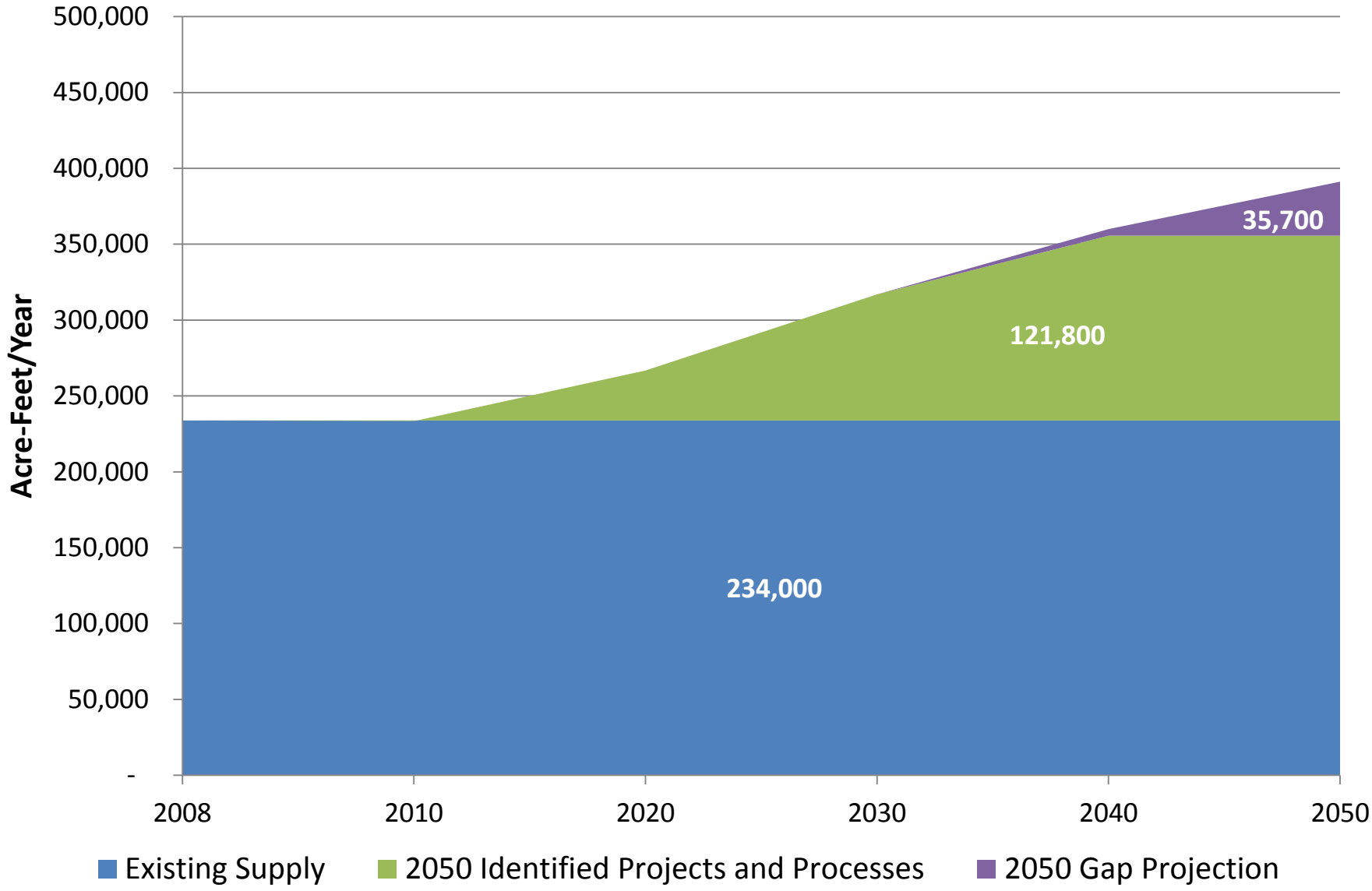


Figure 2-31 South Platte Basin M&I and SSI Gap Summary Medium Scenario (IPPs at 60% Yield)

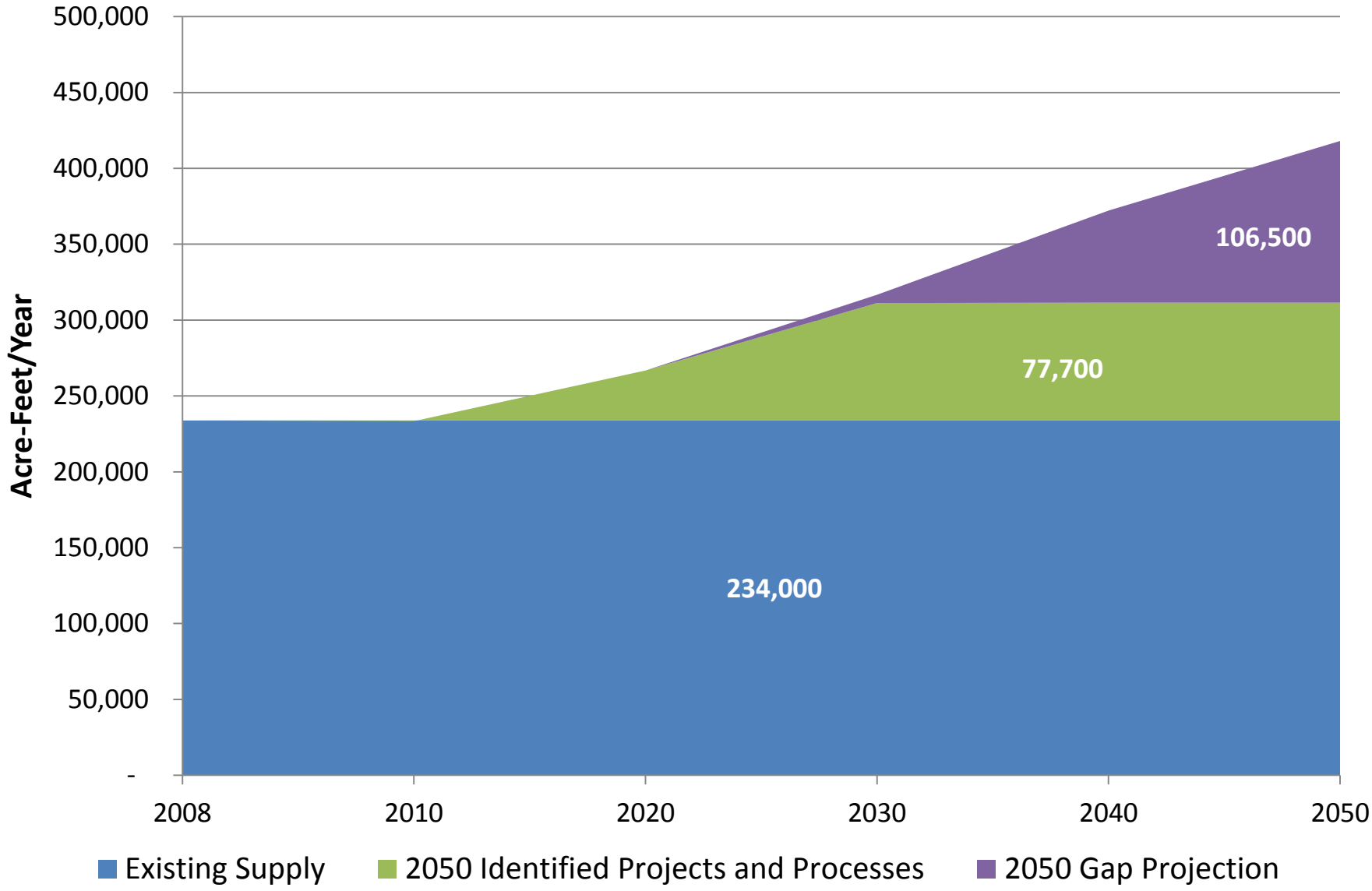
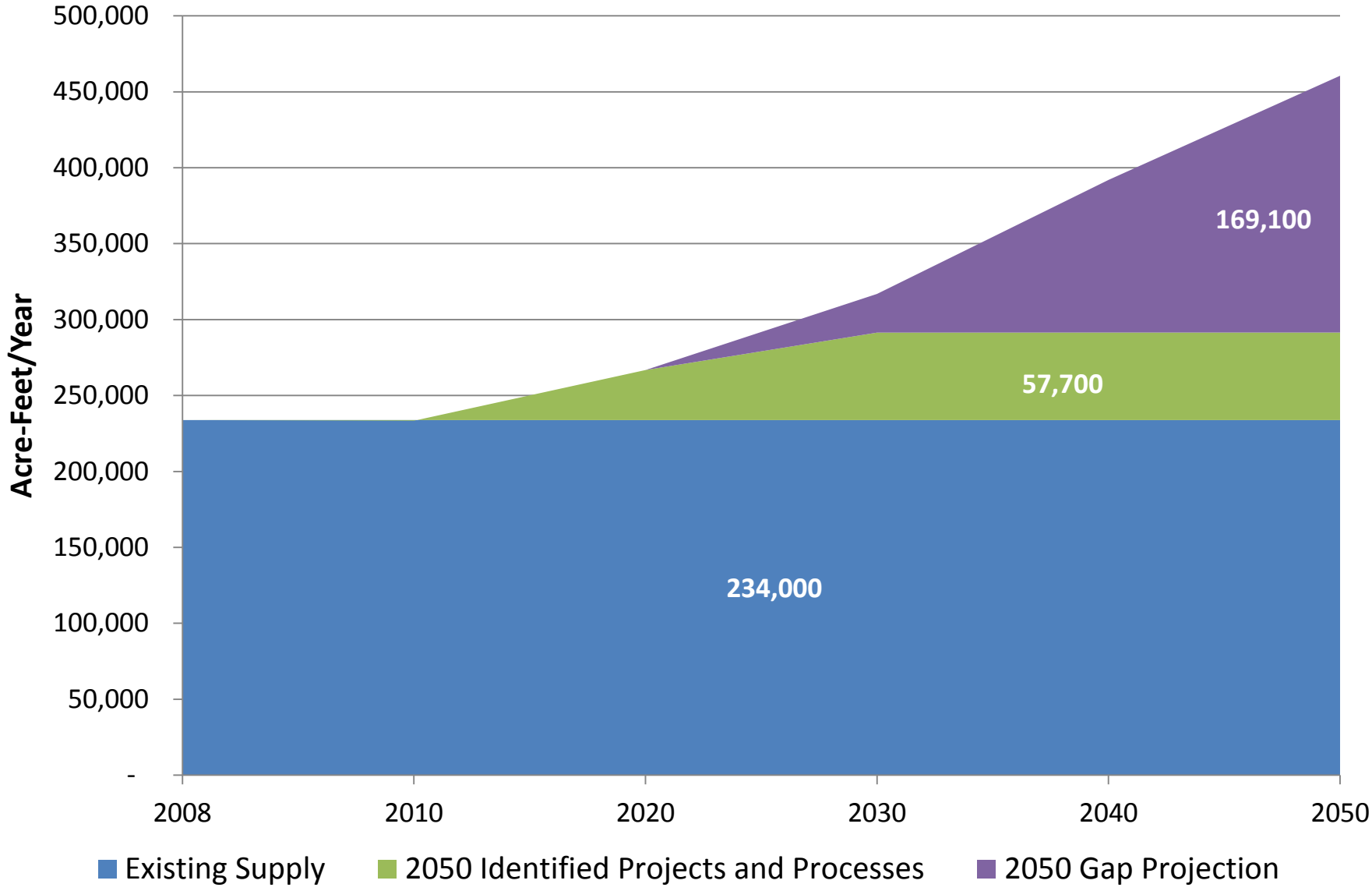


Figure 2-32 South Platte Basin M&I and SSI Gap Summary High Scenario (IPPs at 40% Yield)



2.9 Southwest Basin

Numerous IPPs were developed to meet the diverse uses in the counties of the Southwest (Dolores/San Juan/San Miguel) Basin. During the SWSI Phase 1 study, both the Dolores Project (including McPhee Reservoir) and the Animas-La Plata Project were considered critical to meeting the gap by Roundtable members. The Dolores Project has been constructed and the construction of the Animas-La Plata Project is nearing completion as of mid-2010. In recent interviews conducted by CWCB, the City of Durango indicated plans to acquire additional Animas-La Plata water, and the City of Cortez cited plans to purchase more M&I reserves in McPhee Reservoir.

Overall, the M&I allocations in these projects are projected to be adequate to meet M&I water supply needs in most areas of Dolores, La Plata, and Montezuma Counties. However, some of the infrastructure to deliver Dolores and Animas-La Plata Project water to its end users does not currently exist and must be constructed. This includes water system construction planned by the La Plata Archuleta Water District and the La Plata West Water Authority. This water treatment and delivery infrastructure will be very expensive to construct. It will likely not be financially feasible to serve some unincorporated areas not served by water districts and water hauling is anticipated unless financial assistance is provided to develop the supplies and infrastructure.

In addition, the Pagosa Area Water & Sanitation District has plans for two reservoir projects—Dry Gulch Reservoir and the enlargement of Stevens Reservoir. Based on SWSI Phase 1 analyses, existing supplies and water rights are anticipated to be adequate to meet future needs in Montrose, San Juan, and San Miguel Counties. Anticipated yields from each category of IPPs at 100 percent success rate are summarized for the Southwest Basin in Table 2-17 and Figure 2-33.

Table 2-18 provides a summary of increased M&I and SSI demands, the amount of that increase provided by the IPPs, and the general locations of the gap for each region in the Southwest Basin.

The Southwest Basin M&I/SSI existing supply (24,000 AF), IPPs, and gap projections through 2050 are depicted in Figures 2-34 through 2-36. The Southwest Basin low gap scenario shows all development of IPPs occurring prior to 2040, reaching 14,230AF at that point. The gap increases steadily in the absence of further IPPs development after 2040. By 2050 the gap is 5,120 AF. Similar trends are observed under the medium gap scenario, although IPPs grow at a lesser rate between 2030 and 2040, reaching only 12,770 AF in total. The gap grows steadily after 2030, reaching 11,920 AF in 2050. Under the high gap scenario for the Southwest Basin, IPPs exceed 12,000 AF by 2030, and by 2040 reach a maximum of 15,400AF. Gap accrual doesn't begin until 2030, but it proceeds at a quick pace, reaching 15,740 AF in 2050.

Table 2-17 Southwest 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)	Notes on what the IPPs are
Archuleta County	0	0	0	3,300 – 4,400	0	0	0	• Dry Gulch Reservoir Project • Stevens Reservoir enlargement
Dolores County	0	0	0	300 – 500	0	0	0	• WETPACK Lawn and Garden M&I water • Totten Reservoir
La Plata County	0	0	1,000 – 1,700	5,400 – 8,600	0	0	0	• Existing supplies and water rights • Animas-La Plata Project water • Western La Plata County Domestic Water System • La Plata Archuleta Water District Water System • Florida Water Conservancy District Multipurpose Project
Montezuma County	0	0	2,510 – 3,590	290 – 410	0	0	0	• Existing supplies and water rights • McPhee Reservoir water
Montrose County	0	0	700	0	0	0	0	• Existing supplies and water rights
San Juan County	0	0	30 – 100	0	0	0	0	• Existing supplies and water rights
San Miguel County	0	0	700	0	0	0	0	• Existing supplies and water rights
Total	**0**	**0**	**4,940 – 6,790**	**9,290 – 13,910**	**0**	**0**	**0**	**14,230 – 20,700**

