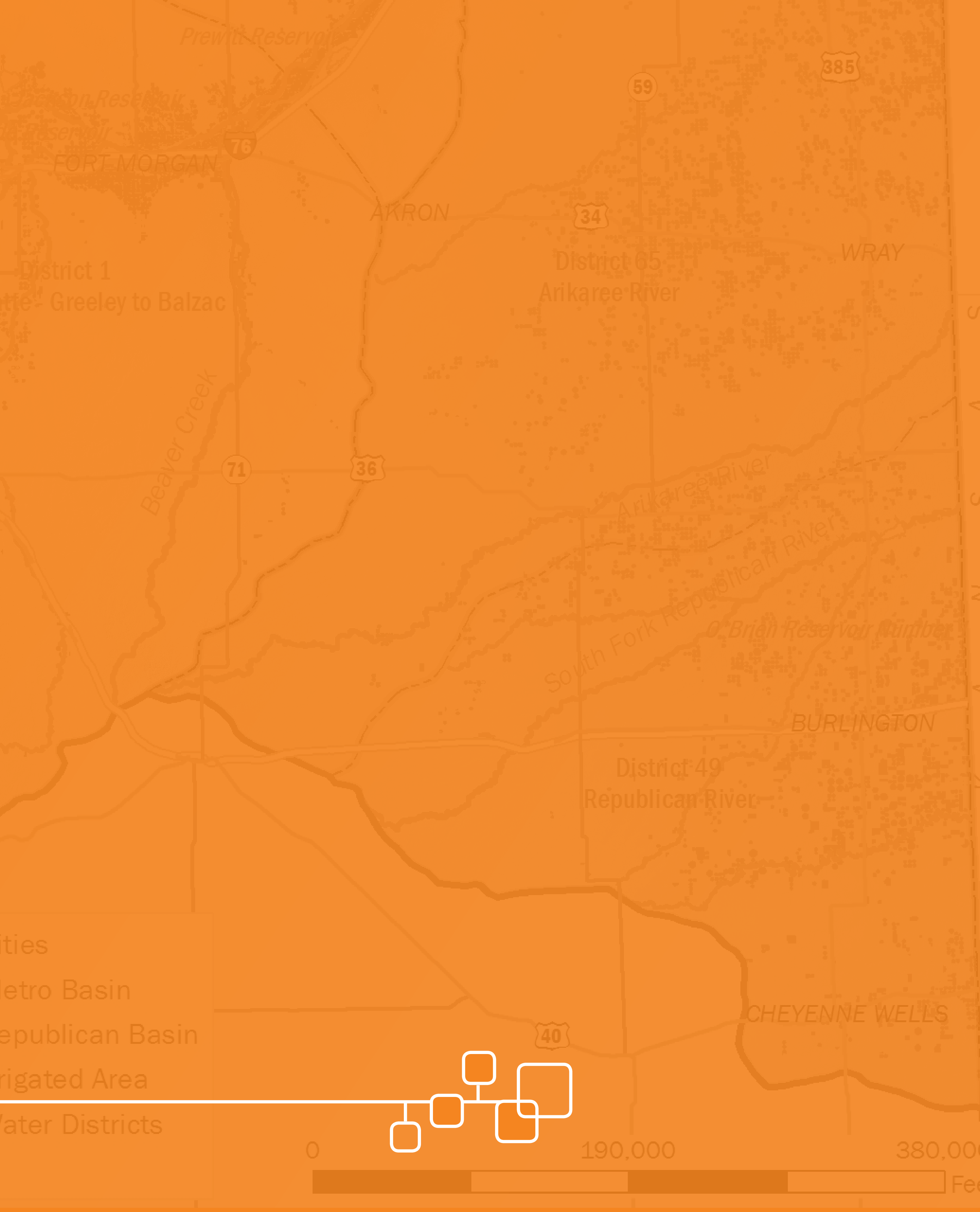
The San Juan River, Dolores River, and San Miguel River Basins are located in the southwest corner of Colorado and cover an area of approximately 10,169 square miles. The Upper San Juan River and its tributaries flow through two Native American reservations in the southern portion of the basin—the Ute Mountain Ute Reservation and the Southern Ute Indian Reservation. The Southwest Basin is a series of nine sub-basins, eight of which flow out of state before they join the San Juan River in New Mexico or the Colorado River in Utah. The Colorado River Compact, the Colorado Ute Indian Water Rights Settlement, and several Bureau of Reclamation storage projects have shaped the water history of the Southwest Basin.

SOUTHWEST


Prewitt Reservoir
FORT MORGAN
AKRON
WRAY
District 1
Greeley to Balzac
District 65
Arikaree River
Beaver Creek
Arikaree River
South Fork Republican River
O'Brien Reservoir Number
BURLINGTON
District 49
Republican River
CHEYENNE WELLS
385
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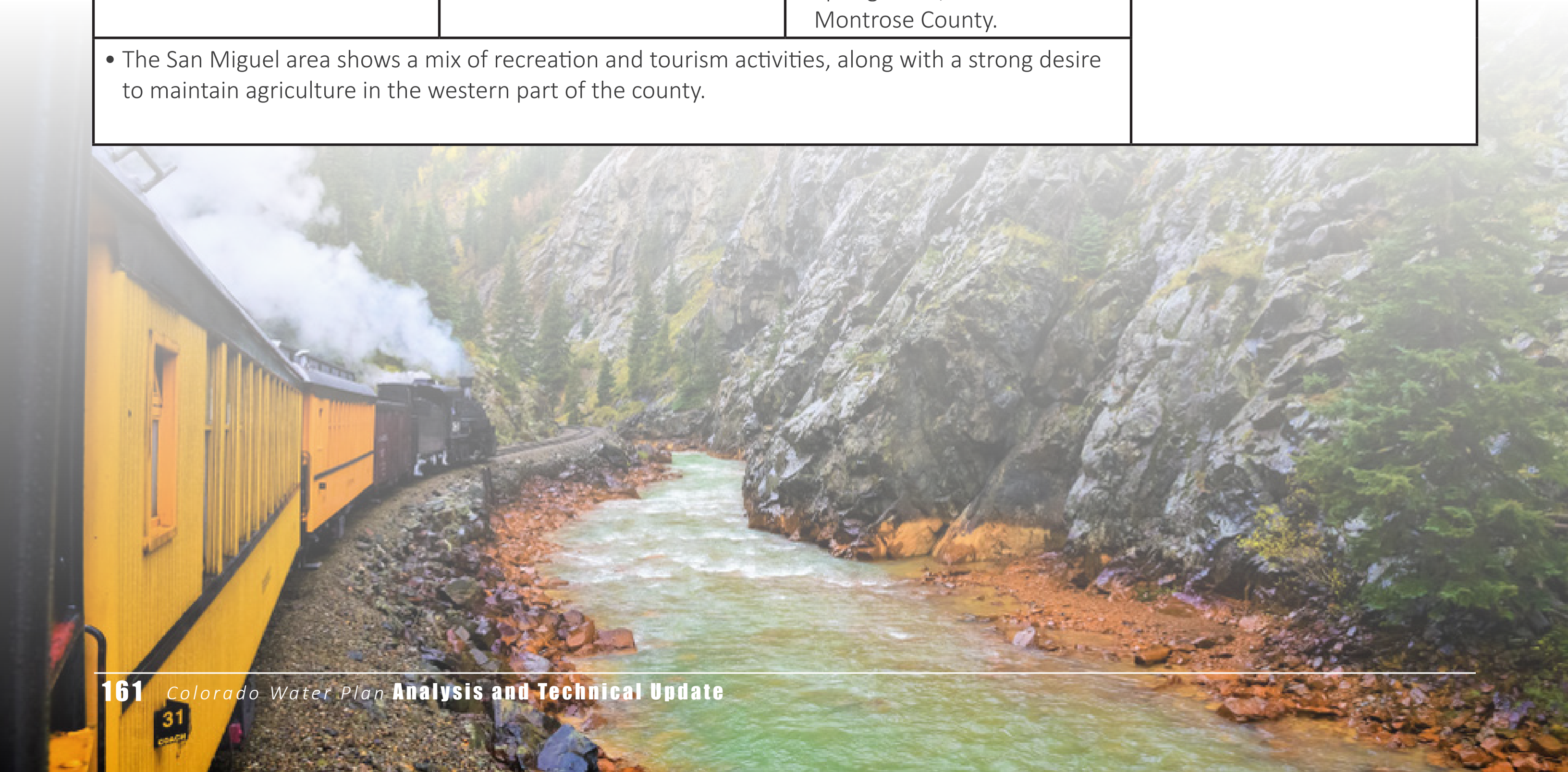
4.9 SOUTHWEST BASIN RESULTS

