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Water Conservation in Colorado

Analyzing Level 1, Current Conservation, and 1% per Year Scenarios

This technical whitepaper was prepared by Drew Beckwith, WRA Water Policy Analyst, with assistance from Bart Miller, WRA Water Program Director, and was funded by the Winslow Foundation.

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2) promote urban water conservation and river restoration; and

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ACRONYMS AND ABBREVIATIONS

AF	acre feet
AFY	acre feet per year
CWCB	Colorado Water Conservation Board
DOLA	Department of Local Affairs
gpcd	gallons per capita per day
IPPs	Identified Projects and Processes
M&I	Municipal and Industrial
SSI	Self-Supplied Industrial
SWSI I	Statewide Water Supply Initiative, Phase I
WRA	Western Resource Advocates

Executive Summary

The Colorado Water Conservation Board (CWCB) has invested significant amounts of time and energy aimed at quantifying the state's future municipal water demands. This report builds upon past and current CWCB efforts by exploring the effects of conservation on reducing future needs. Three different conservation scenarios are evaluated herein – passive conservation, current conservation efforts, and a one-percent per year strategy – by quantifying the water savings and demand reductions associated with each scenario.

Demands are Reduced with Conservation

Estimates of future water demand in Colorado vary significantly depending on how conservation is incorporated into the projections. Under a mid population growth rate, Colorado's future municipal water demands at 2050 are estimated to be as high as 2,296,000 acre-feet (AF); but due to the impact of passive (*Level 1*) and active (*Current Conservation*) conservation programs, this analysis estimates that demands will be closer to 2,001,000 AF. If utilities adopt and achieve a *1% per Year* conservation goal, demands at 2050 could be as low as 1,610,000 AF (Figure 1, Table 1).

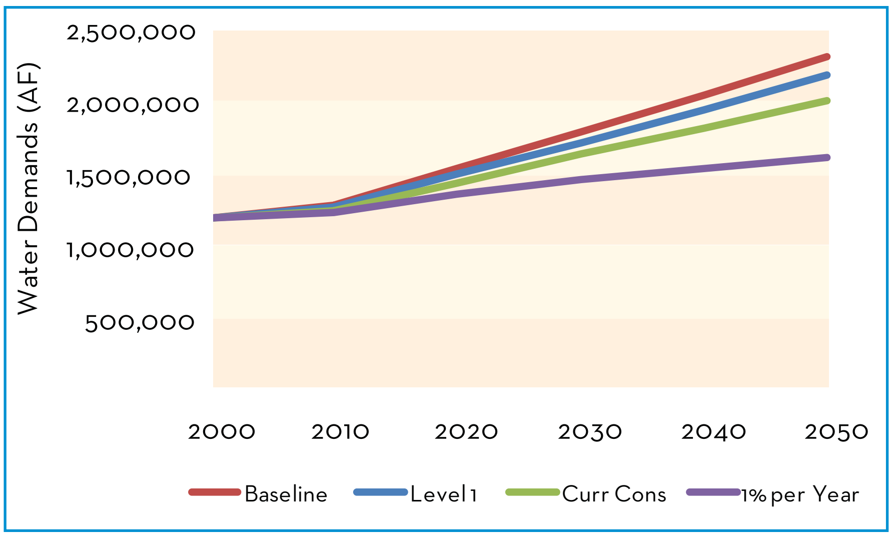

Figure 1. Estimate of statewide municipal water demands using a middle population growth rate.

	Baseline	Level 1	Current Conservation	1% per Year
Arkansas	442,000	418,900	405,300	313,900
Colorado	227,700	213,800	189,700	150,700
Dolores/ San Juan	58,600	55,300	51,900	40,100
Gunnison	47,600	44,700	43,200	31,400
North Platte	800	700	700	500
Rio Grande	29,000	27,200	26,800	19,000
South Platte	1,349,700	1,272,800	1,145,600	923,900
Yampa	140,100	138,400	137,800	130,500
Statewide	2,295,500	2,171,800	2,001,000	1,610,000

Table 1. Basin-by-basin estimate of municipal demands at 2050 using a mid population growth rate (AF).

Unmet Water Needs are Reduced and Delayed with Conservation

Incorporating the effects of conservation into future demand projections reduces the quantity and delays the onset of unmet water needs. Commonly known as the "Gap", unmet needs are the municipal demands that exceed a combination of the state's existing supplies and the utilities' identified projects and processes (IPPs) that will increase existing supplies.