Figure 2-33 Southwest - Summary of IPP Categories at 100% Yield

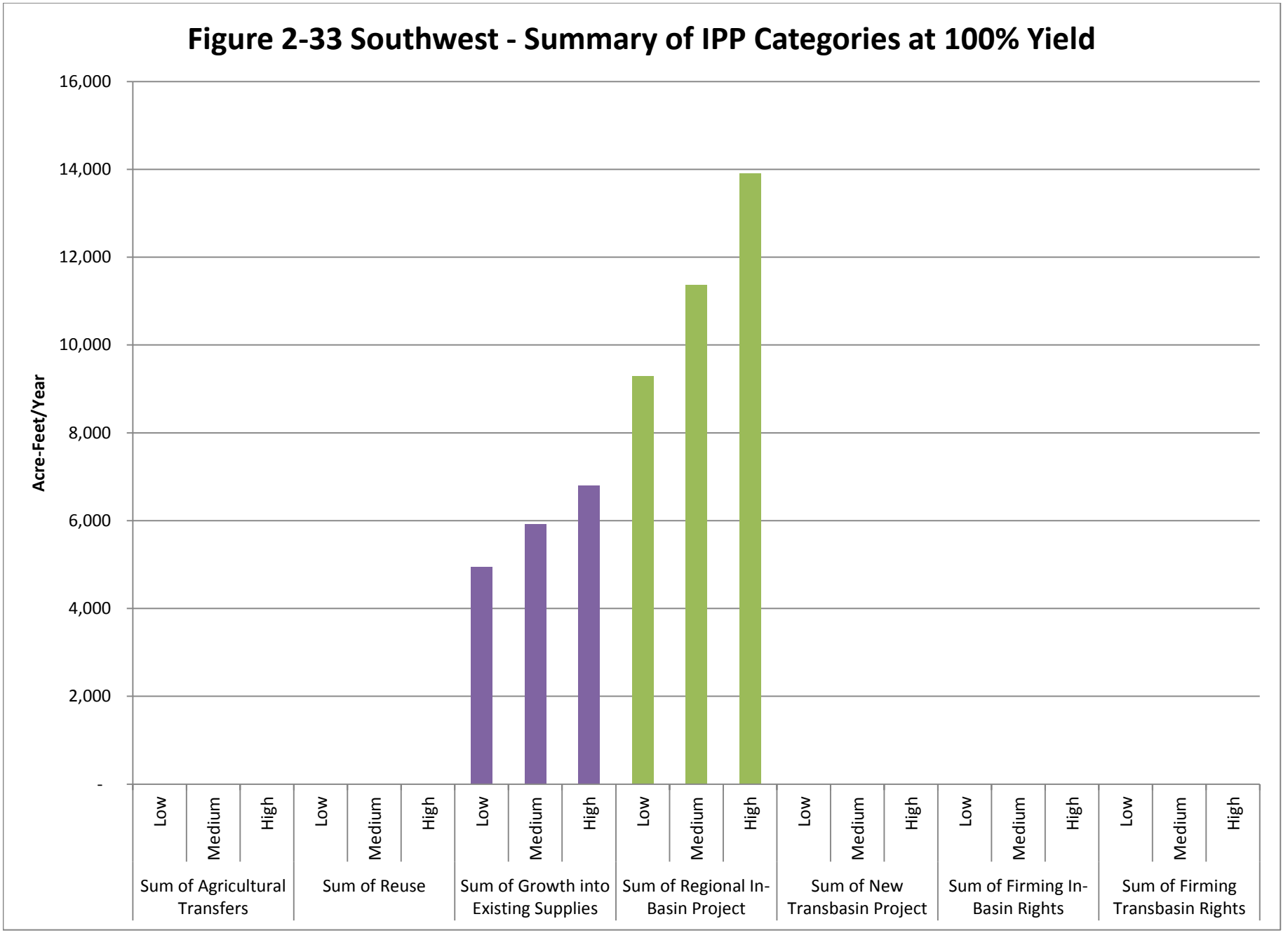


Table 2-18 Southwest Basin M&I and SSI Gaps in 2050

Region or County	Increase in M&I and SSI Demand (AFY)			Estimated Yield of Identified Projects and Processes if 100% success rate (AFY)			Estimated Remaining M&I/SSI Gap after Identified Projects and Processes (AFY)								
							Gap at 100% IPP Success Rate			Gap at Alternative IPP Success Rate (75%)			Gap at Status Quo IPP Success Rate (75%)		
	Low	Med	High	Low	Med	High	Low	Med	High	Low	Med	High	Low	Med	High
Archuleta County	3,500	4,000	4,600	3,300	3,800	4,400	*200*	200	200	1,000	*1,100*	1,300	1,000	1,100	*1,300*
Dolores County	300	400	500	300	400	500	*20*	20	20	100	*100*	100	100	100	*100*
La Plata County	6,800	8,600	10,800	6,400	8,200	10,300	*300*	400	500	2,000	*2,500*	3,100	2,000	2,500	*3,100*
Montezuma County	3,000	3,500	4,200	2,800	3,400	4,000	*100*	200	200	900	*1,000*	1,200	900	1,000	*1,200*
Montrose County	3,000	3,900	5,000	700	700	700	*2,300*	3,200	4,300	2,500	*3,400*	4,500	2,500	3,400	*4,500*
San Juan County	30	90	100	30	90	100	—	—	—	10	*20*	40	10	20	*40*
San Miguel County	2,900	4,300	6,000	700	700	700	*2,200*	3,600	5,300	2,300	*3,800*	5,500	2,300	3,800	*5,500*
Total	**19,530**	**24,790**	**31,200**	**14,230**	**17,290**	**20,700**	***5,120***[1]	**7,620**	**10,520**	**8,810**	***11,920***[2]	**15,740**	**8,810**	**11,920**	***15,740***[3]

[1] Low gap = 5,120 AF represented in Figure 2-34.
[2] Medium gap = 11,920 AF represented in Figure 2-35.
[3] High gap = 15,740 AF represented in Figure 2-36.

Figure 2-34 Southwest Basin M&I and SSI Gap Summary Low Scenario (IPPs at 100% Yield)

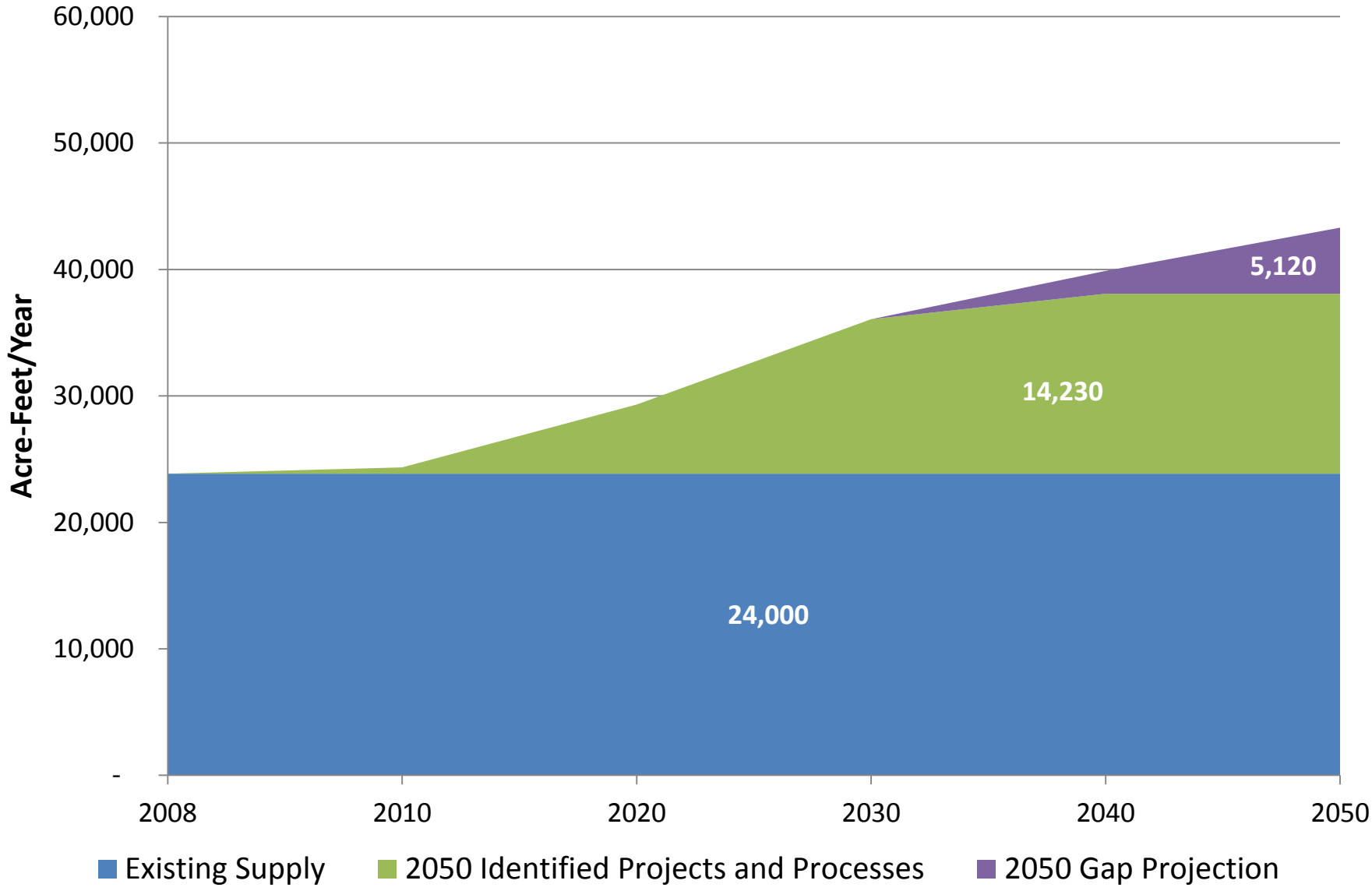


Figure 2-35 Southwest Basin M&I and SSI Gap Summary Medium Scenario (IPPs at75% Yield)

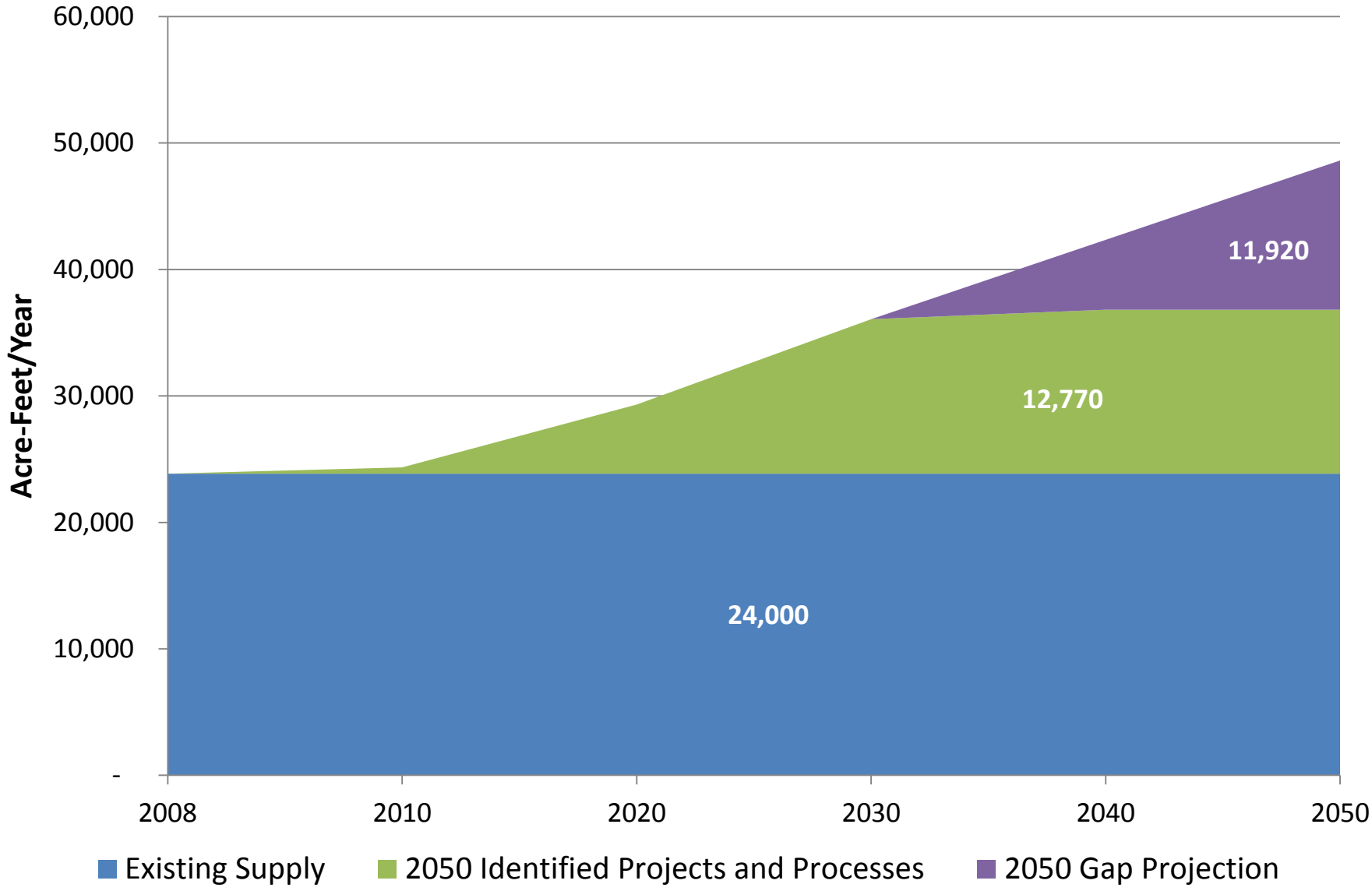
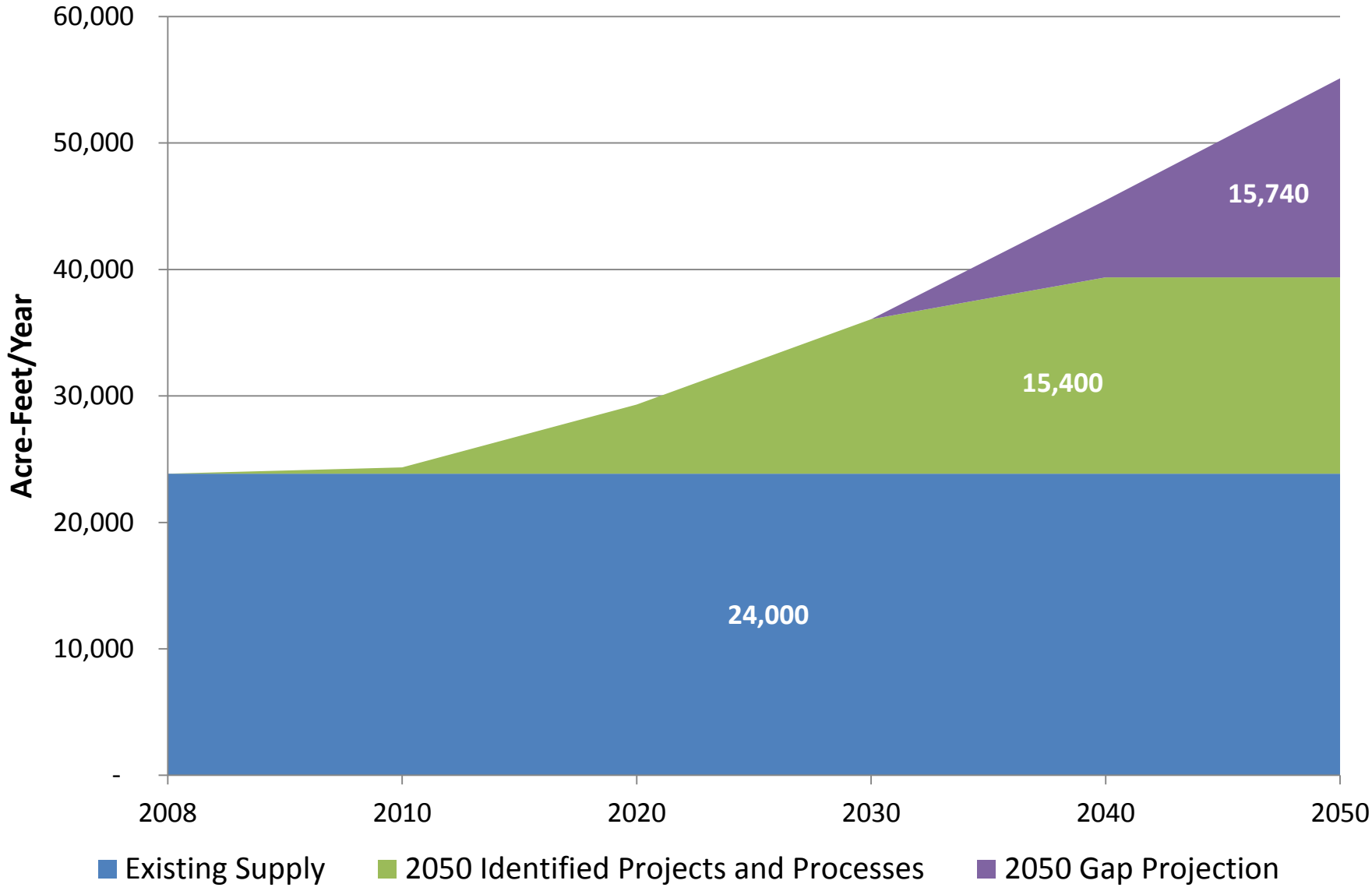


Figure 2-36 Southwest Basin M&I and SSI Gap Summary High Scenario (IPPs at 75% Yield)



2.10 Yampa-White Basin

In the Yampa-White Basin (Moffat, Rio Blanco, and Routt Counties), existing supplies and water rights on the White River, Fish Creek, and other tributaries will be used to meet some of the region's M&I demands through 2050. High transit losses in delivering storage water downstream to the locations of use were experienced during the drought of the early 2000s; consequently, firm yields may be much lower than anticipated, requiring additional water supply development to meet dry year needs.

During the SWSI Phase 1 study, Basin Roundtable participants identified that the Elkhead and Stagecoach Reservoir enlargements are critical to meeting the basin's projected water needs. Based on more recent CWCB interviews, additional IPPs include the Elk River Project (Steamboat Springs) and the Morrison Creek Reservoir Project (Upper Yampa River Water Conservancy District).

SSI demands associated with power generation in the Craig and Hayden areas are projected to increase significantly. Due to unknowns such as international markets, national security, and proprietary processing methods, the rate of potential development of energy resources such as oil shale and the level of associated water demands is not known but could have a significant demand on the basin's water resources, increasing annual demands by nearly 100,000 AF under the high growth scenario. The probability, timing, and extent of such demands are unknown at this time; hence, the increased demands and remaining M&I/SSI gap have a very wide range.

Anticipated yields from each category of IPPs at 100 percent success rate are summarized for the Yampa-White Basin in Table 2-19 and Figure 2-37.

Table 2-20 provides a summary of increased M&I and SSI demands, the amount of that increase provided by the IPPs, and the general locations of the gap for each region in the Yampa-White Basin.