4.9.1 BASIN CHALLENGES

The Southwest Basin will face several key issues and challenges to balance valued agricultural uses with instream water to support recreational and environmental values, all of which combine to support the economic and aesthetic values that drive settlement and commerce in the Southwest Basin. In addition, water quality is a significant concern in the Southwest Basin. These issues were described in the Colorado Water Plan and are summarized below.

Table 4.9.1 Key Future Water Management Issues in the Southwest Basin

Agriculture	Environment and Recreation	Municipal and Industrial	Compacts and Administration
• The Cortez and Dove Creek area remains strongly agricultural, supplemented by energy production. It is also seeing growth through an increase in retirees moving to the area.	• US Forest Service and Bureau of Land Management have worked with the CWCB Instream Flow Program to secure substantial flow protection at high elevations throughout the basin. As stream-flow protections have increasingly focused on lower elevation streams that are below stored water and communities, instream flow appropriations have become more complex and challenging.	• The Pagosa Springs-Bayfield-Durango corridor is rapidly growing while experiencing areas of localized water shortages. This area is transitioning from oil and gas, mining, and agricultural use to tourism and recreation use, and to a retirement or second-home area. • Another challenge is the development of sufficient infrastructure to deliver M&I water where it is needed. There is also discussion regarding new storage to meet long-term supply requirements in the Pagosa Springs area, as well as in Montrose County.	• In addition to the three compacts governing water use across the broader Colorado Basin, other compacts, settlements, and species-related issues are specific to the San Juan/ Dolores/San Miguel region.
• The San Miguel area shows a mix of recreation and tourism activities, along with a strong desire to maintain agriculture in the western part of the county.			



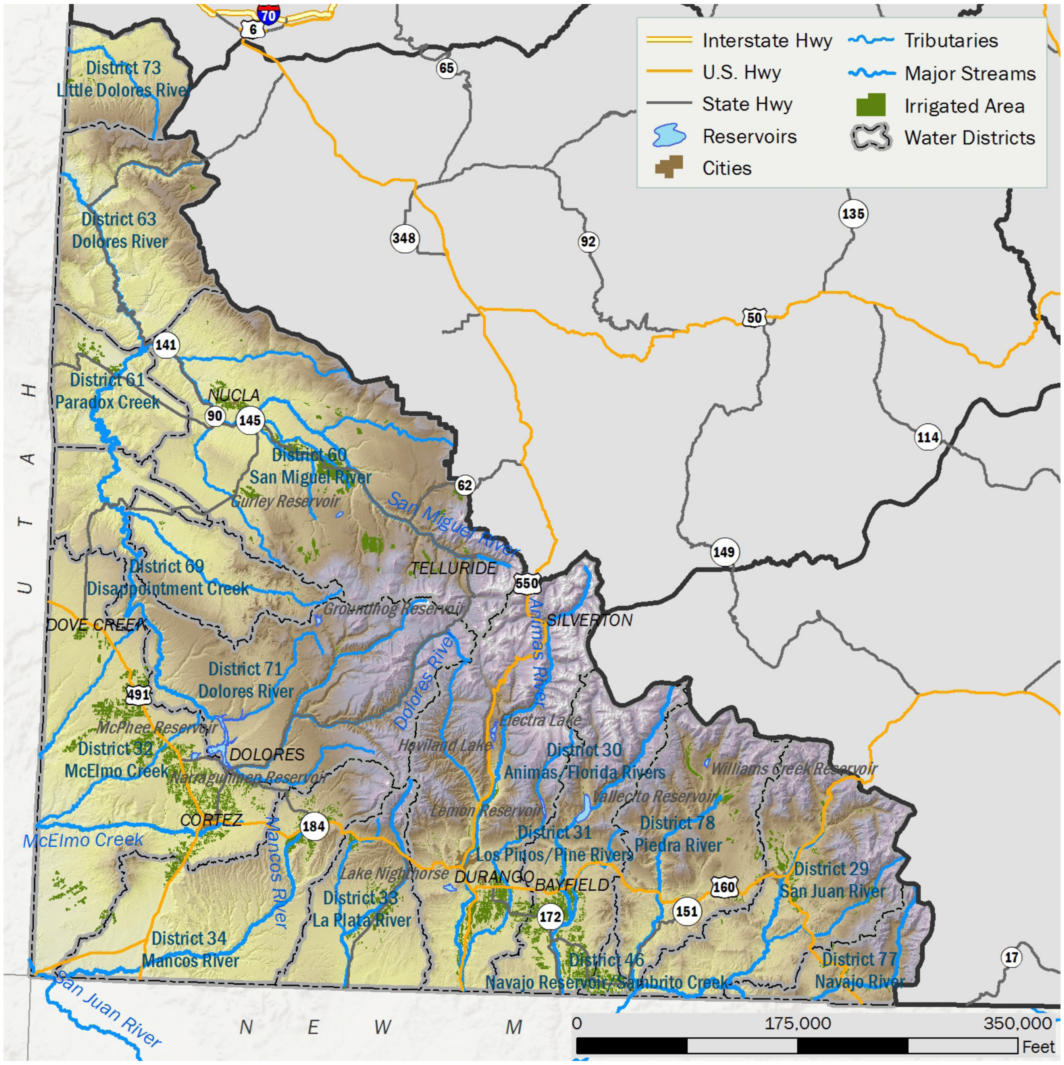


Figure 4.9.1 Map of the Southwest Basin

4.9.2 SUMMARY OF TECHNICAL UPDATE RESULTS

Key results and findings of the Technical Update pertaining to agricultural and M&I demands and gaps as well as findings related to environmental and recreational attributes and future conditions are summarized below.

Table 4.9.2 Summary of Key Results in the Southwest Basin

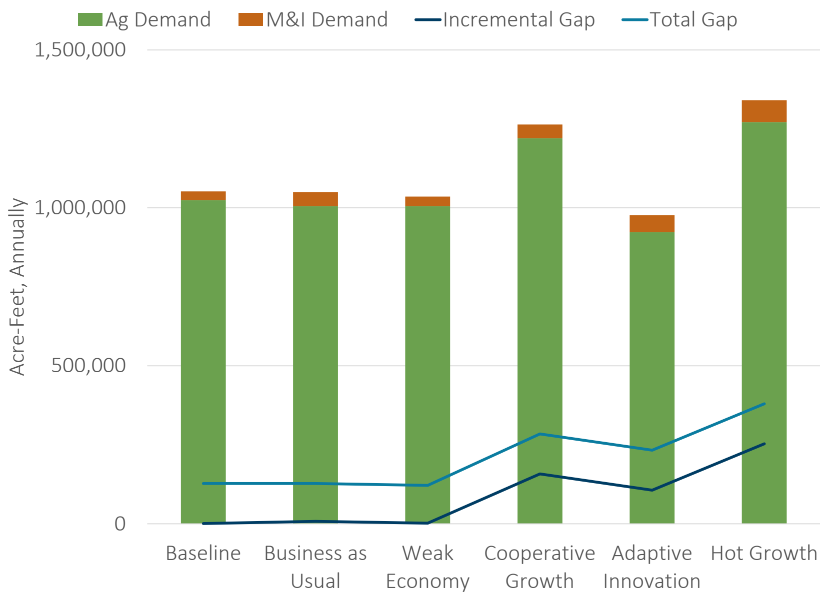
Agriculture	Environment and Recreation	Municipal and Industrial
• Warmer and drier climate conditions in Cooperative Growth, Adaptive Innovation and *Hot Growth* will lead to higher IWR and gaps. • Incorporation of emerging technologies in Adaptive Innovation are projected to help maintain demands and gaps at lower levels than *Hot Growth* despite similar assumptions regarding future climate conditions.	• In locations that are minimally depleted under baseline conditions, peak flows may remain adequate for riparian/wetlands and fish habitat, but timing mis-matches may occur. • In all locations, mid- and late-summer flows may be substantially reduced, creating high risk for coldwater and warmwater fish.	• Relatively large increases in population could create higher M&I demands and gaps in Adaptive Innovation and *Hot Growth*. • Thermoelectric demands drive a modest increase in SSI demand. • Future per capita demands are projected to decrease in all but *Hot Growth*.