Under the baseline scenario, and assuming that only 50% of structural IPPs are implemented successfully, the state is projected to experience unmet needs of 81,000 AF by as soon as 2020 (Table 2). Incorporating current conservation programs into the projections reduces unmet needs in 2020 to 25,000 AF (Figure 2). If utilities successfully achieve a one-percent per year reduction in demand, unmet water needs do not occur until 2025, and by 2050, unmet needs are significantly less than the baseline scenario. Clearly, conservation can play a major role in filling Colorado's unmet needs.

Year	Baseline	Level 1	Current Conservation	1% per Year
2000	-	-	-	-
2005	-	-	-	-
2010	-	-	-	-
2015	-	-	-	-
2020	81,400	38,600	25,300	-
2025	209,500	152,200	125,400	2,500
2030	332,000	258,700	217,500	47,300
2035	450,200	363,700	299,300	83,500
2050 Low	626,000	512,000	395,700	35,800
2050 Med	845,000	721,200	591,600	200,500
2050 High	1,405,500	1,267,700	1,118,600	684,000

Table 2. Projected quantity and timing of unmet water needs by conservation scenario – 50% IPPs.

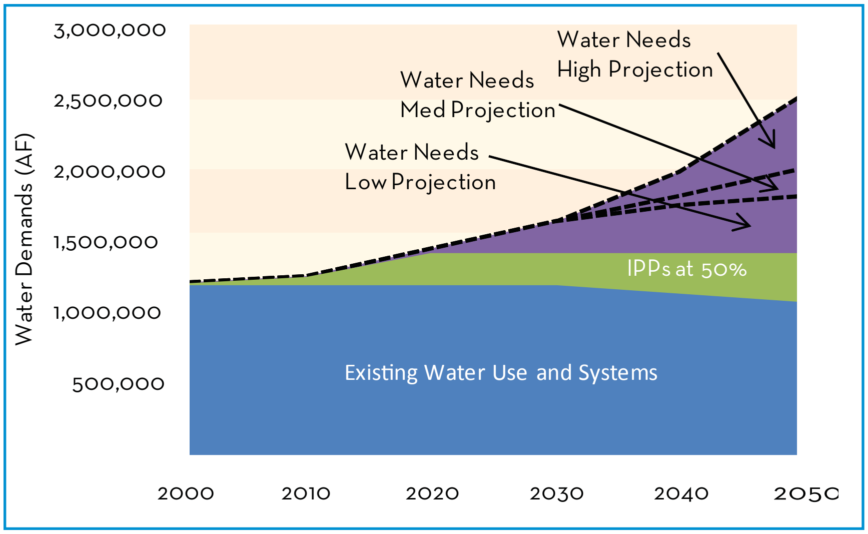

Figure 2. Projected municipal water demands, supplies, and water needs – Current Conservation scenario w/ 50% IPPs.

1% per Year Is a Reasonable and Achievable Goal

A one-percent per year reduction in demand is a reasonable goal for Colorado utilities over the next 40 to 50 years. Many utilities across the West, such as Denver Water, Seattle Public Utilities, and the Southern Nevada Water Authority, have already set goals to reduce water use at one-percent per year or more over the coming decades. In addition, President Obama recently directed the head of each federal agency to reduce their agency's potable water use consumption by two-percent per year through 2020.

Accomplishing a

1% per year

reduction in municipal water use would reduce statewide demands by almost 760,000 AF in the year 2050 under a high population growth scenario.

Existing water use trends and technological improvements also suggest that a one-percent per year reduction is an achievable goal. Front Range utilities have demonstrated a significant reduction in water use over the past several years. Between 2000 and 2007, water use in the Arkansas and South Platte basins declined by 12% and 13%, respectively – a reduction of 1.75% per year. Moreover, water conservation technologies will continue to advance over the coming decades, as they have over the past several. In fact, today's water-smart housing that incorporates existing technology can already achieve a 35-50% reduction in water use compared to normal residential developments, strongly suggesting that a large amount of conservation savings can be achieved using current technologies.