Figures 2-38 through 2-40 illustrate the M&I/SSI existing supply (40,000 AF), IPPs, and gap projections through the year 2050 for the Yampa-White Basin. Owing to the uncertainty of future water needs associated with energy development, the gap projections for the Yampa-White Basin show much greater variability than the other basins. For the low gap scenario, IPPs are fully developed (10,100 AF) by 2020. The gap begins to accrue almost immediately in 2010 and grows steadily through 2030. The rate of gap increase is somewhat less between 2030 and 2040, and reaches a maximum of 23,400 AF after 2040. The timeline for IPPs and gap development under the medium scenario are quite similar, with IPPs maxing out at the slightly higher 10,600 AF in 2020. The gap grows continually from 2010 through 2050, reaching 36,700 AF. For the Yampa-White high gap scenario, maximum IPPs of 12,500 AF are online by 2020. Gap accrual increases significantly after 2030 and totals 82,800 AF by 2050.

Table 2-19 Yampa-White 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)	Notes on what the IPPs are
Moffat County	0	0	2,100 – 3,200	0	0	0	0	• Existing supplies • Elkhead Reservoir enlargement
Rio Blanco County	0	0	600	0	0	0	0	• Existing supplies and water rights from White River and tributaries
Routt County	0	0	760 – 1,100	6,640 – 9,000	0	0	0	• Existing supplies • Fish Creek direct flow and storage • Yampa River wells • Elk River Project • Morrison Creek Reservoir Project • Stagecoach Reservoir enlargement
Total	**0**	**0**	**3,460 – 4,900**	**6,640 – 9,000**	**0**	**0**	**0**	**10,100 – 13,900**

Figure 2-37 Yampa-White - Summary of IPP Categories at 100% Yield

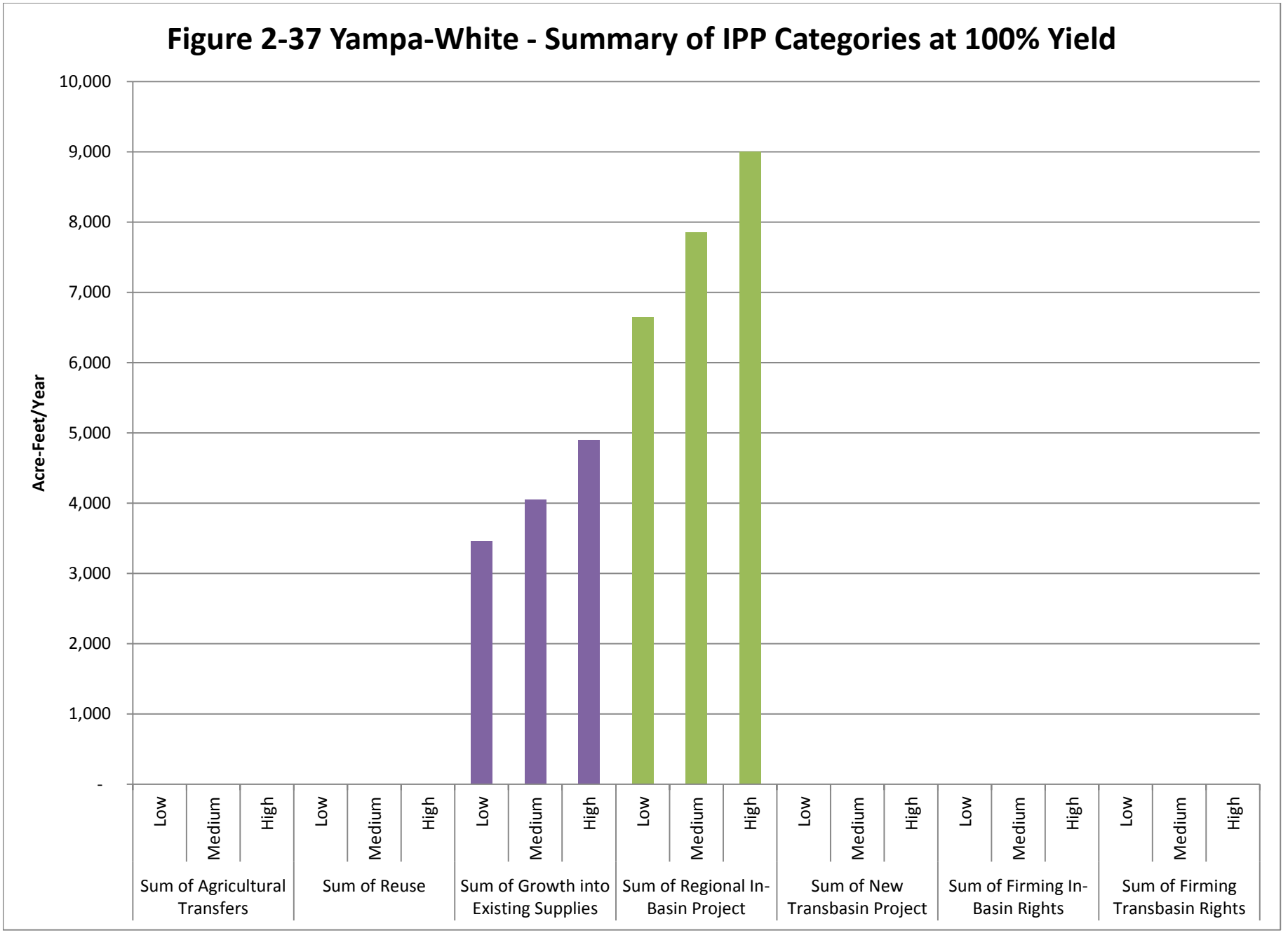


Table 2-20 Yampa-White Basin M&I and SSI Gaps in 2050

Region or County	Increase in M&I and SSI Demand (AFY)			Estimated Yield of Identified Projects and Processes if 100% success rate (AFY)			Estimated Remaining M&I/SSI Gap after Identified Projects and Processes (AFY)								
							Gap at 100% IPP Success Rate			Gap at Alternative IPP Success Rate (90%)			Gap at Status Quo IPP Success Rate (90%)		
	Low	Med	High	Low	Med	High	Low	Med	High	Low	Med	High	Low	Med	High
Moffat County	10,200	12,900	15,400	2,100	2,500	3,200	*8,100*	10,400	12,200	8,300	*10,600*	12,500	8,300	10,600	*12,500*
Rio Blanco County	5,200	12,800	52,300	600	600	600	*4,600*	12,200	51,700	4,700	*12,200*	51,700	4,700	12,200	*51,700*
Routt County	18,100	21,800	27,700	7,400	8,800	10,100	*10,700*	13,000	17,600	11,400	*13,900*	18,600	11,400	13,900	*18,600*
Total	**33,500**	**47,500**	**95,400**	**10,100**	**11,900**	**13,900**	***23,400*[1]**	**35,600**	**81,500**	**24,400**	***36,700*[2]**	**82,800**	**24,400**	**36,700**	***82,800*[3]**

[1] Low gap = 23,400 AF represented in Figure 2-38.
[2] Medium gap = 36,700 AF represented in Figure 2-39.
[3] High gap = 82,800 AF represented in Figure 2-40.

Figure 2-38 Yampa-White Basin M&I and SSI Gap Summary Low Scenario (IPPs at 100% Yield)

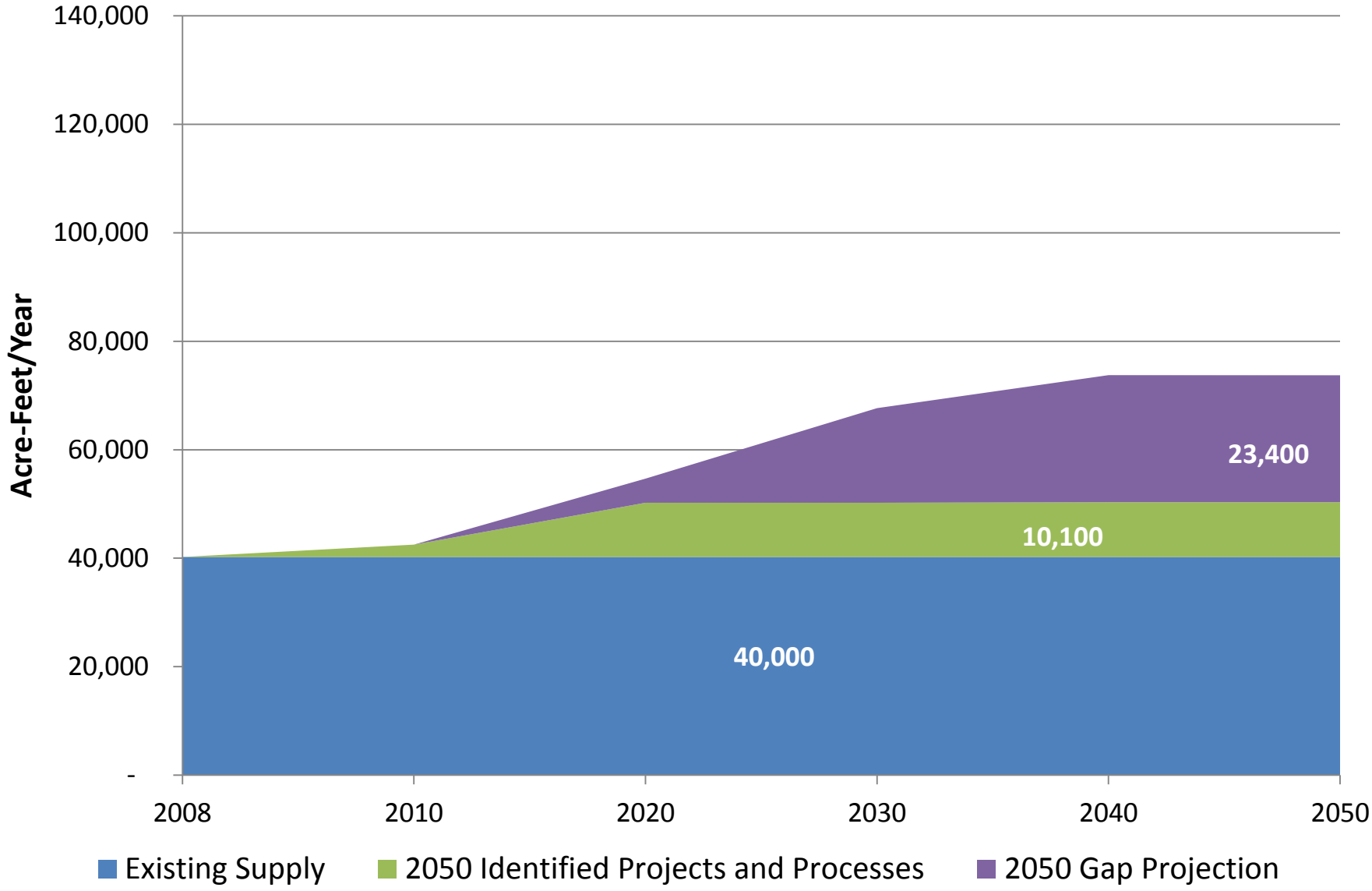


Figure 2-39 Yamp-White Basin M&I and SSI Gap Summary Medium Scenario (IPPs at 90% Yield)

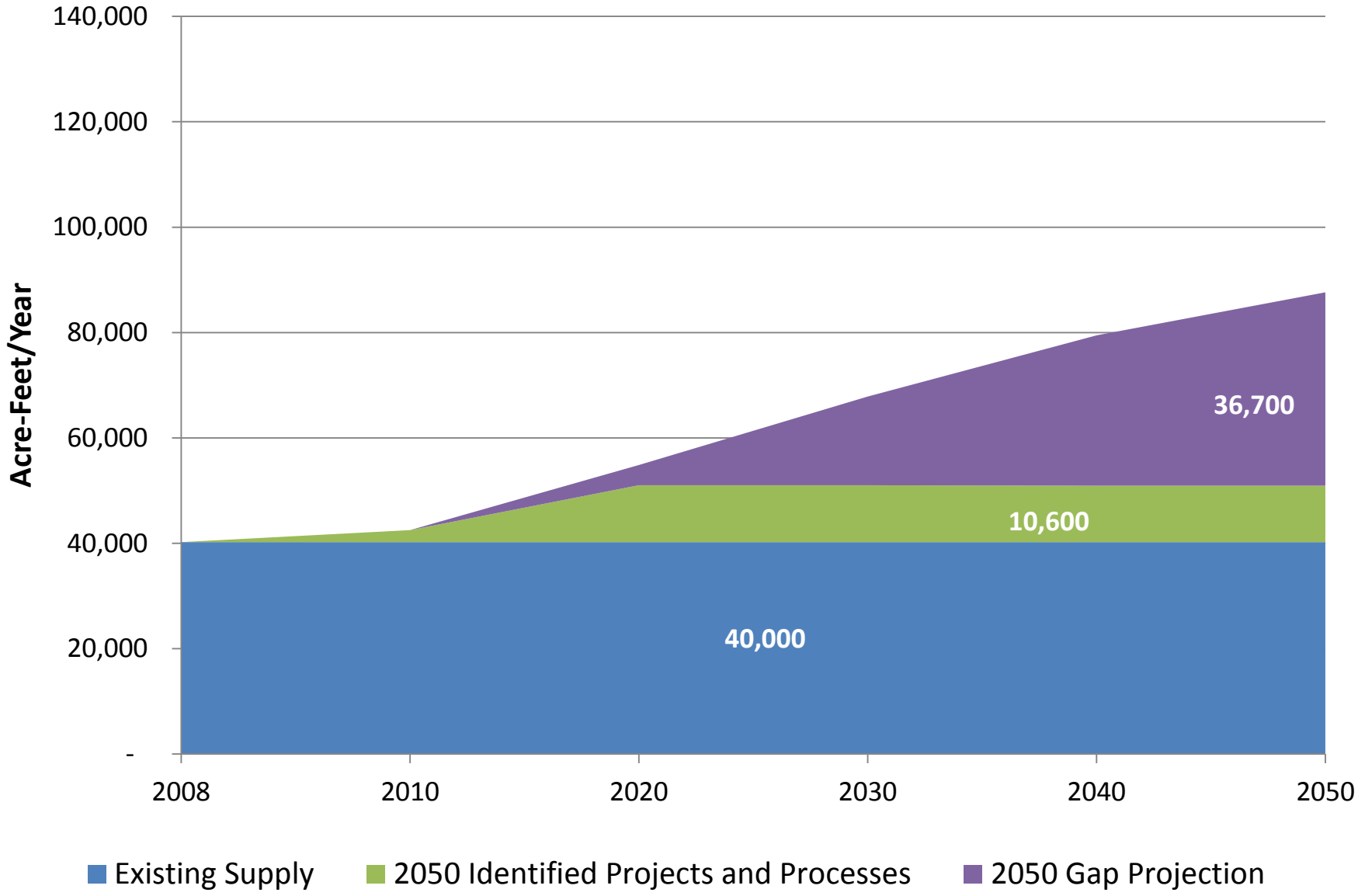
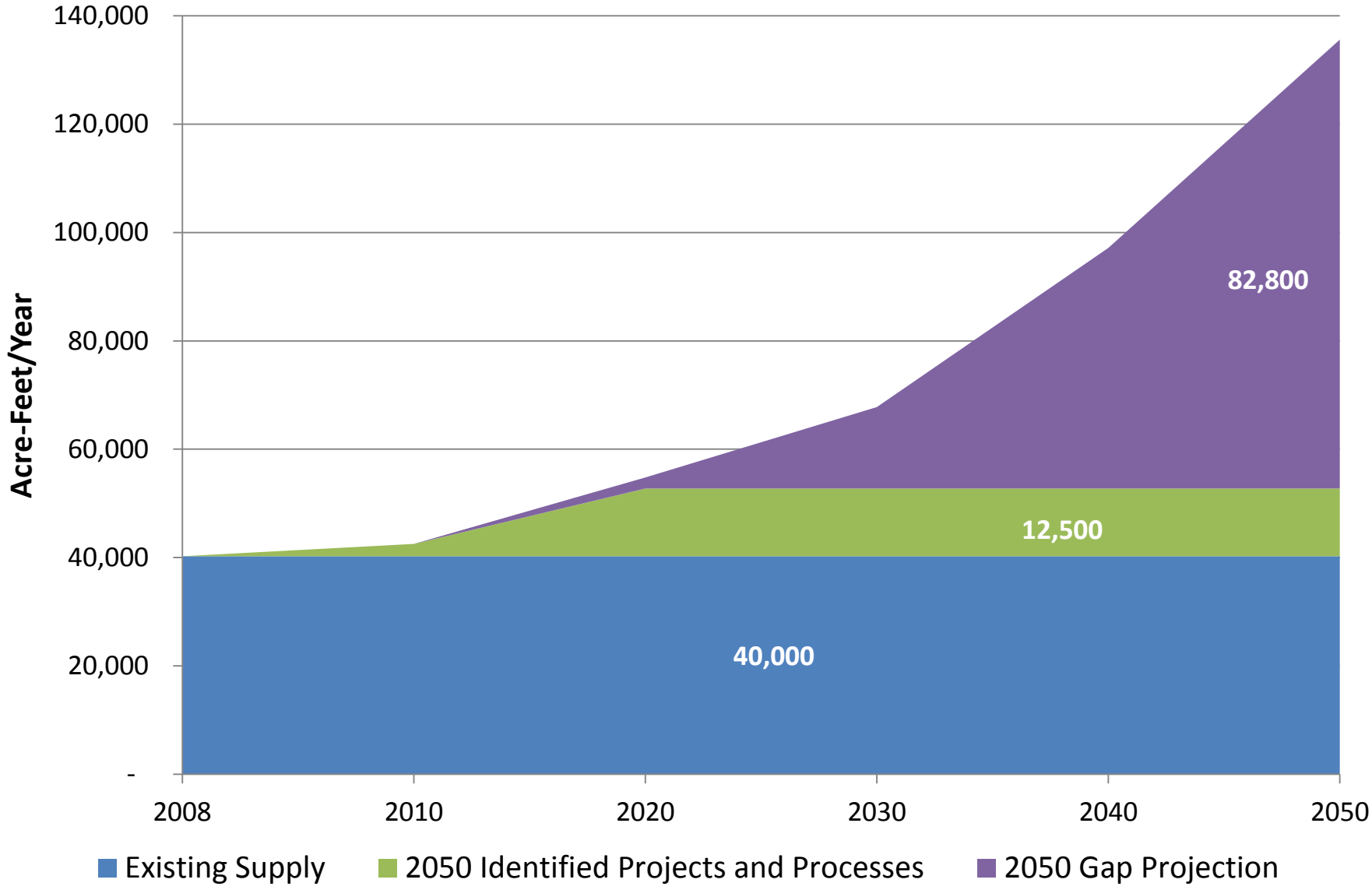