Table 4.9.3 Summary of Diversion Demand and Gap Results in the Southwest River Basin

	Current (2015)	Business as Usual	Weak Economy	Cooperative Growth	Adaptive Innovation	Hot Growth
Average Annual Demand						
Agricultural (AFY)	1,024,800	1,005,400	1,005,400	1,220,500	923,100	1,271,700
M&I (AFY)	27,200	44,800	30,200	43,300	54,000	69,500
Gaps						
Ag (avg %)	12%	12%	12%	23%	24%	28%
Ag (incremental-AFY)	-	-	-	150,100	92,400	228,400
Ag (incremental gap as % of current demand)	-	-	-	15%	9%	22%
M&I (max %)	0%	17%	6%	18%	26%	36%
M&I (max-AF)	0*	7,500	1,800	7,700	13,800	24,800

* *CDSS water allocation model in this basin calculates small baseline M&I gaps, but they are either due to calibration issues or they are reflective of infrequent, dry-year shortages that are typically managed with temporary demand reductions such as watering restrictions.*

Figure 4.9.2 Summary of Diversion Demand and Gap Results in the Southwest Basin



Summary of Environment and Recreation Findings

- In locations that are minimally depleted under baseline conditions (e.g., the San Miguel River), peak flows may remain adequate for riparian/wetlands and fish habitat, with March-May flows increasing substantially while June flows decrease; possible mis-matches between peak flow timing and species needs may occur.
- In some locations peak flows under baseline conditions indicate high risk to riparian/wetlands and fish habitat, and risk may increase in *Cooperative Growth, Adaptive Innovation*, and *Hot Growth*.
- In all locations, mid- and late-summer flows are projected to be substantially reduced (50 to 80 percent) under *Cooperative Growth, Adaptive Innovation*, and *Hot Growth*, creating high risk for coldwater and warmwater fish. Even on rivers where the baseline condition is low-risk for summer flows, future scenarios may see risks increase substantially. The risk expressed in the coldwater and warmwater fish metrics does not include July because historically July flows are sufficient; however, in some locations, July flows may be reduced (e.g., July flows on the Piedra River near Arboles could be by reduced 84 percent), which could result in much-reduced habitat and high stream temperatures.
- Instream Flow water rights in the Southwest and the Recreational In-Channel Diversion on the Animas River often will likely not be fully met under *Cooperative Growth*, *Adaptive Innovation*, and *Hot Growth*.

4.9.3 NOTABLE BASIN CONSIDERATIONS

Section 4.1 described several analysis assumptions and limitations that apply to all basins and should be considered when reviewing and interpreting analysis results. Additional considerations specific to the Southwest Basin are listed below:

- The full development of tribal reserved water rights is not represented in the models for several reasons. The Tribal Water Study was completed in December of 2018, which was after the agricultural and M&I demands for the Technical Update were completed. In addition, full use of the reserved rights are not projected to occur by 2050, which is the planning time period contemplated in the current Technical Update. It should be noted that Tribal water use through 2050 is included in the M&I projections in each planning scenario; however, similar to other future M&I demands, it has been grouped with other M&I demands and included in the water allocation model at representative locations in each water district. Basin roundtables can take a different look at how tribal rights are used when they update their BIP.
- Water availability in the various sub-basins in the Southwest Basin can be drastically different. The differences in sub-basin water availability and gaps may not be evident at a basinwide scale due to the aggregated reporting of results in the Technical Update; however, models developed for the Technical Update reflect the variation in sub-basin results and are available for sub-basin specific evaluations that could be conducted in the Basin Implementation Plan update.

4.9.4 AGRICULTURAL DIVERSION DEMANDS

Agricultural Setting

The Southwest Basin is made up of a series of nine sub-basins, each with their own unique hydrology and demands. The basin is home to a diverse set of demands; several small towns founded primarily due to either mining or agricultural interests, two Native American reservations (Southern Ute Indian Tribe and Ute Mountain Ute Tribe), one major transbasin diversion (San Juan–Chama Project)[13], and four major Reclamation projects (Pine River, Dolores, Florida and Mancos) that both brought new irrigated acreage under production and provided supplemental supplies to existing lands. For areas outside of the Reclamation rojects, producers generally irrigate grass meadows for cattle operations aligned along the rivers and tributaries and rely on supplies available during the runoff season. Producers under the Reclamation Projects irrigate a wider variety of crops, such as alfalfa and row crops, due to lower elevations, warmer temperatures, and supplemental storage supplies during the later irrigation season.

Planning Scenario Adjustments

Urbanization in the basin will likely have a limited impact on agriculture in the future. Only 4,080 acres of irrigated land basin-wide were estimated to be urbanized by 2050. The larger towns of Durango, Cortez, and Pagosa Springs do not have significant areas of irrigated acreage located within or directly adjacent to the current municipal boundaries, and urbanization of acreage in these areas is projected to be low in the future. Smaller towns in the basin, such as Norwood, Nucla, Bayfield, and Mancos are surrounded by irrigated agriculture, which may lead to some urbanization of irrigated lands by 2050.

Table 4.9.4 summarizes the planning scenario adjustments described above and other adjustments that impact agricultural diversion demands in the various scenarios.

Table 4.9.4 Planning Scenario Adjustments for Agricultural Demands in the Southwest Basin

Adjustment Factor*	Business as Usual	Weak Economy	Cooperative Growth	Adaptive Innovation	Hot Growth
Change in Irrigated Land due to Urbanization	3,800 Acre Reduction	3,800 Acre Reduction	3,800 Acre Reduction	3,800 Acre Reduction	3,800 Acre Reduction
IWR Climate Factor	-	-	26%	34%	34%
Emerging Technologies	-	-	-	10% IWR Reduction 10% System Efficiency Increase	-

** See section 2.2.3 for descriptions of adjustment methodologies and assumptions*

Agricultural Diversion Demand Results

Table 4.9.5 and Figure 4.9.3 summarize the acreage, IWR, and the agricultural diversion demand for surface water supplies in the Southwest Basin for current conditions and the five planning scenarios. Increased demands were projected for *Cooperative Growth* and *Hot Growth*, reflecting the impacts of climate change, without the benefit of increased efficiencies reflected in *Adaptive Innovation*.

Table 4.9.5 Summary of Agricultural Diversion Demand Results in the Southwest Basin

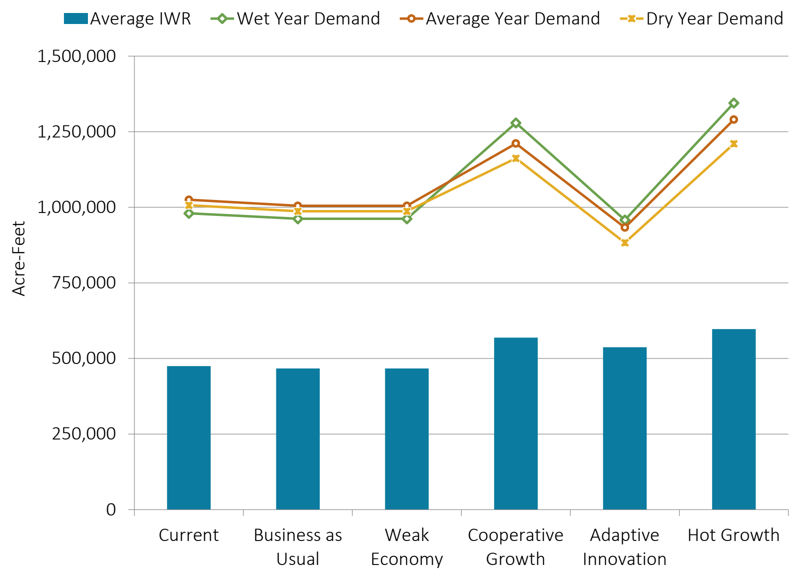
	Current (2015)	Business as Usual	Weak Economy	Cooperative Growth	Adaptive Innovation	Hot Growth
Irrigated Acreage (acres)	222,500	218,800	218,800	218,800	218,800	218,800
Average IWR (AFY)	474,900	467,000	467,000	569,000	537,000	597,000
Total Surface and Groundwater Diversion Demand						
Average Year (AFY)	1,025,000	1,005,000	1,005,000	1,211,000	933,000	1,290,000
Wet Yr. Change	-4%	-4%	-4%	6%	3%	4%
Dry Yr Change	-2%	-2%	-2%	-4%	-5%	-6%

Average agricultural diversion demand was calculated using the average hydrologic years (i.e., years classified as neither wet or dry) from 1950-2013

SYSTEM EFFICIENCY

In some cases, diversion demands can be higher in wet years because system efficiency decreases due to the relative abundance of supply.

Figure 4.9.3 Agricultural Diversion Demands and IWR Results in the Southwest Basin



4.9.5 Municipal and Self-Supplied Industrial Diversion Demands

Population Projections

The Southwest Region currently includes about 2 percent of the statewide population. Between the years 2015 and 2050, it is projected to grow from approximately 110,000 to between 130,000 and 280,000 people in the low and high growth projections, respectively, which is an increase in population of 16 to 161 percent. On a percentage basis, the Southwest Basin has the largest projected increase of all basins throughout the state. Table 4.9.6 shows how population growth is projected to vary across the planning scenarios for the Southwest Basin.

Table 4.9.6 Southwest Basin Baseline and Projected Populations

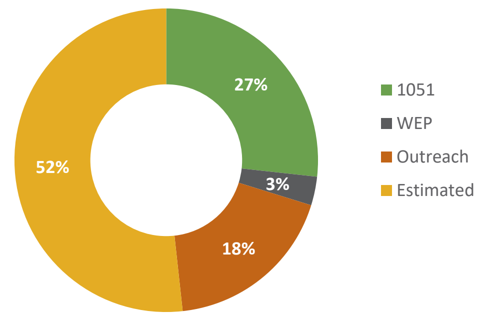
Baseline (2015)	Business as Usual	Weak Economy	Cooperative Growth	Adaptive Innovation	Hot Growth
107,999	195,837	125,814	201,010	264,189	282,144

Current Municipal Demands

Sources of water demand data such as 1051 or WEP data made up less than half of the available information in the Southwest Basin, and baseline water demands were largely estimated as shown in Figure 4.9.4.

Figure 4.9.5 summarizes the categories of municipal, baseline water usage in the Southwest Basin. On a basin scale, the non-residential outdoor demand as a percentage of the systemwide demand is one of the lowest reported throughout the state, at approximately 9 percent. Conversely, the baseline non-revenue water demand is one of the highest statewide, at approximately 15 percent of the systemwide demands.

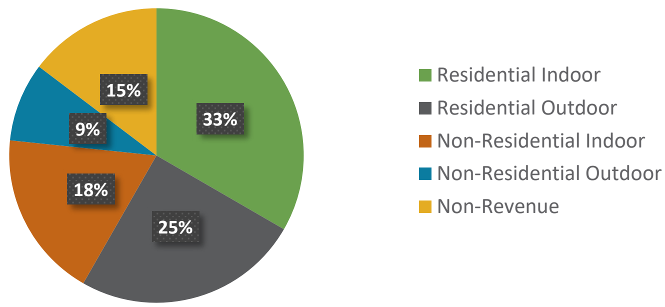
Figure 4.9.4 Sources of Water Demand Data in the Southwest Basin



DECREASING GPCD

The Southwest Region average baseline per capita systemwide demand has increased from 183 gpcd in SWSI 2010 to approximately 198 gpcd.

Figure 4.9.5 Categories of Water Usage in the Southwest Basin



Projected Municipal Demands

Figure 4.9.6 provides a summary of per capita baseline and projected water demands for the Southwest Basin. Systemwide, the projected per capita demands decrease relative to the baseline except for *Hot Growth,* which has a similar systemwide per capita demand as the baseline, but the demand category distributions are different. The residential indoor demand is the greatest demand category in the baseline, but the residential outdoor demand exceeds the residential indoor demand in the all of the projections except for *Weak Economy*. Outdoor demands increased significantly for *Hot Growth* due to an increase in outdoor demands driven by the "Hot and Dry" climate factor (described in Section 2).

The Southwest Basin municipal baseline and projected demands are provided in Table 4.9.7, showing the combined effect of population and per capita demands. Municipal demands are projected to grow from approximately 24,000 AFY in 2015 to between 26,000 and 63,000 AFY in 2050. La Plata County accounts for nearly half of the baseline demand, followed by Montezuma County at just under one-third of the basin demand.

The baseline and projected demand distributions shown in Figure

Figure 4.9.6 Southwest Basin Municipal Baseline and Projected Per Capita Demands by Water Demand Category (gpcd)

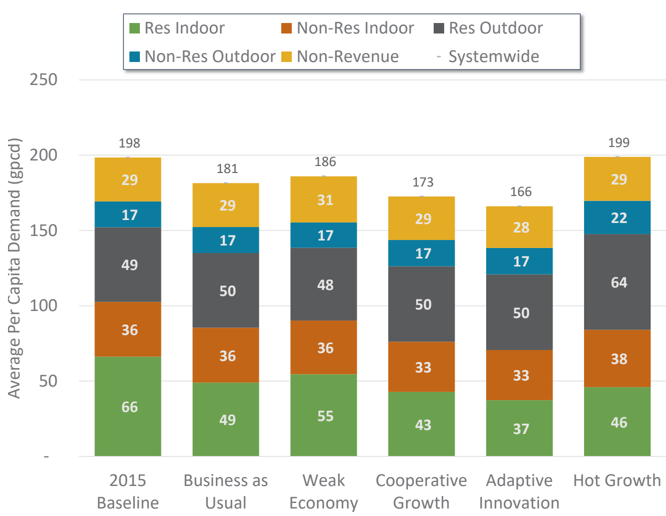
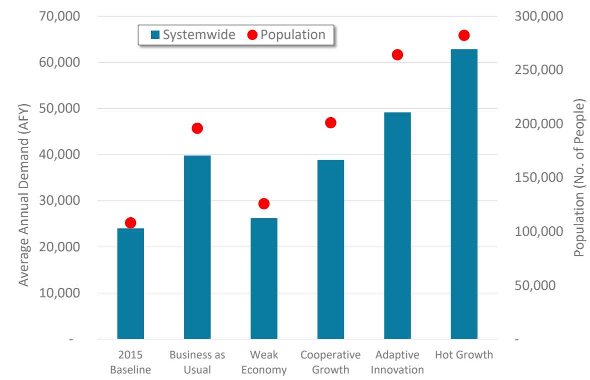


Table 4.9.7 Southwest Basin Municipal Baseline and Projected Demands (AFY)

Baseline (2015)	Business as Usual	Weak Economy	Cooperative Growth	Adaptive Innovation	Hot Growth
24,009	39,810	26,214	38,864	49,164	62,851

4.9.7 also show how the population varies between the scenarios. All of the planning scenarios except for *Weak Economy* result in a significant increase relative to the baseline. Demands generally follow the population patterns, however increased outdoor demands for the "Hot and Dry" climate condition have a greater impact on gpcd, resulting in higher demands for *Hot Growth*.