Figure 2-40 Yampa-White Basin M&I and SSI Gap Summary High Scenario (IPPs at 90% Yield)

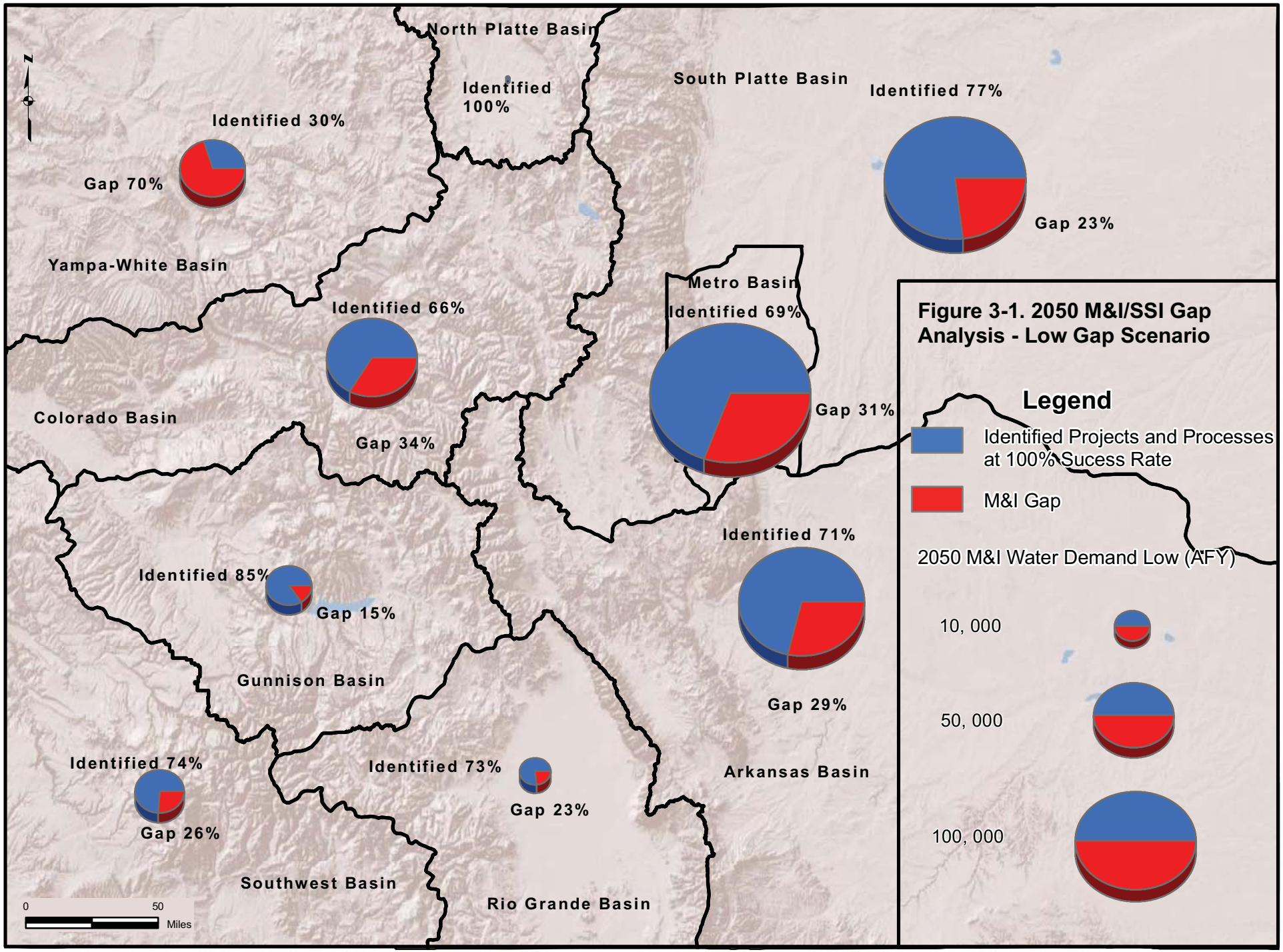


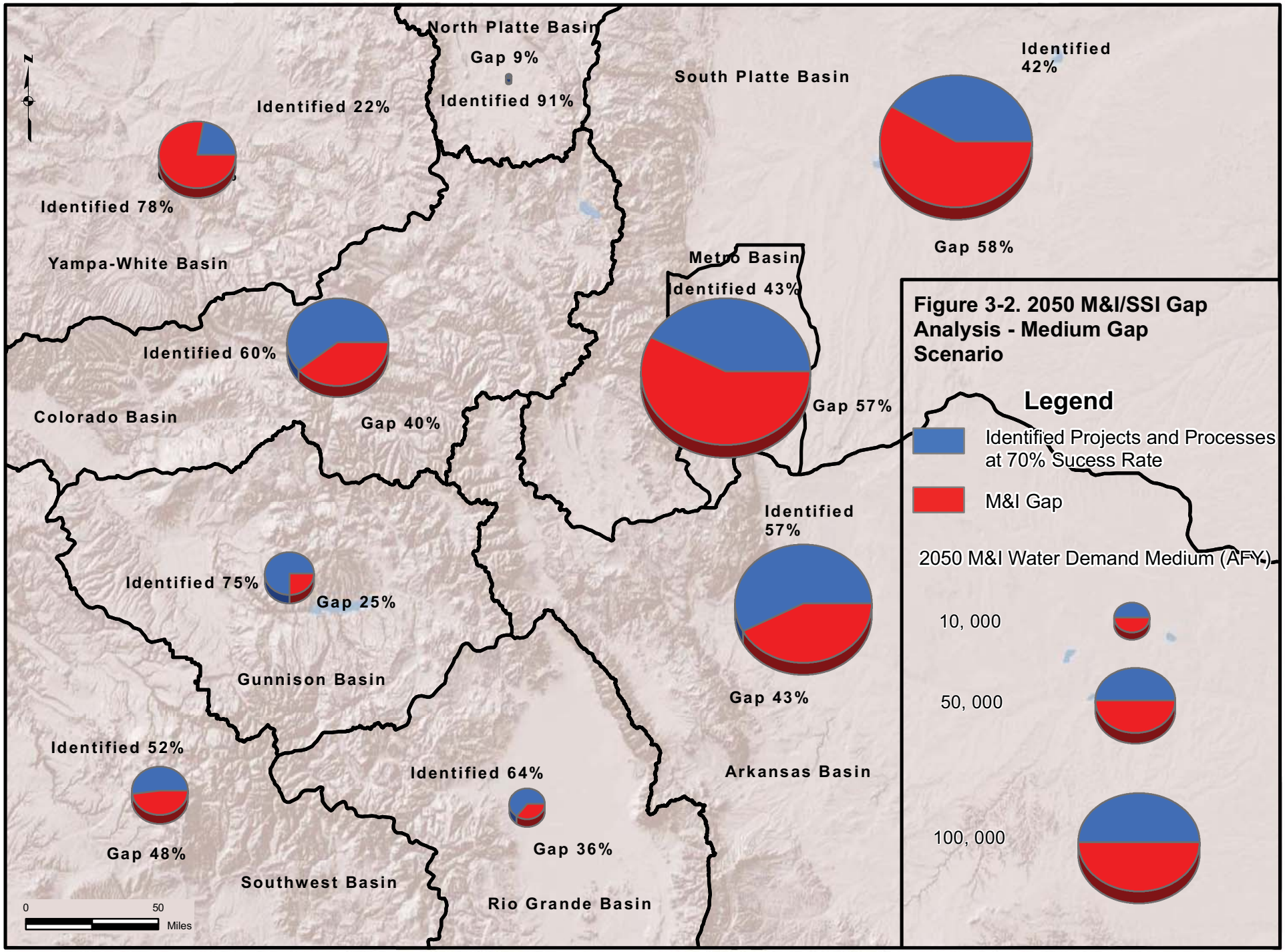
Section 3 – Conclusions and Next Steps

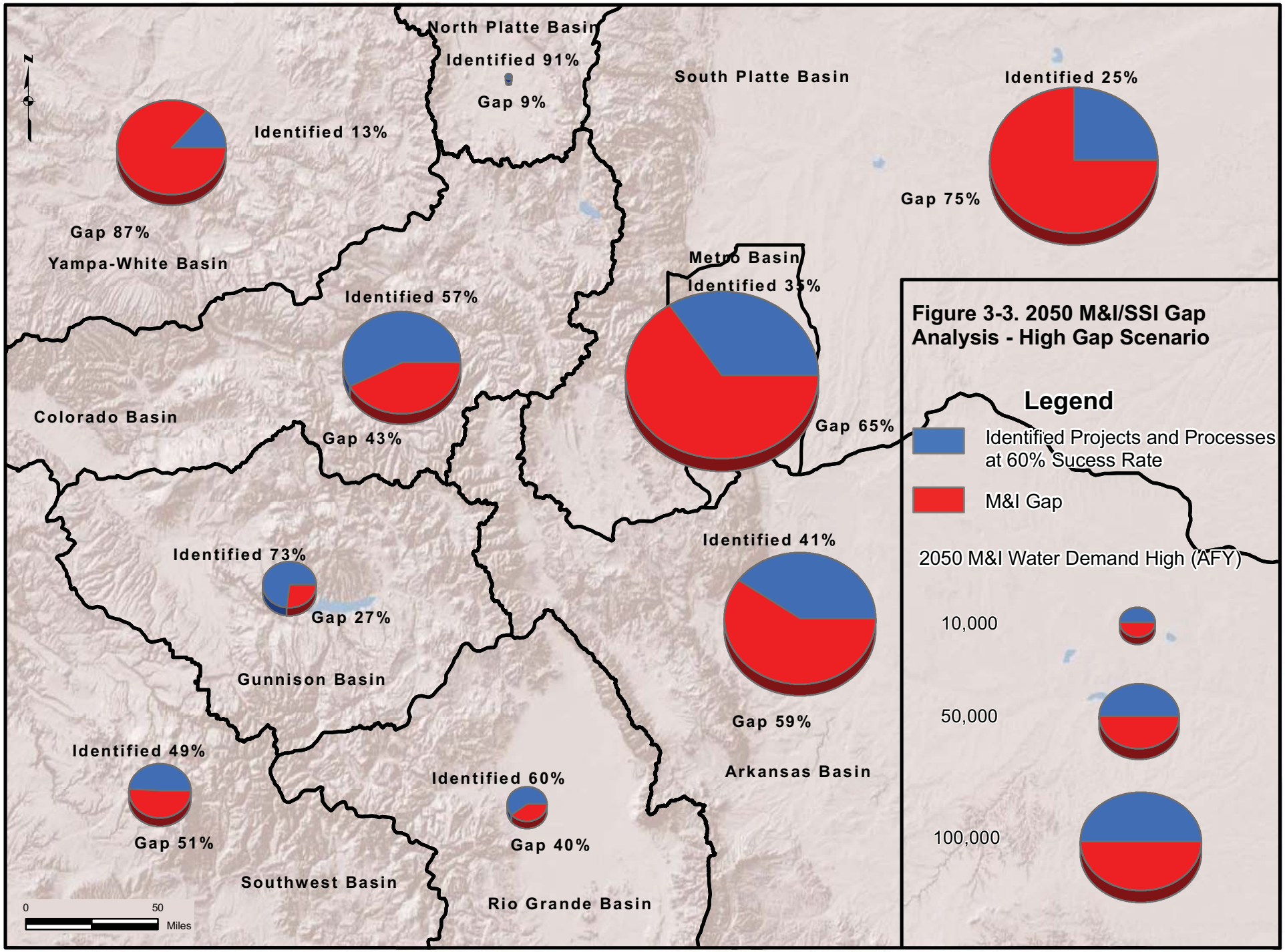
Statewide, the new water supplies needed for M&I and SSI use by the year 2050—above and beyond all existing supplies—are estimated to range from 592,320 AF to 949,200 AF. This range reflects the uncertainty associated with forecasting water demands 40 years into the future, in particular SSI demands associated with energy development and other market-driven commodities. Based on extensive interviews with water providers, input from Basin Roundtable and IBCC members, and a thorough review of other pertinent information, IPPs have been identified that will meet a significant portion of this future new demands. At the low end, quantified IPPs would provide 437,240 AF, or 74 percent of the new demands under the low growth scenario (and assuming 100 percent IPP success rate). At the high end, again assuming 100 percent success rate, IPPs would total 587,800 AF and represent 62 percent of the high demand increase. The projects associated with the IPPs represent significant quantities of water. However, even with the implementation of the IPPs, there are still remaining M&I/SSI water supply gaps that will need to be satisfied. The statewide gap ranges from 189,400 AF (low gap scenario, with low demands and 100 percent IPP success rate) to 628,930 AF (high gap scenario, with high demands and reduced IPP success rates in all basins), including amounts necessary to replace current use of non-renewable groundwater in the South Metro area (20,850 AF) and northern El Paso County (13,500 AF).

Figures 3-1 through 3-3 illustrate the relative percentages of 2050 net new water needs occupied by IPPs and the gap for each basin for the low, medium, and high gap scenarios. The IPPs are assumed to have 100 percent success rate for the low gap scenario. For the medium and high gap scenarios, the IPP success rates are those shown in Table 1-1; at the statewide level, the overall IPP success rates are 70 percent for the medium gap scenario and 60 percent for the high gap scenario. Under the low gap scenario (Figure 3-1), completely successful IPPs meet two-thirds or more of the 2050 net new water needs in every basin except for the Yampa-White. In that basin, almost the opposite is true, with only 30 percent of the need met by IPPs. As discussed in Section 2.10, the large gap is a result of uncertainty surrounding future SSI water needs for energy development in the basin.

For the medium gap scenario (Figure 3-2), the relative percentage of 2050 new water demand that is met by IPPs decreases in every basin, and the gap percentage increases correspondingly. This result is consistent with the IPP success rates in Table 1-1. The most significant gap increases are in the South Platte and Metro Basins, where, the IPP success rates drop to 60 percent, and in the Arkansas, where the IPP success rate is 75 percent. The gap in the Yampa-White Basin continues to increase, representing more than three-fourths of the 2050 net new water needs under the medium gap scenario.


North Platte Basin
Identified 100%
South Platte Basin
Identified 77%
Gap 23%
Identified 30%
Gap 70%
Yampa-White Basin
Metro Basin
Identified 69%
Gap 31%
Identified 66%
Gap 34%
Colorado Basin
Identified 71%
Gap 29%
Identified 85%
Gap 15%
Gunnison Basin
Identified 74%
Gap 26%
Identified 73%
Gap 23%
Arkansas Basin
Southwest Basin
Rio Grande Basin
0
50
Miles
Figure 3-1. 2050 M&I/SSI Gap Analysis - Low Gap Scenario
Legend
Identified Projects and Processes at 100% Sucess Rate
M&I Gap
2050 M&I Water Demand Low (AFY)
10, 000
50, 000
100, 000


North Platte Basin
Gap 9%
Identified 91%
South Platte Basin
Identified 42%
Gap 58%
Identified 22%
Identified 78%
Yampa-White Basin
Metro Basin
Identified 43%
Gap 57%
Identified 60%
Gap 40%
Colorado Basin
Identified 57%
Identified 75%
Gap 25%
Gap 43%
Gunnison Basin
Identified 52%
Identified 64%
Arkansas Basin
Gap 48%
Gap 36%
Southwest Basin
Rio Grande Basin
0
50
Miles
Figure 3-2. 2050 M&I/SSI Gap Analysis - Medium Gap Scenario
Legend
Identified Projects and Processes at 70% Sucess Rate
M&I Gap
2050 M&I Water Demand Medium (AFY)
10, 000
50, 000
100, 000


North Platte Basin
Identified 91%
Gap 9%
South Platte Basin
Identified 25%
Gap 75%
Identified 13%
Gap 87%
Yampa-White Basin
Metro Basin
Identified 35%
Gap 65%
Identified 57%
Gap 43%
Colorado Basin
Identified 73%
Gap 27%
Gunnison Basin
Identified 41%
Gap 59%
Arkansas Basin
Identified 49%
Gap 51%
Identified 60%
Gap 40%
Southwest Basin
Rio Grande Basin
0
50
Miles
Figure 3-3. 2050 M&I/SSI Gap Analysis - High Gap Scenario
Legend
Identified Projects and Processes at 60% Sucess Rate
M&I Gap
2050 M&I Water Demand High (AFY)
10,000
50,000
100,000

Under the high gap scenario (Figure 3-3), the relative gap percentage continues to increases in all basins.

In most basins, these increases are the result of the combined effects of the potential yield of IPPs being limited (success rates in most basins are the same as the medium gap scenario) while M&I/SSI demands continue to grow. The relative gap percentage in the South Platte and Metro Basins becomes even more significant under the high gap scenario, as the IPP success rates are further reduced.

Figures 3-4 through 3-6 show a spatial distribution of the percentage of M&I gaps at the county level and the regional level (Arkansas, Metro, and South Platte Basins) for low, medium, and high gap scenarios. As with the preceding figures, the low gap scenario represents 100 percent IPP success rate, while the medium and high scenarios illustrate the effect of successively reduced IPP success rates.

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 (BOR or USACE for most ongoing EIS projects). The list of these projects includes high-yield regional projects such as NISP, WGFP, SDS, 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 3-7 and 3-8. For the medium growth scenario and assuming 100 percent IPP success rate, South Platte Basin and Metro IPPs in NEPA represent 115,100 AF of potential yield, or 40 percent of the total IPP yield for the combined basins. Likewise, NEPA IPPs in the Arkansas Basin total 48,500 AF, or 52 percent of overall IPP yield for the medium growth scenario.

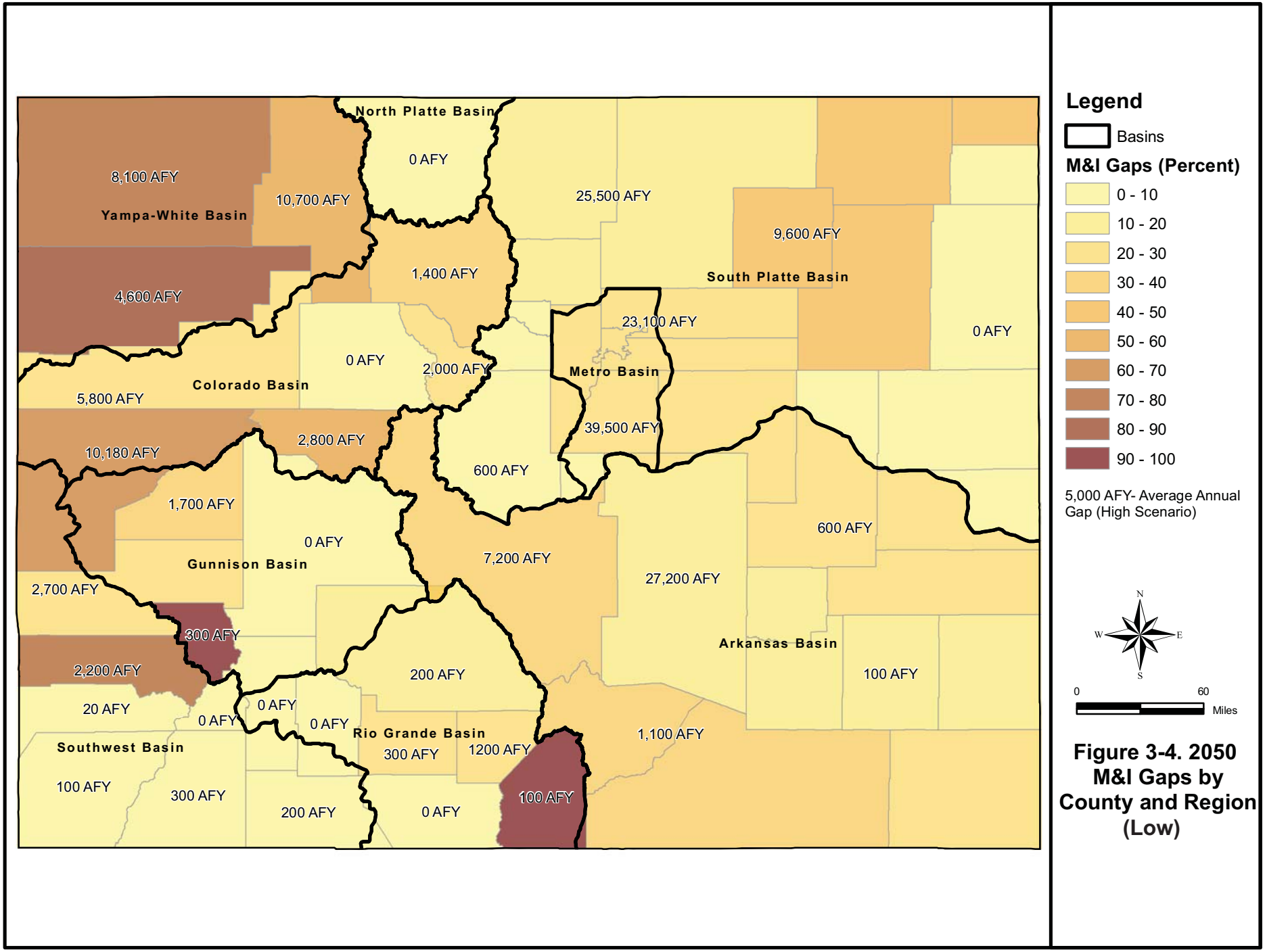


Figure 3-4. 2050 M&I Gaps by County and Region (Low)

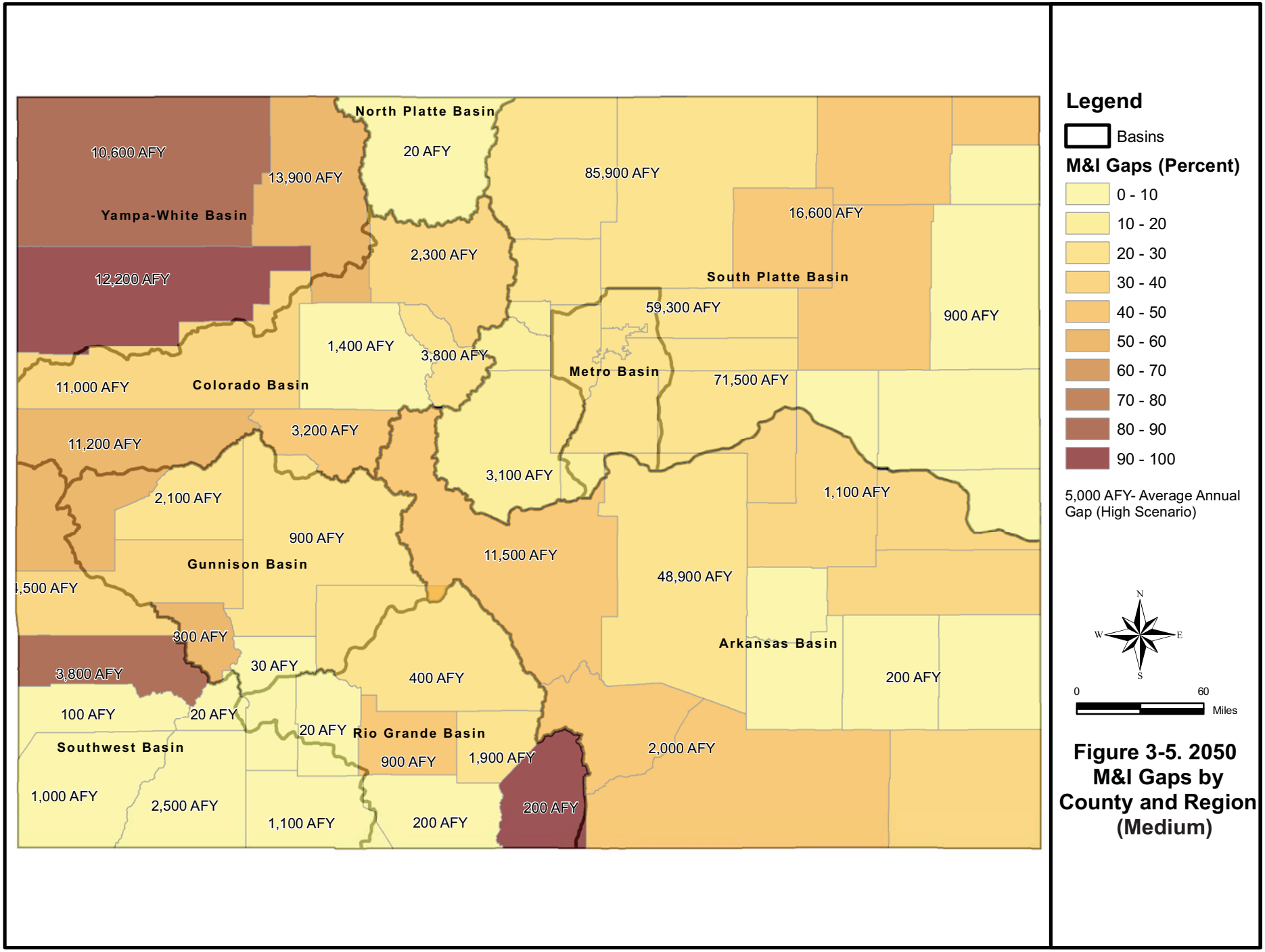


Figure 3-5. 2050 M&I Gaps by County and Region (Medium)

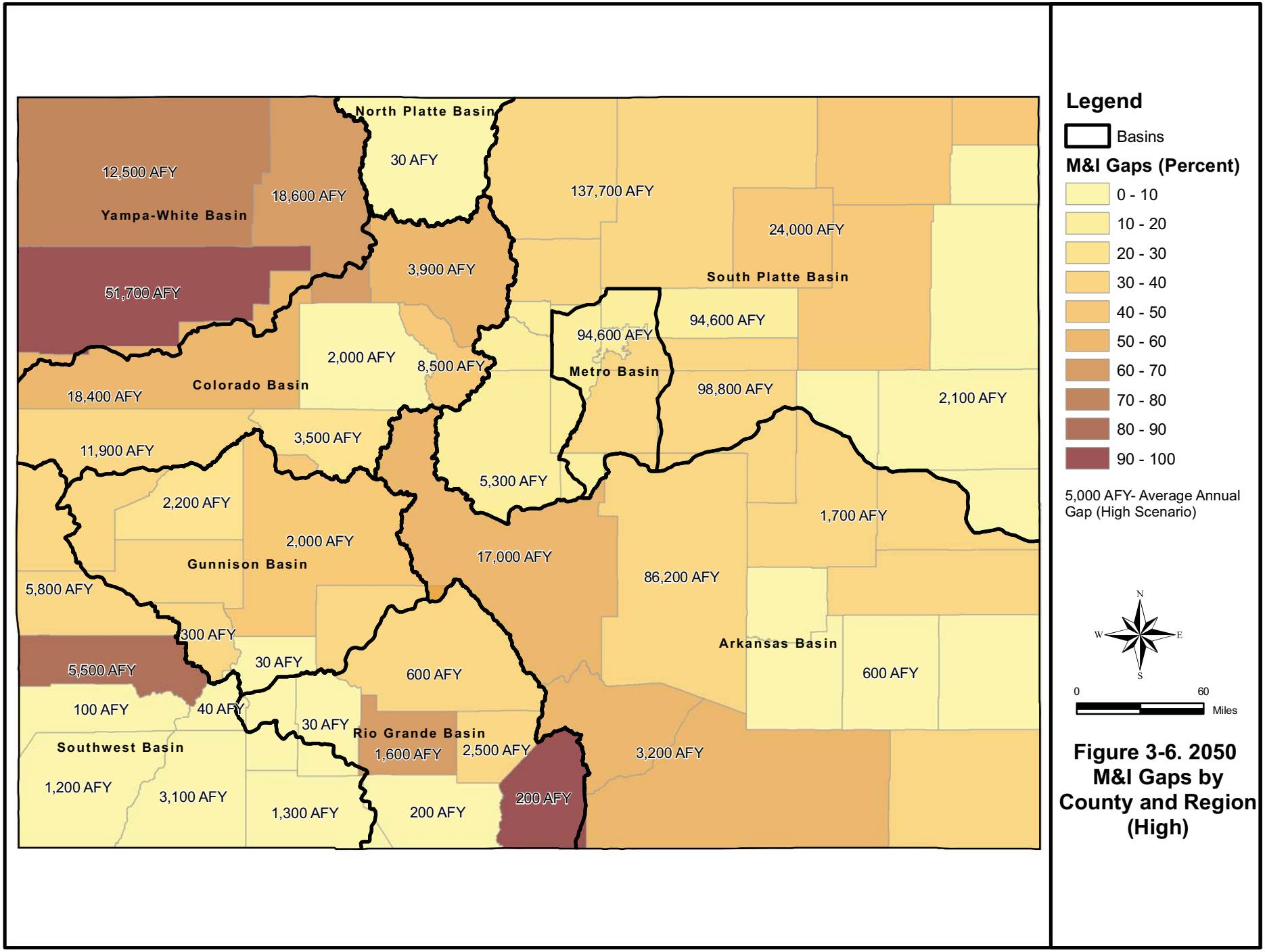


Figure 3-6. 2050 M&I Gaps by County and Region (High)

Figure 3-7. South Platte Basin and Metro 2050 New Demand

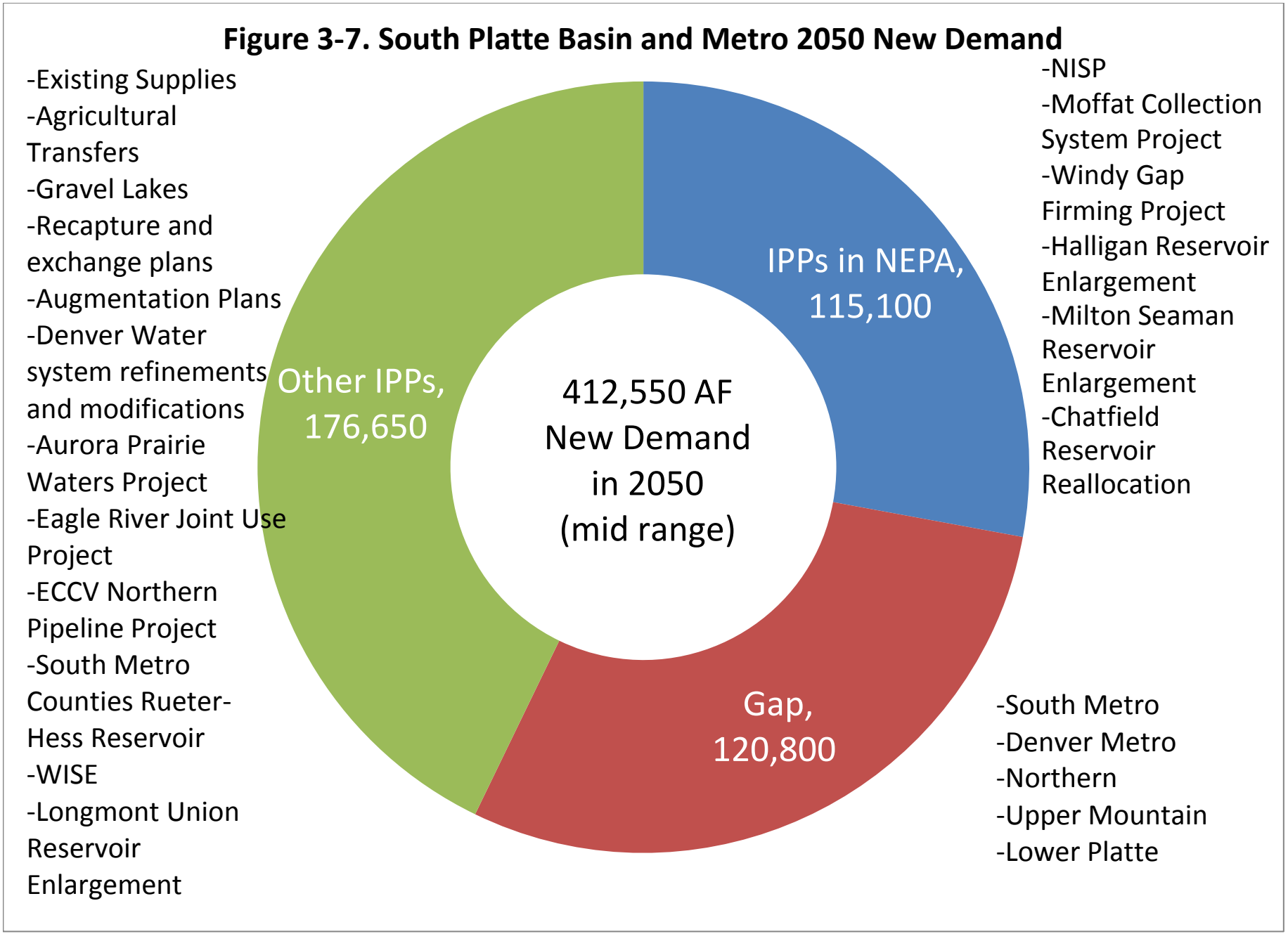
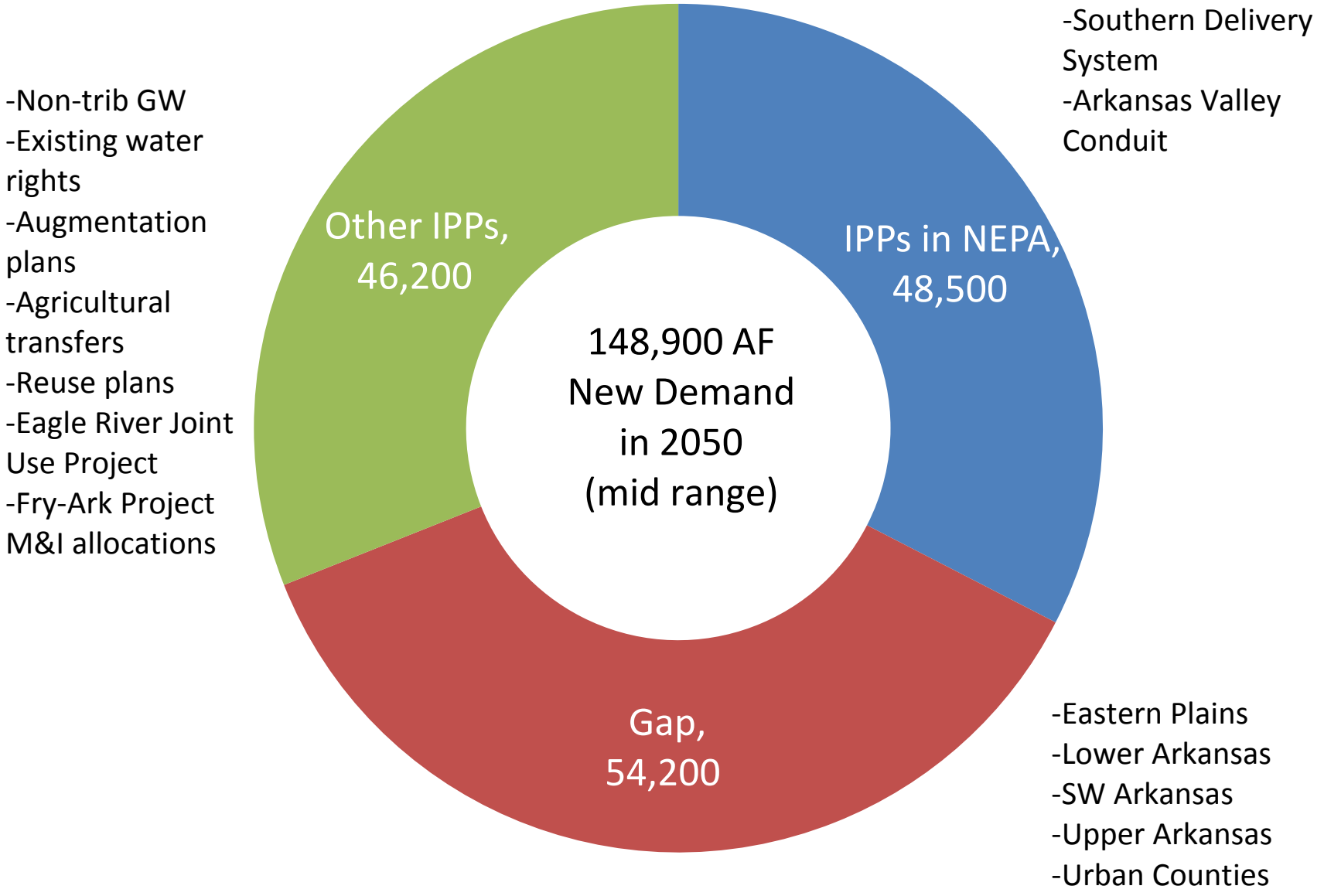