Figure 4.9.7 Southwest Basin Baseline and Projected Population and Municipal Demands



Self-Supplied Industrial Demands

The Southwest Basin currently includes about 1 percent of the statewide SSI demand. SSI demands in this basin are associated with the snowmaking and thermoelectric sub-sectors, with no demands projected for large industry or energy development sub-sectors. Southwest region total SSI demands are shown in Figure 4.9.8 and summarized in Table 4.9.8.

The baseline snowmaking demand is 430 AFY as compared to 410 AFY in SWSI 2010. Projected demands remain at 430 AFY because there is no planned expansion of snowmaking acreage. Projected demands were not varied by scenario.

Thermoelectric demands are related to one facility located in Montrose County and were based on information in SWSI 2010. The baseline demand remains 1,850 AFY as represented in SWSI 2010. Projected thermoelectric demands range from 3,510 AFY to 4,290 AFY.

Figure 4.9.8 Southwest Basin Self-Supplied Industrial Demands

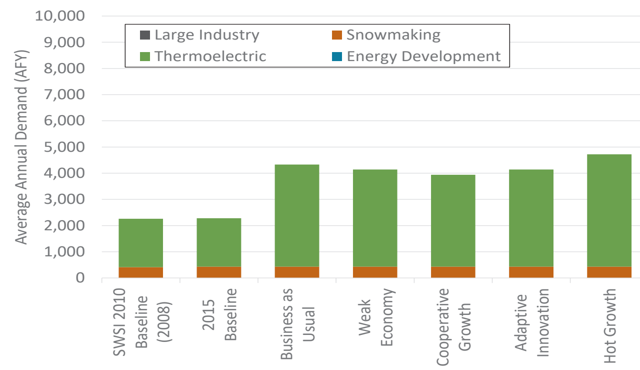


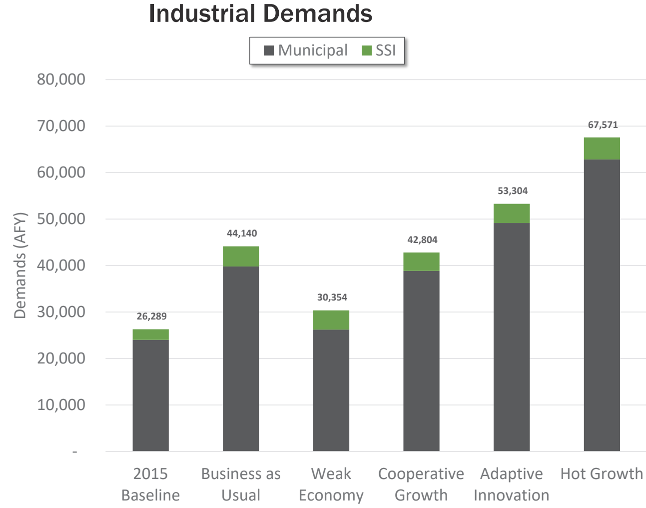
Table 4.9.8 Southwest Basin SSI Baseline and Projected Demands (AFY)

Sub-sector	Baseline (2015)	Business as Usual	Weak Economy	Cooperative Growth	Adaptive Innovation	Hot Growth
Large Industry	-	-	-	-	-	-
Snowmaking	430	430	430	430	430	430
Thermoelectric	1,850	3,900	3,710	3,510	3,710	4,290
Energy Development	-	-	-	-	-	-
Sub-Basin Total	2,280	4,330	4,140	3,940	4,140	4,720

Total M&I Diversion Demands

Southwest Basin combined M&I demand projections for 2050 range from approximately 30,000 AFY in the *Weak Economy* to 68,000 AFY in *Hot Growth*, as shown in Figure 4.9.9. SSI demands account for around 7 to 14 percent of the M&I demands in the Southwest Basin. On a basin scale, the demand projections follow the statewide sequence of the scenario rankings described in the CWP.

Figure 4.9.9 Southwest Basin Municipal and Self-Supplied Industrial Demands



4.9.6 Water Supply Gaps

The agricultural and M&I diversion demands were compared against available water supply modeled for current conditions and the five planning scenarios. Gaps were calculated when water supply was insufficient to meet demands.

Agricultural

The Southwest Basin agricultural diversion demands, demand gaps, and consumptive use gaps for the baseline and planning scenarios are presented in Table 4.9.9 and illustrated in Figure 4.9.10. An annual time series of gaps in terms of percent of demand that was unmet is shown in Figure 4.9.11.

> **INCREMENTAL GAP**
>
> The incremental agricultural gap quantifies the degree to which the gap could increase beyond what agriculture has historically experienced under water shortage conditions.

Table 4.9.9 Southwest Basin Agricultural Gap Results (AFY)

		Scenario					
		Scenario	Business as Usual	Weak Economy	Cooperative Growth	Adaptive Innovation	Hot Growth
Average	Average Annual Demand	1,024,800	1,005,400	1,005,400	1,220,500	923,100	1,271,700
Average	Average Annual Gap	126,600	120,300	119,800	276,700	219,000	355,100
Average	Average Annual Gap Increase from Baseline	-	-	-	150,100	92,400	228,400
Average	Average Annual Percent Gap	12%	12%	12%	23%	24%	28%
Average	Average Annual CU Gap	72,300	68,700	68,400	158,500	147,200	206,400
Maximum	Demand in Maximum Gap Year	1,153,000	1,131,100	1,131,100	1,215,200	899,300	1,238,200
Maximum	Gap in Maximum Gap Year	517,600	507,400	504,900	679,500	474,000	738,100
Maximum	Increase from Baseline Gap	-	-	-	161,900	-	220,500
Maximum	Percent Gap in Maximum Gap Year	45%	45%	45%	56%	53%	60%

Study period for Water Supply Analysis is 1975-2013, reflecting different baseline demand than described in Agricultural Diversion Demands section.

Figure 4.9.10 Projected Average Annual Agricultural Diversion Demand, Demand Met, and Gaps in the Southwest Basin

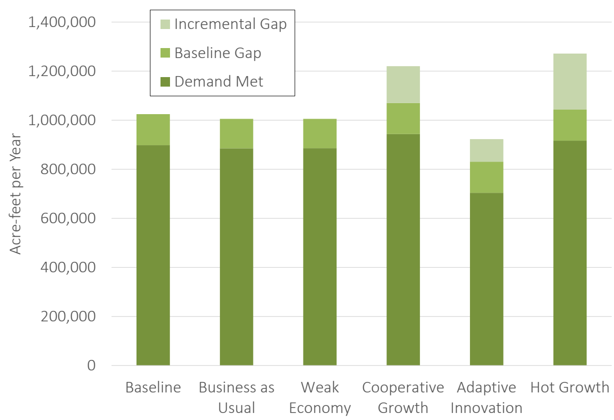
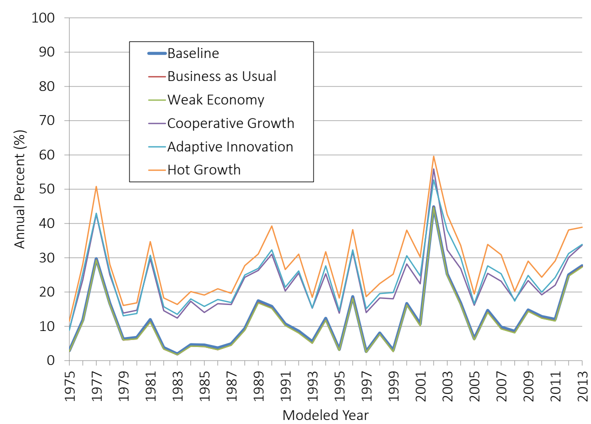