Figure 3-8. Arkansas Basin 2050 New Demand



This updated M&I gap analysis reconfirms several important conclusions. First, Colorado is facing a significant increase in future M&I water demands. By 2050 Colorado will need approximately 590,000 AF and 950,000 AF of new M&I water. Second, a portion of this future water demand can be met through the successful implementation of local water providers' IPPs. However, the extent to which local water providers' IPPs are not successful, the state's overall M&I water supply gap is larger. Third, even with the successful implementation of local water providers' IPPs, Colorado is still facing an M&I water supply gap. By 2050 our state's water supply gap will range from approximately 189,400 to 628,930 AF unless new projects are undertaken to meet this demand.

Through September 2010, CWCB will be working with the Basin Roundtables, CWCB Board, and IBCC to discuss results of the updated 2050 gap analysis. CWCB expects to refine the low to high M&I and SSI gaps presented above based on Basin Roundtable feedback and additional information.

CWCB will also continue to work with the Basin Roundtables, CWCB Board, and IBCC to develop portfolios of solutions for meeting the gap. Colorado's basin-wide and state planning efforts have concluded that meeting Colorado's future water supply needs will require a portfolio of solutions; there is no "silver bullet" and no single strategy will meet our needs. Meeting the gap will require a mix of conservation, reuse, agricultural transfers, and the development of new water supplies.

Section 4 – References

Arkansas Basin Roundtable. 2010. Arkansas Basin Consumptive Use – Water Needs Assessment: 2030. Public Progress Report. June 2010 update. Prepared by Applegate Group.

Arkansas Basin Roundtable. 2008. Arkansas Basin Consumptive Use – Water Needs Assessment: 2030. July 2008 update. Prepared by Applegate Group.

Black & Veatch, Rick Giardina & Associates, Inc., HRS Water Consultants, Inc., Hydrosphere Resource Consultants, Inc., and Mulhern MRE, Inc. 2004.South Metro Water Supply Study. February.

Browning, Tom. 2007. Memorandum "Approval of Re-distribution Agreement for the Chatfield Reallocation Project." Exhibit "D."Submitted to Colorado Water Conservation Board Members.

CWCB (Colorado Water Conservation Board). 2010. *Colorado's Water Supply Future – State of Colorado 2050 Municipal & Industrial Water Use Projections*. Prepared by CDM and Harvey Economics.

CWCB. 2004. *Statewide Water Supply Initiative. Final Report*. Prepared by CDM.

Fisher, Greg. 2010. Personal email communication, 06/15/2010.

Upper Colorado River Study. 2003. Hydrosphere Resource Consultants, Inc.

Appendix A
List of Water Providers

List of Water Providers Interviewed or Surveyed for Updated Gap Analysis - 1st Quater 2010

Basin	County	Provider Name
Arkansas	El Paso	Colorado Springs Utilities
South Platte	Douglas	Castle Rock
South Platte	Larimer	Loveland
South Platte	Arapahoe	East Cherry Creek Valley
South Platte	Adams	City of Brighton
South Platte	Boulder	Longmont
South Platte	Various (100% Denver and portions of Arapahoe (1%), Jefferson (7.5%), Douglas (0.4%), Adams (1%). Broomfield not in service, fixed water contract counted in their estimates.	Denver Water
South Platte	Adams	City of Thornton
South Platte	Jefferson	Arvada
South Platte	Arapahoe	Aurora
South Platte	Arapahoe	Centennial WS District
Yampa-White	Routt	City of Steamboat Springs & Mt. Werner District
Yampa	Moffat	Craig Public Works Dept, City of
Yampa	Rio Blanco	Town of Rangely
Colorado	Eagle	Basalt (Eagle County Part)
Colorado	Eagle	Vail (ERWSD)
Colorado	Eagle	Cordillera (Upper Eagle Regional Water Authority)
Colorado	Eagle	Edwards (Upper Eagle Regional Water Authority)
Colorado	Eagle	Avon (Upper Eagle Regional Water Authority)
Colorado	Eagle	Eagle, Town of
Colorado	Eagle	Eagle River Water & Sanitation
Colorado	Eagle	Mid Valley Metropolitan District
Colorado	Garfield	Carbondale
Colorado	Garfield	City of Glenwood Springs
Colorado	Garfield	Rifle, City of
Colorado	Garfield	Roaring Fork Water & Sanitation District
Colorado	Garfield	Silt, Town of
Colorado	Garfield	New Castle, Town of
Colorado	Grand	Blue Valley Metropolitan District
Colorado	Grand	Fraser
Colorado	Grand	Granby
Colorado	Grand	Winter Park
Colorado	Grand	Hot Sulphur Springs
Colorado	Grand	Grand Lake, Town of
Colorado	Grand	Kremmling, Town of
Colorado	Mesa	Grand Junction, City of
Colorado	Mesa	Palisade, Town of
Colorado	Mesa	Collbran, Town of
Colorado	Mesa	Mesa, Town of
Colorado	Mesa	Ute Water Conservancy District
Colorado	Mesa	Clifton
Colorado	Pitkin	Aspen, City of
Colorado	Pitkin	Redstone, Town of
Colorado	Pitkin	Basalt (Pitkin County Part)

Colorado	Summit	East Dillon Water District
Colorado	Summit	Silverthorne
Colorado	Summit	Breckenridge, Town of
Colorado	Summit	Dillon Public Works, Town of
Colorado	Summit	Mesa Cortina
Colorado	Summit	Dillon Valley
Colorado	Summit	Copper Mountain CMD
Colorado	Summit	Frisco, Town of
Colorado	Summit	Willow Brook Metropolitan District
Southwest	Montezuma	Cortez, City of
Southwest	La Plata	Durango, City of
Southwest	Montezuma	Montezuma Water Company
Southwest	Archuleta	Pagosa Area W&S
Rio Grande	Alamosa	City of Alamosa
Rio Grande	Rio Grande	Monte Vista, City of
South Platte	Broomfield	City and County of Broomfield
South Platte	Arapahoe	Englewood, City of
South Platte	Adams	City of Northglenn
South Platte	Adams	City of Westminster
North Platte	Jackson	Walden Public Works, Town of
Arkansas	Pueblo	Pueblo, Board of Water Works
South Platte	Larimer	Fort Collins
South Platte	Weld	Greeley
South Platte	Boulder	City of Boulder
Gunnison	Gunnison	Crested Butte, Town of
Gunnison	Gunnison	Town of Gunnison
Gunnison	Delta	City of Delta (Project 7 Water Authority)
Gunnison	Montrose	City of Montrose (Project 7 Water Authority)
Gunnison	Montrose	Menoken Water District (Project 7 Water Authority)
Gunnison	Montrose	Town of Olathe (Project 7 Water Authority)
Gunnison	Montrose	Tri-County WCD

Appendix B
Summary of IPP Categories

M&I Identified Projects and Processes

DRAFT - Data is currently being updated and verified

September 17, 2010

Basin	Providers	Project	Yield [Acft]	Estimated Cost [$]	Storage	Estimated Completion Date	
Arkansas	Colorado Springs Utilities, Fountain, Security WSD, Pueblo West MD	Southern Delivery System Phase I (with Local System Improvements)	42,400	$880,000,000	28,000	2016	
Arkansas	Colorado Springs Utilities, Fountain, Security WSD, Pueblo West MD	Southern Delivery System Phase II (with Local System Improvements)		$500,000,000	30,000	2025	
Arkansas, Metro, Col	Colorado Springs Utilities, Aurora, Vail Consortium (Eagle River W&SD, Upper Eagle W&SD, Vail Associates), the Colorado River Water Conservation District, Cyprus Climax Metals Company	Eagle River Joint-Use Project (Eagle River MOU)	30,000	TBD	20,000	TBD	
Arkansas	El Paso County Water Authority	Groundwater	2,551	$12,686,000			
Arkansas	El Paso County Water Authority	Reuse	2,480	$2,472,000			
Arkansas	Upper Arkansas Water Conservancy District	Augmentation Plan	500	$2,000,000			
Arkansas	East Twin Lakes Ditches & Waterworks Economic Development	Cache Creek Reservoir	3,000	$7,000,000	7,620		
Arkansas	Southeastern Colorado Water Conservancy District	Arkansas Valley Conduit	5,023	$328,000,000			
Arkansas	Southeastern Colorado Water Conservancy District	Preferred Storage Option Plan - Fry-Ark		$7,400,000	38,425		
Arkansas	Southeastern Colorado Water Conservancy District	Preferred Storage Option Plan - Pueblo Reservoir		$75,600,000	69,625		
Arkansas	Southeastern Colorado Water Conservancy District	Preferred Storage Option Plan - Turquoise Reservoir		$14,500,000			
Arkansas	Pueblo Board of Water Works	Water Rights Acquisition - Bessemer	7,200	$65,000,000			
Colorado	Colorado River Water Conservation District, Denver Water	Wolford Reservoir Enlargement	2,000	$1,800,000	6,500		
Colorado	Colorado River Water Conservation District, Denver Water, City of Aurora, Eagle River Water and Sanitation District, Northern Colorado Water Conservancy District, Upper Eagle Regional Water Authority	Wolcott Reservoir	25,000	$60,000,000	100,000		
Colorado	Upper Colorado River Basin Study (UPCO)	Grand County M&I	2,400	$25,000,000			
Colorado	Upper Colorado River Basin Study (UPCO)	Summit County M&I and Environmental	9,900			?	
Colorado	Dillon and Silverthorne	Old Dillon Reservoir Expansion		$7,000,000	286		
Colorado	Ute Water Conservancy District	Hunter Reservoir Enlargement	1,200	$5,000,000	1,200		
Colorado	Town of Eagle	Water Rights Acquisition	369				May increase with demand
Colorado	Town of Silt	Water Rights Acquisition	160				
Colorado	Town of Silt	Reudi Contracts	217				
Colorado	City of Aspen	Golf Course Reuse/West Aspen Reclaimed Project	540				
Colorado	Town of New Castle	Ag Transfer Water Rights Dedication Policy	3,300				Greatly exceeds total projected 2050 demand…
Gunnison	Upper Gunnison River Water Conservancy District	Plan for augmentation for non-agricultural purposes using Aspinall Unit	500				
Gunnison	Mt.Crested Butte and the Upper Gunnison River Water Conservancy District	Augmentation Storage for Mt. Crested Butte	400	$6,000,000			
Gunnison	Upper Gunnison River Water Conservancy District and Hinsdale County Commissioners	Lake San Cristobal water development	950	$600,000			
Metro	Aurora, South Metro Water Supply Authority, Denver Water	Water Infrastructure Supply Efficiency (WISE) Partnership					
Metro	Town of Castle Rock	Renewable Water Project Phase I	3,360	$25,000,000		2012	
Metro	Town of Castle Rock	Renewable Water Project Phase II	2,340	$10,000,000		2035	
Metro	City of Brighton	South Platte and Beebe Draw Well Project	6,700	unknown	2012 ?	2012	
Metro	City of Brighton	Westminster Agreement	2,000	$9,150,000	0	2010	
Metro	Aurora	Prairie Waters Project	10,000	$754,000,000			Expandable to 50,000+ AF
Metro	Centennial Water and Sanitation District	Conservation	1,764				

Basin	Providers	Project	Yield [Acft]	Estimated Cost [$]	Storage	Estimated Completion Date	
Metro	Centennial Water and Sanitation District	ECCV Pipeline Agreement	2,500				
Metro	Consolidated Mutual Water Company	Consolidated Mutual Water District Reservoir Construction					
Metro	Arvada	Ag Transfer	1,000				
Metro	Arvada	Highway 93 Lakes	500	$15,000,000	2,000		
Metro	Denver Water & Arvada	Moffat Collection System Project	18,000	$140,000,000	72,000	2016	EIS in 8th or 9th year (Arvada's Portion = 3000AF, $77M) Formerly identified yield of 6000AF
Metro	East Cherry Creek Valley, South Metro Water Supply Authority	Northern Project Pipeline	4,500	$150,000,000			
Metro	Parker Water and Sanitation District	Rueter Hess Reservoir		$104,000,000	16,200	2011	
Metro	Parker Water and Sanitation District, Castle Rock, Castle Pines North, Stonegate	Rueter Hess Reservoir Enlargement	14,810		71,920	2011	
Metro	City of Northglenn	Ag Transfer	500				
Metro	City of Northglenn	Reuse Plan	700				
Metro	City of Northglenn	New Storage Projects	1,500				
Metro	City of Thornton	Thornton Northern Project	13,500				
Metro	City of Thornton	Conservation	3,500				
Metro	City of Thornton	Reuse	2,000				
South Platte	City of Fort Collins	Halligan Reservoir Enlargement	7,000	$40,000,000	40,000		
South Platte	City of Greeley	Milton Seaman Reservoir Enlargement	10,000	$95,000,000	53,000		
South Platte	City of Greeley	Conservation	3,000				
South Platte	City of Greeley	Water Rights Acquisition	9,000				
South Platte	Erie	Reclaimed Water	5,390	$43,430,000			
South Platte	Erie City of Lafayette Left Hand Water District City of Fort Morgan City of Dacono Town of Eaton Town of Windsor City of Fort Lupton Fort Collins - Loveland Water District Central Weld County Water District Town of Evans Morgan County Quality Water Town of Severance Town of Firestone Town of Frederick	Northern Integrated Supply Project	40,000	$490,000,000	210,000	Cost updated per Reporter Herald Article 3/27/2010 (Formerly $426M)	
South Platte	Northern Colorado Water Conservancy District, Erie, Lafayette, Longmont, Louisville, Broomfield, Loveland, Greeley, Fort Lupton, Superior, Central Weld County Water District, Evans, Little Thompson Water District	Windy Gap Firming	31,575	$261,000,000	90,000		
South Platte	Aurora, Brighton, Central Colorado WCD, Colorado Division of Parks and Outdoor Recreation, Denver Botanic Gardens at Chatfield, Western Mutual Ditch Company, Castle Pines Metro District, Castle Pines North Metro District, Centennial WSD, Center of Colorado WSD, Mount Carbon Metro District, Perry Park Country Club, Roxborough WSD, South Metro Water Supply Authority, Town of Castle Rock	Chatfield Reservoir Storage Reallocation Project	8,000	$110,000,000	20,600		
South Platte	Longmont	Union Pumpback Pipeline	4,950	$18,800,000			
South Platte	Longmont	Union Reservior Enlargement	1,770	$25,000,000	12,280		
South Platte	Longmont	Conservation	3,500	$11,000,000			
South Platte	Longmont	Ag Transfer Water Rights Dedication Policy	1,700				
South Platte	Loveland	Ag Transfer Water Rights Dedication Policy	3,150				
Southwest	City of Cortez	Purchase of Additional McPhee Water	1,000				
Southwest	City of Durango	ALP Contract Purchase	3,800	$6,000,000		2012	
Southwest	City of Durango	Horse Gulch Reservoir	1,850				
Southwest	City of Durango	La Posta Pumping Station				8700 gpm to pump water straight from river to new WTP below ALP outlet	

Basin	Providers	Project	Yield [Acft]	Estimated Cost [$]	Storage	Estimated Completion Date
Southwest	City of Durango	Recreation Complex	200			In "3 Springs" area, 200 AF/yr new demand, supply is transferred ag water from land, but need storage
Southwest	City of Durango	Water for Wetland Replacement				Could be significant demand (i.e. one development requires 300 AF of additional depletions). Have some WR but may need change of use or additional junior rights.
Southwest	La Plata Archuleta Water District	Water System	2,300	$100,000,000		ALP and/or PRID water via Vallecito and joint WTP with Bayfield
Southwest	LaPlata West Water Authority	Western La Plata County Domestic Water System	2,000	$100,000,000		
Southwest	Pagosa Area Water and Sanitation District, San Juan Water Conservancy District	Dry Gulch Reservoir & Inlet Pump Station Project		$189,500,000	35,000	
Southwest	Pagosa Area Water and Sanitation District, San Juan Water Conservancy District	Stevens Reservoir Enlargement	1,151			Nearly complete - only final work on wetlands remains
Southwest	Dolores Water Conservancy District	WETPACK Lawn and Garden M&I Water	4,500			
Southwest	Dolores Water Conservancy District	Totten Reservoir	500		3,300	Existing reservoir acquired by DWCD
Southwest	Ute Mountain Ute Tribe	Unspecified M&I Project	300			
Southwest	Florida Water Conservancy District (FWCD)	Multipurpose Project (M&I and Ag) - New Bureau Contract, Augmentation Rights, Ditch Improvements.	2,614			
Yampa	Upper Yampa Water Conservancy District	Stagecoach Reservoir Enlargement	1,000	$3,500,000	3,000	December 31, 2010
Yampa	Upper Yampa Water Conservancy District	Morrision Creek Reservoir Project	5,000	$20,000,000	5,000	12/31/2020
Yampa	Colorado River Water Conservation District, Town of Craig	Elkhead Reservoir Enlargement Project	4,300	$21,500,000	11,750	
		Total	**388,814**	**$ 4,741,938,000**	**947,706**	
Completed Projects						
Colorado	Ute Water Conservancy District	Jerry Creek Reservoir Enlargement	1,400	$2,800,000		
South Platte	City of Loveland	Green Ridge Glade Enlargement	4,900	$20,000,000	6,835	completed 2004
South Platte	City of Golden, Public Works	Guanella Reservoirs	2,112			
South Platte	Denver Water	IRP Non-Potable Recycling	17,000			Already in existing firm yield
South Platte	Denver Water	IRP System Refinement / Modifications	13,000			Already in existing firm yield
South Platte	Denver Water	Conservation	29,000			This should be subtracted from demand and a reduction to the gap
Southwest	Pagosa Area Water and Sanitation District	Dutton Ditch and Pipeline				
Gunnison	Upper Gunnison River Water Conservancy District	Reservoirs on Cochetopa Crrek	500			
Yampa	Steamboat Springs	Elk River Project	3,000			

Appendix C
Summary of Gap Analysis Methodology

Appendix C – Summary of Gap Analysis Methodology
August 12, 2010

Arkansas Basin

- Included 2000 and 2030 demands calculated from SWSI 1 study data.
- 2008 demand – from "Basin_Data" tab of file "Master_WaterUse_Database_FINAL_w_Passive_Conservation.xlsx" (June 10, 2010 version)
- 2030 demands – Assume high passive conservation.
- 2050 low, medium, high demands – same source as above. Assume high passive conservation.
- Several split counties:
    - Cheyenne County – 38% of population/demand in Arkansas Basin.
    - Elbert County – 31% of population/demand in Arkansas Basin.
    - Lincoln County – 81% of population/demand in Arkansas Basin.
    - Teller County – 51% of population/demand in Arkansas Basin.
- 2050 low, medium, high water needs = incremental increase in water demand = [2050 low, medium, high M&I demands minus 2008 M&I demand] plus [2050 low, medium, high SSI demand minus 2008 SSI demand].
- SSI demands – Sourced from Table 4-12 in July 2010 report *State of Colorado 2050 Municipal & Industrial Water Use Projections.* Added 2,000 AF for Climax Mine in Lake County based on 2008 Arkansas Roundtable update (Arkansas Basin Consumptive Use Water Needs Assessment: 2030. July 2008 Update).
- Provider gaps – Sourced from SWSI 1 report, Section 6, Table 6-4; 2008 Arkansas Roundtable update report; or June 2010 Roundtable Update presentation by Applegate. All values are for year 2030.
    - Baca County – zero gap in Table 6-4.
    - Bent County – Revised gap is zero based on Table 1 in 2008 Arkansas Roundtable update.
    - Chaffee County – Revised gap is 700 AF based on page 4 of 2008 Arkansas Roundtable update.
    - Cheyenne County – zero gap in Table 6-4.
    - Crowley County – Revised gap is zero based on Table 1 in 2008 Arkansas Roundtable update.
    - Custer County – Includes 150 AF for Round Mountain Water District (Towns of Westcliffe and Silvercliff) and 100 AF for unincorporated areas. Based on June 2010 update presentation.
    - El Paso County – Revised gap is 22,600 AF based on page 3 of 2008 Arkansas Roundtable update. Gap is specifically associated with unincorporated areas and Town of Monument.
    - Elbert County – Revised gap is zero based on page 4 of 2008 Arkansas Roundtable update (also Table 1).
    - Fremont County – Revised gap is 1,200 AF based on June 2010 Roundtable update presentation.
    - Huerfano County – zero gap in Table 6-4.
    - Kiowa County – zero gap in Table 6-4.

  - Lake County – Revised gap is 1,950 AF based on June 2010 Roundtable update presentation
  - Las Animas – Table 6-4 has 500 AF for unincorporated areas, also in spreadsheet.
  - Lincoln County – zero gap in Table 6-4.
  - Otero County – Revised gap is range 500-652 AF based on Table 1 in 2008 Arkansas Roundtable update.
  - Prowers County – Revised gap is 100 AF based on Table 1 in 2008 Arkansas Roundtable update.
  - Pueblo County – zero gap in Table 6-4. Pueblo BOWW specified 9,500 AF gap in CWCB interviews, but this was not factored into calculations because IPPs exceed 2050 demands, except for high growth scenario.
  - Teller County – Table 6-4 shows 600 AF gap for Victor.
- IPPs (low, medium, high). In general, estimated as [SWSI 2030 demand] minus [SWSI 2000 demand] minus [identified gaps from SWSI 1 or 2008 Roundtable update], unless otherwise noted.
  - Lake County – Eagle River Joint Use Project includes up to 3,000 AF of storage for Climax Mine, so assume IPPs equal to 2,000 AF SSI demand. Add 250 AF for one-quarter share of Upper Arkansas Water Conservancy District augmentation plan (1,000 AF).
  - El Paso County – From CWCB interview updates, CSU IPPs = 44,016 AF, including CSU components of Southern Delivery System (36,960 AF) and Eagle River Joint Use Project (7,056 AF); total reduced by 9,448 AF surplus to 34,568 AF. Additional IPPs include 5,440 AF for other SDS participants (42,400 AF total SDS yield minus 36,960 AF CSU share); 2,551 AF for El Paso County Water Authority groundwater; and 2,480 AF for El Paso County Water Authority reuse.
  - Pueblo County – From CWCB interview updates, Pueblo BOWW IPPs total 36,738 AF, including reuse project, acquisition of Bessemer Ditch shares, and enlargement of Clear Creek Reservoir (located in Chaffee County). Total exceeds 2050 low and medium water needs. Additional IPPs (1,306 AF) from AVC.
  - Bent County – AVC allocation of 513 AF exceeds 2050 water needs, so IPPs set equal to 2050 water needs.
  - Crowley County – AVC allocation of 719 AF exceeds 2050 water needs, so IPPs set equal to 2050 water needs.
  - Otero County – AVC allocation of 2,214 AF exceeds 2050 water needs, so IPPs set equal to 2050 water needs.
  - Prowers County – AVC allocation of 1,292 AF exceeds 2050 water needs, IPPs reduced by 100 AF of unincorporated areas gaps.
  - Baca County – 2030 demand is less than 2000, no identified gaps in SWSI; assume zero gap.
  - Cheyenne County - 2030 demand is less than 2000, no identified gaps in SWSI; assume zero gap.
  - Kiowa County – IPPs equal to AVC allocation of 90 AF, except low IPPs, set equal to 2050 low needs (78 AF).
- Draft M&I IPPs list (dated March 31, 2010) includes significant yield for Arkansas Basin.
  - Part of SDS and Eagle River Joint Use Project captured in El Paso IPPs described above.

  - Up to 3,000 AF of storage in Eagle River Joint Use Project available for Climax Mine; captured in Lake County IPPs as described above.
  - Pueblo acquisition of ag rights and reuse project captured in IPPs described above.
  - AVC shown as 10,000 AF, but CDM analysis for STAG report based on lower annual yield (5,023 AF; excludes Parkdale, Riverside, Joseph, and O'Neal). The 5,023 AF is allocated to counties (Pueblo, Bent, Crowley, Otero, Prowers, Kiowa) as IPPs. Reserve account (158 AF) and NPANIW (954 AF) allocated to counties as additional IPPs based on same percentage distribution as the 5,023 AF primary AVC yield.
- Information/real gap calculated as [2050 water needs (low, medium, high)] – [IPP (low, medium, high)].
  - Bent, Crowley, and Otero Counties – IPPs exceed 2050 needs, no gaps.
  - Baca, Cheyenne Counties – No gaps in SWSI 1, assume no gaps for current analyses.

Colorado Basin

- 2008 demand – from "Basin_Data" tab of file "Master_WaterUse_Database_FINAL_w_Passive_Conservation.xlsx" (June 10, 2010 version)
- 2050 low, medium, high demands – same source as above. Assume high passive conservation.
- Split county
  - Mesa County – 90% of population/demand in Colorado Basin.
- 2008 and 2050 low, medium, high SSI demand – Table 4-12 of July 2010 *State of Colorado 2050 Municipal & Industrial Water Use Projections* report.
  - Eagle, Grand, Pitkin, Summit – snowmaking only.
  - Garfield, Mesa – Mostly energy development, minor snowmaking. Assume all Mesa County SSI demand in Colorado Basin. Current energy development numbers higher than 2050 low growth scenario. Assume zero additional SSI need for this scenario, but current energy development water not used in future is not reallocated to other uses.
- Interviewed provider gaps – Numerous water providers interviewed, summarized by county.
  - Eagle County – None
  - Garfield County – Town of Silt (190 AF).
  - Grand County – Blue Valley MD (28 AF); Fraser (426 AF); Winter Park (19 AF); Hot Sulphur Springs (160 AF); Grand Lake (228 AF); Kremmling (535 AF). Total = 1,396 AF.
  - Mesa County – Ute WCD (6,000 AF); Clifton (4,140 AF).
  - Pitkin County – Aspen (2,818 AF, after 270 AF conservation excluded from IPPs).
  - Summit County – East Dillon WD (388 AF); Dillon Public Works (513 AF); Frisco (1,138 AF); Willow Brook MD (9 AF). Total = 2,048 AF.
- IPPs (low, medium, high) – Cross-referenced CWCB interview updates with Draft M&I IPPs list. Also identified county IPPs in Table 6-7 of SWSI 1 report for year 2030.

  - Eagle County – Specified IPPs for Town of Eagle total 1,846 AF. SWSI 2030 IPPs = 12,500 AF. Estimated additional IPPs as 2050 firm yield minus 2035 demand for CWCB interviewed providers, net gain = 7,781 AF. Assume total SWSI and/or net gains capture Town of Eagle IPPs. **Therefore, total IPPs = 12,500 AF + 7,781 AF = 20,281 AF. Exceeds all levels of 2050 water needs, so IPPs set equal to 2050 water needs.** Eagle River Joint Use Project also includes 10,000 AF dry year firm yield for Eagle County (Jacob Bornstein, personal communication 07/30/2010).
  - Garfield County – CWCB interviews include: Town of Silt (377 AF); also shows Town of New Castle (3,300 AF). Assumed to be captured by SWSI (11,700 AF) and/or 2035 to 2050 net gain (4,928 AF). **Total IPPs = 16,628 AF.**
  - Grand County – CWCB interviews include 172 AF IPPs for Winter Park. Assumed to be captured by SWSI (3,200 AF). No net gain from 2035-2050. Estimated total IPPs = 3,200 AF. However, resulting information/real gap for 2050 low is less than 1,396 AF specified provider gap; low IPP adjusted downward such that low gap is matched. **Final IPPs = 2,671AF (low); 3,200 AF (med, high).**
  - Mesa County – CWCB interviews specify 1,200 AF for Ute WCD. Assumed to be captured by SWSI (14,800 AF) and/or 2035 to 2050 net gain (15,495 AF). Estimated total IPPs = 30,295 AF. Exceeds all levels of 2050 water needs. However, provider specified gap of 10,140 AF, so all gaps set to match. IPPs adjusted downward such that gap + IPPs = 2050 needs. **Final IPPs = 3,943 AF (low); 7,389 AF (med); 14,180 AF (high).**
  - Pitkin County – CWCB interviews specify 810 AF for City of Aspen. Assumed to be captured by SWSI (8,500 AF). No net gain from 2035-2050. Estimated IPPs of 8,500 AF exceed all but 2050 high water needs. However, 2,818 AF provider gap, so all gaps set to match. IPPs adjusted downward such that gap + IPPs = 2050 needs. **Final IPPs = 1,927 AF (low); 3,834 AF (med); 6,967 AF (high).**
  - Summit County – CWCB interviews have no quantified IPPs. Estimated IPPs = SWSI (8,200 AF) + net gain 2035 to 2050 (985 AF) = 9,185 AF. Exceeds 2050 low water needs, but provider specified gap of 2,048 AF. Low gap set to 2,048 AF, and low IPPs adjusted downward. **Final IPPs = 6,948 AF (low); 9,185 AF (med, high).**
- Information/real gaps (low, medium, high)
  - Eagle County – IPPs exceed all 2050 water needs, no gaps.
  - Garfield County – Gaps = 2050 water needs minus IPPs.
  - Grand County – Low gap = 1,396 AF (provider specified). Medium and high gaps = 2050 water needs minus IPPs (assumed to capture provider specified).
  - Mesa County – Provider specified gap (10,140 AF) used for low, medium, high.
  - Pitkin County – Provider specified gap (2,818 AF) used for low, medium, high.
  - Summit County – Low gap = 2,048 AF (provider specified). Medium and high gaps = 2050 water needs minus IPPs (assumed to capture provider specified).