Figure 4.9.11 Annual Agricultural Gaps (expressed as a percentage of demand) for Each Planning Scenario



The following are observations on agricultural demands and gaps:

- Agricultural diversion demands are reduced in three of the five planning scenarios due to urbanization and reduction of irrigated acres.
- Agricultural diversion demand is projected to increase by 11 to 16 percent in *Cooperative Growth* and *Hot Growth* due to climate impacts. The increased demand in these scenarios is exacerbated by reduced water supply, resulting in an increased gap.
- Although *Adaptive Innovation* estimates reduced demand, the reduction in water supply due to climate change could result in an increased gap over baseline.

M&I

The diversion demand and gap results for M&I in the Southwest Basin are summarized in Table 4.9.10 and illustrated in Figure 4.9.12. An annual time series of gaps in terms of percent of demand that was unmet is shown in Figure 4.9.13.

Table 4.9.10 Southwest Basin M&I Gap Results (AFY)

		Scenario					
		Scenario	**Business as Usual**	**Weak Economy**	**Cooperative Growth**	**Adaptive Innovation**	**Hot Growth**
Average	Average Annual Demand	27,200	44,800	30,200	43,300	54,000	69,500
	Average Annual Gap	0[1]	3,300	400	4,100	7,800	13,400
	Average Annual Percent Gap	0%	7%	1%	9%	14%	19%
Maximum	Demand in Maximum Gap Year	27,200	44,800	30,200	43,300	54,000	69,500
	Gap in Maximum Gap Year	0*	7,500	1,800	7,700	13,800	24,800
	Percent Gap in Maximum Gap Year	0%	17%	6%	18%	26%	36%

** CDSS water allocation model in this basin calculates small baseline M&I gaps, but they are either due to calibration issues or they are reflective of infrequent, dry-year shortages that are typically managed with temporary demand reductions, such as watering restrictions.*

Study period for Water Supply Analysis is 1975-2013, reflecting different baseline demand than described in M&I Demand section. Baseline demand also may vary slightly from previous section due to differences in geographic distribution of demand for counties that lie in multiple basins.

Figure 4.9.12 Projected Maximum Annual M&I Demand Met and Gaps in the Southwest Basin

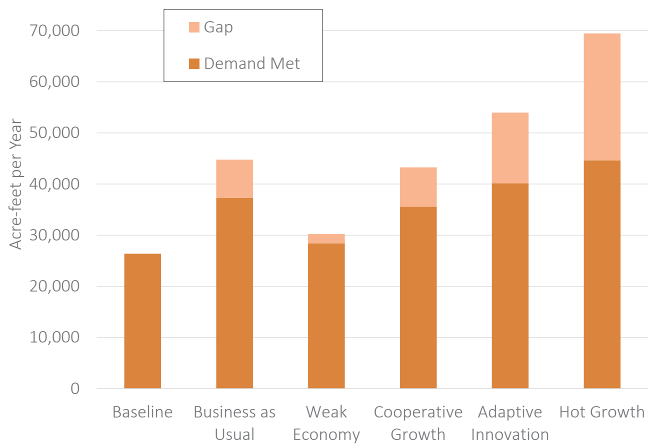
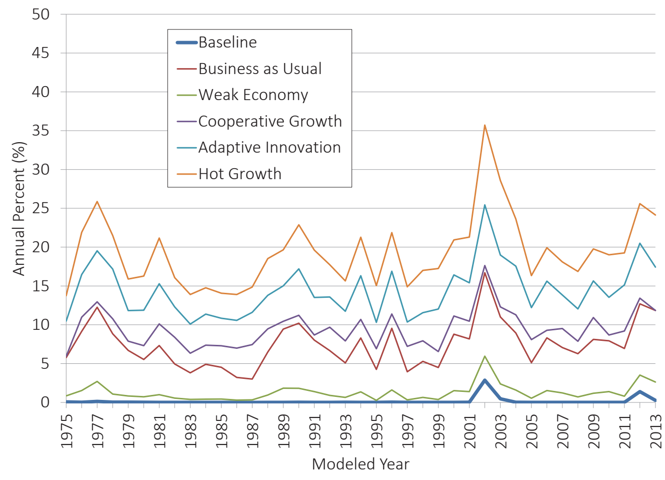


Figure 4.9.13 Annual M&I Gaps (expressed as a percentage of demand) for Each Planning Scenario



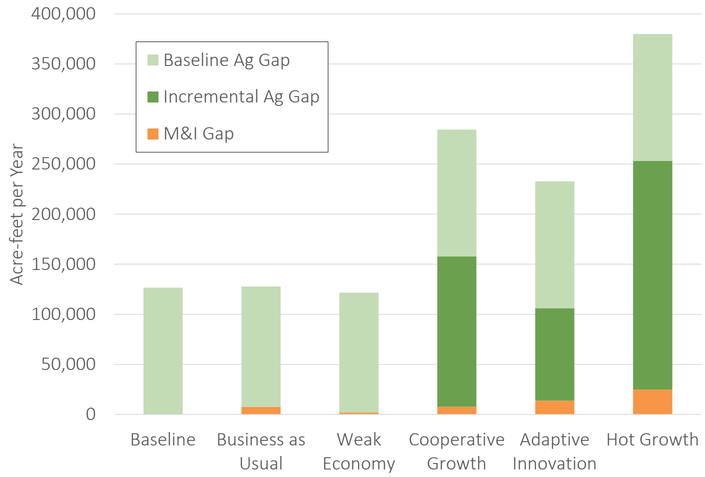
The following are observations on M&I diversion demands and gaps:

- The Southwest Basin is projecting the largest percentage increase in population in the state, which results in increased municipal demand for all future scenarios.
- Thermoelectric demands drive a modest increase in SSI demand.
- Water supply gaps for the planning scenarios range from 1 to 20 percent of demand. The largest gap is projected for *Hot Growth*, which is 36 percent of demand in the maximum gap year.

Total Gap

Figure 4.9.14 illustrates the total combined agricultural and M&I diversion demand gap in the Southwest Basin. The figure combines the average annual baseline and incremental agricultural gaps and the maximum M&I gap. In *Cooperative Growth*, *Adaptive Innovation*, and *Hot Growth*, gaps were driven by agricultural demands, which increase in the "Hot and Dry" climate conditions.

Figure 4.9.14 Projected Average Annual Agricultural Gaps and Maximum M&I Diversion Demand Gaps in the Southwest Basin



Supplies from Urbanized Lands

By 2050, irrigated acreage in the Southwest Basin is projected to decrease by 3,800 acres due to urbanization. Irrigation supplies for these lands could potentially be used for M&I needs in the future (subject to a variety of unknowns such as seniority and type of water supply, willingness to change the use of water through water court, etc.). The average annual historical consumptive use associated with potentially urbanized acreage for each scenario is reflected in Table 4.9.11. The data in the table represent planning-level estimates of this potential supply and has not been applied to the M&I gaps.

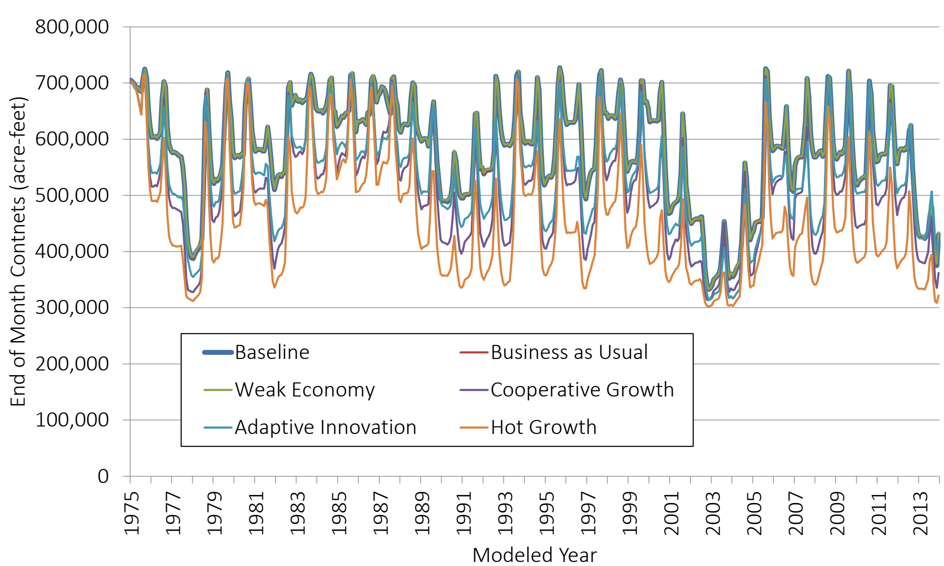
Table 4.9.11 Estimated Consumptive Use from Lands Projected to be Urbanized by 2050 in the Southwest Basin

	Business as Usual	Weak Economy	Cooperative Growth	Adaptive Innovation	Hot Growth
Urbanized Acreage (acres)	3,800	3,800	3,800	3,800	3,800
Estimated Consumptive Use (AFY)	6,900	6,900	7,100	6,800	6,800

Storage

Total simulated reservoir storage from the Southwest Basin water allocation model is shown on Figure 4.9.15. Baseline and *Weak Economy* conditions show the highest levels of water in storage (in general) and the lowest is in *Hot Growth*. A significant spread between storage levels is shown for the various planning scenarios, with as much as 200,000 AF storage difference between *Weak Economy* and *Hot Growth*.

Figure 4.9.15 Southwest Basin Total Simulated Storage



4.9.7 Available Supply

Figures 4.9.16 through 4.9.19 show simulated available flow for the Southwest Basin at two locations to illustrate the difference in hydrology and water availability across the multiple sub-basins. The Animas River at Durango gage is located just upstream of the Durango Boating Park, which is a recreational instream flow demand of 1,400 cfs. Available flow greatly increases downstream of the Boating Park reach.

The La Plata River produces very little runoff and demands on the river chronically experience shortages due to physical flow limitations and curtailment due to the La Plata Compact. At both of the locations, available flows are projected to diminish and peak flows could occur earlier in the runoff season under planning scenarios with climate change impacts.

Figure 4.9.16 Simulated Hydrographs of Available Flow at Animas River at Durango, CO

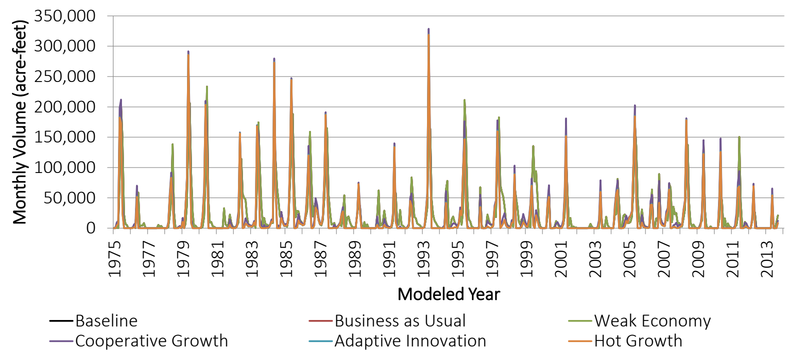


Figure 4.9.17 Average Monthly Simulated Hydrographs of Available Flow at Animas River at Durango, CO

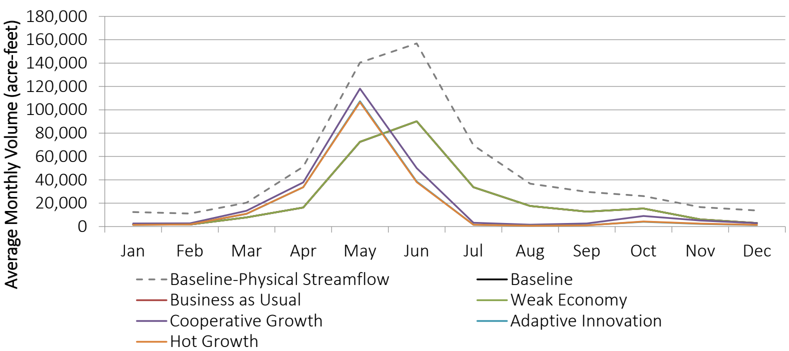


Figure 4.9.18 Simulated Hydrographs of Available Flow at La Plata River at Hesperus, CO

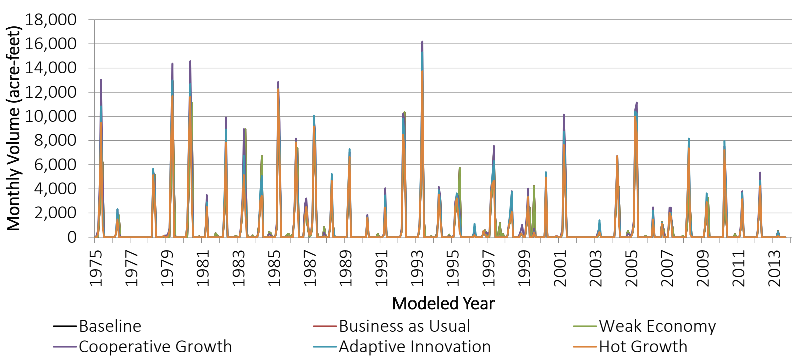
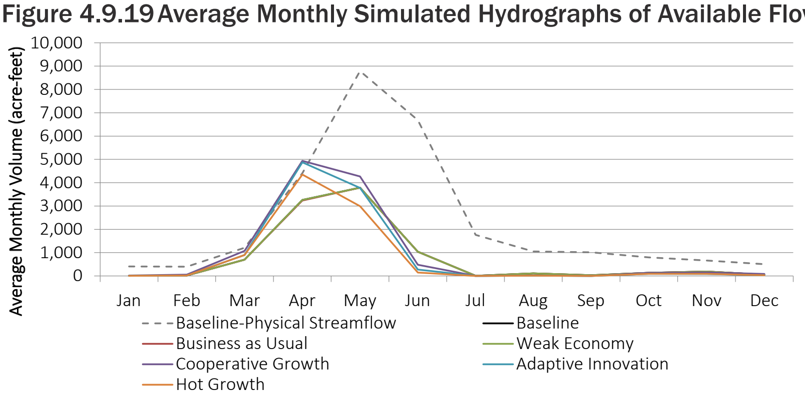


Figure 4.9.19 Average Monthly Simulated Hydrographs of Available Flow at La Plata River at Hesperus, CO