Gunnison Basin

- 2008 demand – from "Basin_Data" tab of file "Master_WaterUse_Database_FINAL_w_Passive_Conservation.xlsx" (June 10, 2010 version)
- 2050 low, medium, high demands – same source as above. Assume high passive conservation.
- Split counties
    - Mesa County – 10% of population/demand in Gunnison Basin.
    - Montrose County – 90% of population/demand in Gunnison Basin.
- 2008 and 2050 low, medium, high SSI demand – From Table 4-12 of July 2010 *State of Colorado 2050 Municipal & Industrial Water Use Projections* report.
    - Mesa County (split between Gunnison and Colorado) – assume all SSI demand in CO basin.
    - Montrose County (split between Gunnison and SW) – assume all SSI demand (thermoelectric) in Southwest basin.
- 2050 low, medium, high water needs = incremental increase in water demand = [2050 low, medium, high M&I demands minus 2008 M&I demand] plus [2050 low, medium, high SSI demand minus 2008 SSI demand].
- Interviewed water provider gap – based on CWCB interviews, Gunnison Roundtable Report, and other sources.
    - Delta County (1,105 AF) – Includes Coalby Domestic Water Company (22 AF); Town of Cedaredge (417 AF); Town of Orchard City (263 AF); Upper Surface Creek Domestic Water Users Association (403 AF). Gap is based on projected shortfall under drought conditions in year 2035.
- SWSI 1 provider gaps – from Section 6, Table 6-25, of 2004 SWSI final report.
    - Delta County – 300 AF for Paonia.
    - Gunnison County – 300 AF for Mt. Crested Butte WSD, assumed now to be eliminated by 400 AF of IPPs by Mt. Crested Butte WSD and UGRWCD. Table 6-25 in SWSI Phase 1 report shows 200 AF gap for Crested Butte Mountain Resort, assumed to now be captured in 2050 SSI demands for snowmaking.
    - Hinsdale County – 95 AF for Lake City, assumed now to be eliminated by 950 AF IPPs by Hinsdale County Commissioners and UGRWCD.
    - Ouray County – 150 AF for Town of Ouray, 100 AF for Town of Ridgway.
- Unincorporated areas low, medium, high gaps – assumed to be 5% of 2050 incremental demands (M&I only).
- Information/real gap (low, medium, high)
    - Delta, Ouray, Montrose, and Mesa Counties – calculated as [interviewed water provider gap] + [SWSI 1 provider gaps] + [unincorporated areas gaps].
    - Gunnison and Hinsdale Counties – calculated as 2050 water needs minus IPPs.
- IPP yields (low, medium, high)
    - Delta, Ouray, Montrose, and Mesa Counties – calculated as [2050 incremental demands] minus [information/real gaps]. Project 7 Water Authority assumed to meet most needs in Delta, Ouray, Montrose. Most Mesa County needs probably met by Grand Junction-area providers.

  - Gunnison and Hinsdale County IPPs from draft list, below. After adding surplus Lake San Cristobal water to Gunnison County, low IPPs exceeded 2050 low water needs; low IPPs reset to 2050 low water needs.
- Draft M&I IPPs list includes the following:
  - Upper Gunnison River Water Conservancy District (UGRWCD) – 500 AF, play for augmentation for non-agricultural purposes using Aspinall Unit. Assigned to Gunnison County IPPs.
  - UGRWCD – 500 AF, reservoirs on Cochetopa Creek . Assigned to Gunnison County IPPs.
  - Mt. Crested Butte and UGRWCD – 400 AF, augmentation storage for Mt. Crested Butte. Assigned to Gunnison County IPPs.
  - UGRWCD and Hinsdale County Commissioners – 950 AF, Lake San Cristobal water development. Assigned to Hinsdale County IPPs. Yield above Hinsdale County 2050 needs applied to Gunnison County.

Metro Basin

- 2008 demand – from "Basin_Data" tab of file "Master_WaterUse_Database_FINAL_w_Passive_Conservation.xlsx" (June 10, 2010 version)
- 2050 low, medium, high demands – same source as above. Assume high passive conservation.
- Split county:
  - Elbert County – 69% of population/demand in Metro Basin.
- 2008 and 2050 low, medium, high SSI demand – From Table 4-12 of July 2010 *State of Colorado 2050 Municipal & Industrial Water Use Projections* report.
  - Adams County – thermoelectric.
  - Denver County – thermoelectric.
  - Jefferson County – large industry.
- Interviewed provider gaps
  - Adams County – CWCB interview updates show 1,300 AF gap for Brighton.
  - Broomfield County – CWCB interview updates show 5,600 AF, but it appears that WGFP yield cancels this deficit. Confirmed that Broomfield has no gap (6/24 meeting with CWCB).
  - Denver County – CWCB interview updates show Denver Water as having 31,000 AF from unidentified long-term projects, considered here to be provider gap.
  - Douglas County – CWCB interview updates show 3,800 AF gap for Castle Rock after implementation of IPPs.
- IPPs (low, medium, high) – Cross-referenced CWCB interview updates and Draft M&I IPPs list.
  - Adams County – CWCB interview updates include the following: Aurora (40% of 35,816 AF); Westminster (14,000 AF); Brighton (10,210 AF); Thornton (21,290 AF IPPs – 3,775 AF surplus); Northglenn (2,700 AF); plus a proportional share of Denver Water IPPs (10% of county population in DW service area); plus a share of Chatfield Reallocation Project (588 AF). Conservation excluded from IPPs: Thornton (3,500 AF); Northglenn (600 AF). Aggregate IPPs exceed all levels of

total (M&I + SSI) 2050 water needs, but provider specified gaps (Brighton, Denver Water) reduce IPPs.
    - Broomfield County – CWCB interview updates include 10,277 AF of IPPs, with 5,600 AF from WGFP and 4,677 AF being additional yield from existing portfolio. Total exceeds all levels of 2050 total new water needs, so IPPs set equal to water needs.
    - Denver County – CWCB interview updates indicate 82,000 AF of long-term IPPs. Receives proportional share of IPPs (split with Adams, Arapahoe, Douglas, and Jefferson Counties, based on population in DW combined service area). IPPs exceed 2050 low and medium water needs, but provider-specified gaps reduce IPPs.
    - Jefferson County – IPPs include proportional share from Denver Water system (54% of population in DW service area) plus 11,930 AF Arvada IPPs minus 3,310 AF Arvada surplus. Add share of Chatfield Reallocation Project (16 AF). Low IPPs exceed 2050 low water needs, but share of Denver Water gap ranges from 6,200 AF to 6,600 AF. Low and medium info/real gaps set equal to Denver Water gap shares. High gap exceeds 6,600 AF, therefore assumed to be inclusive. Low and medium IPPs reduced to account for Denver Water gap.
    - Arapahoe County – IPPs include: ECCV (4,500 AF); Aurora (58% of 35,816 AF); Englewood (6,173 AF); Centennial WSD (4,500 AF IPPs – 3,192 AF surplus); plus proportional share of Denver Water IPPs (35% of county population in DW service area); plus share of Chatfield Reallocation Project (3,039 AF). IPPs exclude conservation: Centennial WSD (1,764 AF). Low and medium IPPs exceed 2050 water needs, but reduced by share of Denver Water gap. High gap assumed to include Denver Water.
    - Douglas County – IPPs include proportional share from Denver Water system (5% of population in DW service area); Aurora (2% of 35,816 AF); Castle Rock (7,750 AF); plus share of Chatfield Reallocation Project (3,051 AF). IPPs exclude conservation: Castle Rock (1,025 AF).
    - Elbert County – No known IPPs.
- Information/real gaps (low, medium, high) – generally calculated as 2050 water needs minus IPPs. Denver Water 31,000 AF gap associated with unidentified long-term project proportionally distributed to Adams, Denver, Jefferson, Arapahoe, and Douglas Counties.

North Platte Basin

- 2008 demand – from "Basin_Data" tab of file "Master_WaterUse_Database_FINAL_w_Passive_Conservation.xlsx" (June 10, 2010 version)
- 2050 low, medium, high demands – same source as above. Assume high passive conservation.
- 2008 and 2050 low, medium, high SSI demand – None shown in Section 4 of July 2010 *State of Colorado 2050 Municipal & Industrial Water Use Projections* report.
- Interviewed water provider gaps – Town of Walden Public Works interviewed by CWCB in March 2010, no anticipated gaps.

- IPPs (low, medium, high) – None in SWSI 1 report or draft M&I IPPs list. IPPs set equal to 2050 incremental water needs.
- Information/real gaps (low, medium, high) – IPPs equal 2050 water needs, so no gaps.
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Rio Grande Basin

- 2008 demand – from "Basin_Data" tab of file "Master_WaterUse_Database_FINAL_w_Passive_Conservation.xlsx" (June 10, 2010 version)
- 2050 low, medium, high demands – same source as above. Assume high passive conservation.
- 2050 low, medium, high SSI demands – From Table 4-12 of July 2010 *State of Colorado 2050 Municipal & Industrial Water Use Projections* report (Alamosa County only)
- 2050 low, medium, high water needs = incremental increase in water demand = [2050 low, medium, high M&I demands minus 2008 M&I demand] plus [2050 low, medium, high SSI demand minus 2008 SSI demand].
- IPP yield (low, medium, high)
    - Alamosa County – IPPs set equal to 2050 M&I water needs, assume IPPs do not cover SSI demands.
    - Conejos County – 500 AF, from SWSI Table 6-31 Estimated Demand met by Identified Projects and Processes and Additional Conservation. However, SWSI also indicated water available beyond 2030 to meet future needs, so IPPs set equal to 2050 total new water needs.
    - Costilla County – 0 AF, from SWSI Table 6-31.
    - Mineral County – 100 AF, from SWSI Table 6-31. Exceeds 2050 low water needs. However, SWSI also indicated water available beyond 2030 to meet future needs, so all IPPs set equal to 2050 total new water needs.
    - Rio Grande County – 900 AF, from SWSI Table 6-31.
    - Saguache County – 800 AF, from SWSI Table 6-31.
- Interviewed water provider gap = 0 AF for all counties
    - No new survey data.
- Information/real gap (low, medium, high) = [2050 water needs] minus [IPP yield].
    - Alamosa County – information/real gap equal to 2050 SSI demands.
    - SWSI Table 6-32 shows ±50 AF gap for Costilla County WSD. SWSI Table 6-33 shows 100 AF gap for Costilla County, preceded by statement "Costilla County was the only area with an identified gap due to six wells that are located in an unconfined aquifer." Calculated information/real gap for Costilla County exceeds 100 AF, so assume this includes value from SWSI tables.
- Draft M&I IPPs list includes no information for Rio Grande Basin.

South Platte Basin

- 2008 demand – from "Basin_Data" tab of file "Master_WaterUse_Database_FINAL_w_Passive_Conservation.xlsx" (June 10, 2010 version)

- 2050 low, medium, high demands – same source as above. Assume high passive conservation.
- Several split counties
    - Cheyenne County – 62% of population/demand in SP Basin.
    - Lincoln County – 19% of population/demand in SP Basin.
    - Teller County – 49% of population/demand in SP Basin.
- 2008 and 2050 low, medium, high SSI demand – From Table 4-12 of *State of Colorado 2050 Municipal & Industrial Water Use Projections* report.
    - Boulder County – snowmaking, thermoelectric.
    - Clear Creek County – snowmaking (values based on new data collected by CDM for Upper Mountain Counties study).
    - Larimer County – thermoelectric.
    - Morgan County – large industry, thermoelectric.
    - Weld County – large industry, thermoelectric.
- Interviewed provider gaps
    - Larimer County – CWCB interview updates indicate 4,350 AF gap for Loveland, calculated as difference between 30,000 AF demand projected at buildout and estimated 2050 firm yield.
    - No others identified for water providers outside of Metro area.
- IPPs (low, medium, high) – Cross-referenced CWCB interviews and Draft M&I IPPs list. Unless documented otherwise, lists matched. Distributed NISP (40,000 AF) and WGFP (31,575 AF) to counties based on participant location.
    - Boulder County – IPPs include: Boulder (9,670 AF, calculated as 2050 firm yield minus 2008 demands); Longmont (17,420); Erie (assume 50% of 5,390 AF reclaimed water, from Draft M&I IPPs list); NISP firm yield (50% of Erie = 3,250 AF; 75% of LHWD = 3,675 AF; Lafayette = 1,800 AF); WGFP yield = 11,900 AF (includes Lafayette, Longmont, Louisville, Superior, 50% of Erie, 50% of PRPA). IPPs exclude conservation: Longmont (3,500 AF). Aggregate IPPs exceed all levels of 2050 water needs.
    - Larimer County –IPPs include: Loveland (8,000 AF); Fort Collins (15,767 AF, calculated as 2050 firm yield minus 2008 demands, and including 7,000 AF Halligan Reservoir expansion); NISP firm yield (FCLWD = 3,000 AF; 50% of Windsor = 1,650 AF); WGFP yield = 7,775 AF (includes Little Thompson WD, Loveland, 50% of PRPA).
    - Weld County – From CWCB interviews, IPPs include 22,000 AF for Greeley. Add NISP firm yield (CWCWD = 8,400 AF; Eaton = 1,300 AF; 50% of Erie = 3,250 AF; Evans = 1,600 AF; Fort Lupton = 3,000 AF; 25% of LHWD = 1,225 AF; Severance = 1,300 AF; 50% of Windsor = 1,650 AF). Add Erie reclaimed water (assume 50% of 5,390 AF). Add WGFP yield = 6,300 AF (includes CWCWD, Evans, Fort Lupton, Greeley, 50% of Erie). Add share of Chatfield Reallocation (1,764 AF).
    - Clear Creek, Gilpin, Park, Teller Counties (Upper Mountain region) – IPPs equal 90% of 2050 water needs, based on SWSI Phase 1 estimates.
        - Park County includes share of Chatfield Reallocation for Center of Colorado Water Conservancy District (42 AF).
    - Logan, Morgan, Sedgwick, Washington Counties (Lower Platte region) – IPPs equal 50% of 2050 water needs, based on SWSI 1 estimates.

        - Morgan County – IPPs include NISP firm yield (Fort Morgan = 3,600 AF; MCQWD = 1,300 AF)
    - Cheyenne, Kit Carson, Lincoln, Phillips, Yuma Counties (High Plains region) – SWSI assumed high plains aquifer meets all future water needs.
- Information/real gaps (low, medium, high) – Calculated as 2050 water needs minus IPPs.

Southwest Basin (San Juan/Dolores)

- 2008 demand – from "Basin_Data" tab of file "Master_WaterUse_Database_FINAL_w_Passive_Conservation.xlsx" (June 10, 2010 version)
- 2050 low, medium, high demands – same source as above. Assume high passive conservation.
- Split county
    - Montrose County – 10% of population/demand in Southwest Basin.
- 2008 and 2050 low, medium, high SSI demand – From Table 4-12 in July 2010 *State of Colorado 2050 Municipal & Industrial Water Use Projections* report.
    - La Plata County, San Miguel County – snowmaking.
    - Montrose County – thermoelectric.
- Interviewed water provider gaps – None in CWCB interview updates.
    - Archuleta, Dolores, La Plata, and Montezuma Counties – included unincorporated areas gap equal to 5% of 2050 M&I water needs.
- IPPs (low, medium, high) – cross-referenced CWCB interviews and draft M&I IPPs list.
    - Archuleta County – From CWCB interviews, IPPs include 11,674 AF for Pagosa Area W&S. IPPs exceed all levels of 2050 water needs, but reduced by unincorporated areas gaps.
    - Dolores County – Draft M&I IPPs list includes two projects for Dolores WCD (4,500 AF and 500 AF), exceeding 2050 needs. IPPs reduced by unincorporated areas gaps.
    - La Plata County – From CWCB intereviews, IPPs include 5,881 AF for Durango, consistent with 5,900 AF in Table 6-19 of SWSI 1 report. Draft M&I IPPs list includes additional: La Plata Archuleta WD (2,300 AF); La Plata West Water Authority (2,000 AF); Florida WCD (2,614 AF); Ute Mountain Ute Tribe (300 AF, may be split with Montezuma County). Collective IPPs exceed all levels of 2050 water needs, but IPPs reduced by unincorporated areas gaps.
    - Montezuma County – From CWCB interviews, IPPs include 2,977 AF for Cortez, 9,456 AF for Montezuma Water Company. Total IPPs (12,433 AF) exceed 2050 water needs, but reduced by unincorporated areas gaps.
    - Montrose County, San Miguel County – No CWCB interview updates. IPPs from Table 6-19 in SWSI 1 report.
    - San Juan County – No gap in SWSI 1. Per 6/24 meeting with CWCB, assume no gap, IPPs = 2050 water needs.
- Information/real gap (low, medium, high) – calculated as 2050 water needs minus IPPs
    - Archuleta County, Dolores County, La Plata County, Montezuma County – gaps for unincorporated areas.
    - Montrose County, San Miguel County – have gaps.

- San Juan County – no gaps.

Yampa/White Basin

- 2008 demand – from "Basin_Data" tab of file "Master_WaterUse_Database_FINAL_w_Passive_Conservation.xlsx" (June 10, 2010 version)
- 2050 low, medium, high demands – same source as above. Assume high passive conservation.
- 2008 and 2050 low, medium, high SSI demand – From Table 4-12 of July 2010 *State of Colorado 2050 Municipal & Industrial Water Use Projections* report.
  - Moffat County – energy development, large industry, thermoelectric.
  - Rio Blanco County – energy development.
  - Routt County – energy development, large industry, snowmaking, thermoelectric.
- Interviewed provider gaps – none in CWCB updates.
- IPPs (low, medium, high) – Cross-referenced CWCB interview updates and Draft M&I IPPs list.
  - Moffat County – IPPs include 4,470 AF for City of Craig Public Works (4,400 AF out of Elkhead Reservoir). Assume IPPs meet all 2050 M&I needs, gap for all 2050 SSI needs.
  - Rio Blanco County – CWCB interviewed Town of Rangeley, no IPPs shown. 600 AF from SWSI 1 Table 6-41, for existing supplies and water rights from White River and tributaries.
  - Routt County – IPPs include: Steamboat Springs and Mt. Werner District (4,065 AF, calculated as 2050 medium demand minus 2008 demand, per 6/24 meeting with CWCB); Upper Yampa River WCD (5,000 AF Morrison Creek Reservoir Project); Stagecoach Reservoir expansion (1,000 AF). Per 6/24 meeting with CWCB, low and medium IPPs set equal to 2050 low and medium SSI demands plus 1,000 AF from Stagecoach applied to SSI need. High IPPs equal to sum of specified projects, with reduced amount from Stagecoach applied toward SSI.
- Information/real gap (low, medium, high) – Calculated as 2050 water needs minus IPPs.