4.9.8 Environment and Recreation

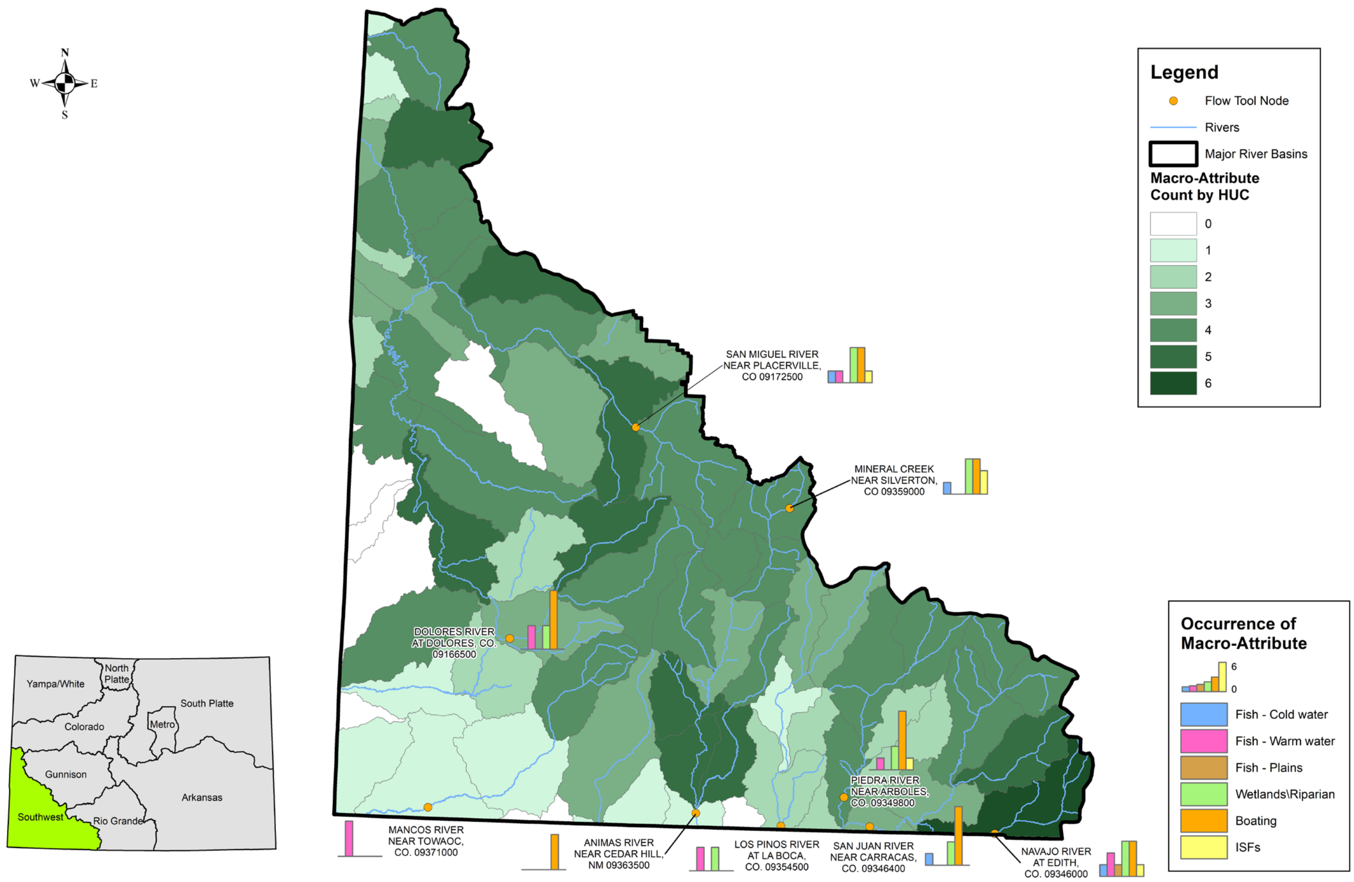
A total of nine water allocation model nodes were selected for the Flow Tool within the Southwest Basin (see list below and Figure 4.9.20). Figure 4.9.20 also shows subwatersheds (at the 12-digit HUC level) and the relative number of E&R attributes located in each subwatershed.

- Dolores River at Dolores, Colorado (09166500)
- San Miguel River near Placerville, Colorado (09172500)
- Navajo River at Edith, Colorado (09346000)
- San Juan River near Carracas, Colorado (09346400)
- Piedra River near Arboles, Colorado (09349800)
- Los Pinos River at La Boca, Colorado (09354500)
- Animas River at Howardsville, Colorado (09357500)
- Animas River near Cedar Hill, New Mexico (09363500)
- Mancos River near Towaoc, Colorado (09371000)

NATURALIZED FLOW

Naturalized flows reflect conditions that would occur in the absence of human activities. Baseline flows reflect current conditions as influenced by existing infrastructure and river operations. While observations regarding naturalized flows may be informative, baseline flows reflect actual conditions and the diverse operations of a river's many users.

Figure 4.9.20 Flow Tool Nodes Selected for the Southwest Basin



Results and observations regarding Flow Tool analyses using flow data developed in the water supply and gap analyses for baseline conditions and the planning scenarios are described below in Table 4.9.12.

Table 4.9.12 Summary of Flow Tool Results in the Southwest Basin

Category	Observation
Projected Flows	In locations where baseline conditions are minimally depleted from naturalized conditions (e.g., the San Miguel River), peak flow magnitude under *Business as Usual* and *Weak Economy* are projected to decline only slightly below baseline. Under climate change scenarios, declines in peak flow magnitude are projected to be further below baseline.
	At all locations, the timing of peak flow is projected to move earlier in the year for all climate change projections (Cooperative Growth, Adaptive Innovation, and Hot and Dry). Under these climate change projections, June flows may decrease the most (e.g., Dolores River at Dolores). Under these same scenarios, April flow may increase, but the increase in April flow magnitude may not offset the decline in June flow magnitude.
Ecological Risk	In all locations, mid- and late-summer flows are projected to decline under *Cooperative Growth*, *Adaptive Innovation*, and *Hot Growth* scenarios, increasing risks for coldwater and warmwater fish.
	In locations where naturalized and baseline conditions are similar, peak flow-related risk to riparian/wetland plants and fish are projected to remain low to moderate under *Business as Usual*, *Weak Economy*, and *Cooperative Growth* scenarios. Under *Adaptive Innovation* and *Hot Growth*, this risk may increase.
	In locations where peak flows under baseline are already substantially less than naturalized conditions, peak flow-related risk to riparian/wetland plants and fish is already high and may increase under climate change scenarios.
	Under all climate change scenarios, runoff and peak flows occur earlier, and possible mis-matches between peak flow timing and species' needs may occur.
	In locations where naturalized and baseline conditions are similar, risk to coldwater fish (mainly trout) may increase under the various planning scenarios because of declines in mid- and late-summer flow. However, the risk remains moderate in most years.
	In locations that experience low summer flows, risk to fish may increase. Note that the Flow Tool risk assessment using coldwater and warmwater fish metrics does not include July because historically July flows are sufficient. In some locations, July flows may be significantly reduced under climate change scenarios (e.g., July flows under *Hot Growth* on the Piedra River near Arboles). The projected reduction will likely result in reduced habitat and increased stream temperatures.
ISFs and RICDs	ISFs throughout the Southwest and the RICD on the Animas River may not be met in many years under *Cooperative Growth*, *Adaptive Innovation*, and *Hot Growth*. For example, flows on the San Miguel River near Placerville are projected to fall short of the 93 cfs summer ISF regularly during mid- and late-summer. In August, this ISF is projected to be unmet during 1 out of 3 years under *Cooperative Growth* and during two out of three years under *Adaptive Innovation* and *Hot Growth*.
	On the Animas River, the 25 cfs RICD near Howardsville is projected to not be met in numerous years during late summer (August) through October, and again in January and February (when the minimum flow is 13 cfs) under the three climate change scenarios.
E&R Attributes	Under baseline, *Business as Usual*, and *Weak Economy*, current flow issues related to E&R attributes arise primarily because of depletions that increase moving downstream.
	In some locations, transbasin diversions reduce and change the timing of flow in the basin of origin while augmenting flows in the receiving basin.
	Under climate change scenarios, the shift in the timing of peak flow, reductions in total runoff, and increasing consumptive demands may contribute to reductions in mid- and late-summer flows.