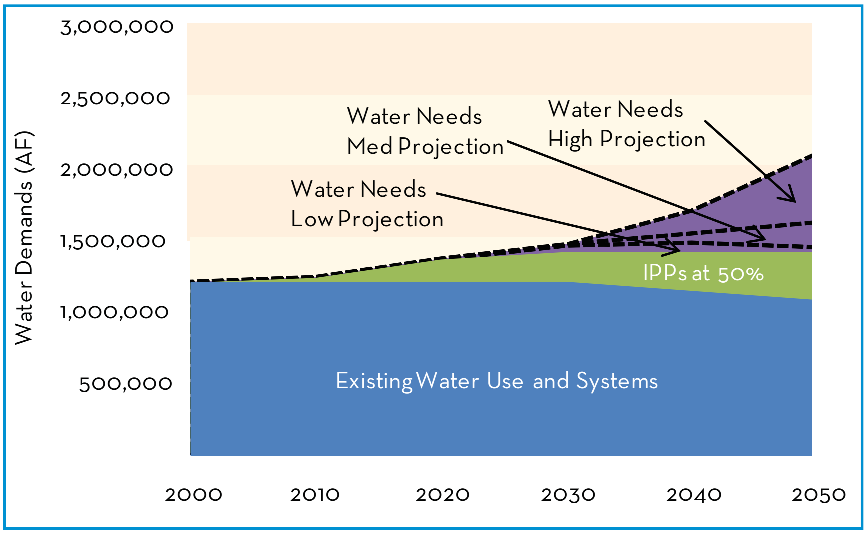

Figure 3. Projected municipal water demands, supplies, and water needs – 1% per Year scenario w/ 50% IPPs.

Accomplishing a one-percent per year reduction in municipal water use would result in statewide demands between 1.4 million AF and 2.1 million AF in the year 2050; a reduction of more than 760,000 AF compared to baseline demands (Figure 3). Concurrently, this would delay the onset of unmet water needs by at least 5 years, and significantly reduce the need for additional water supply at 2050. Forty years is a substantial amount of time to implement effective conservation programs and attain real water savings. Most every utility has the ability to reduce water use by one-percent per year over the next few years, starting with small steps and building up to more comprehensive programs over time.

Introduction

The Colorado Water Conservation Board (CWCB) has invested significant amounts of time and energy aimed at quantifying our state's future municipal water demands, however, the State has not been consistent in how it incorporates conservation into these projections. In 2004, CWCB released the Statewide Water Supply Initiative Phase I Report (SWSI I) that presented a first ever, basin-by-basin estimate of municipal and industrial (M&I) water needs across the state through the year 2030. Notably, SWSI I provided an estimate of future demands that include the effects of passive, conservation in which the natural replacement of indoor plumbing fixtures gradually reduces demand over time. In the appendices, SWSI I also presented estimates of future demands that include reductions caused by active conservation programs.

In 2009, CWCB released a subsequent draft report entitled "*State of Colorado 2050 Municipal and Industrial Water Use Projections*," which uses updated population and water use data to estimate future demands and expanded the planning horizon to 2050. Interestingly, CWCB's most recent report does not address the effects of any passive or active conservation programs on future demands.

This purpose of this report is to analyze the impacts of conservation on future municipal demands – as was done in SWSI I – by estimating savings associated with the effects of three different conservation scenarios (Table 3). "*Level 1*" conservation is the passive or natural savings achieved through the gradual replacement of old fixtures and appliances with new, more water-efficient products – these savings occur without any effort on behalf of utilities. "*Current Conservation*" is the savings achieved by active conservation programs already implemented by utilities across the state. Finally, *1% per Year* is an alternative conservation strategy achieved by reducing demand by one percent per year over the period of interest.

Scenario	**Description**
Baseline	Present-day water use rates are projected to remain steady from now through 2050.
Level 1	Present-day water use rates are reduced through time as old fixtures and appliances are gradually replaced with more water-efficient models.
Current Conservation	Present-day water use rates are reduced through time due to the effect of active conservation programs implemented by utilities. Active programs include: water rate structures, educational programs, financial incentives, and ordinances.
1% per Year	Present-day water use rates decline at a rate of one-percent per year.

Table 3. Description of conservation scenarios evaluated in this report.

For each of the scenarios, this report presents a brief introduction, the associated demand projections and water conservation savings, and a description of the methodology used to quantify the results. We then present a comparison of the four scenarios with each other, which also includes an estimate of gallons per capita per day (gpcd) water use at 2050 for each conservation scenario. Lastly, the demand reductions associated with conservation are combined with existing water use and identified projects and processes – at varying success rates – to estimate unmet water needs across the state through time.

Baseline Demands

The baseline demand scenario assumes that future water use rates will remain the same as they are now (i.e. no reduction from conservation). In a baseline scenario, CWCB estimates total statewide M&I demands at 2050 in a low, medium, and high growth scenario to be 2.1 million acre-feet (AF), 2.3 million AF, and 2.9 million AF, respectively.[1] As discussed later, it is unlikely that actual demands will reach these estimates because both passive and active conservation programs will reduce future demands.

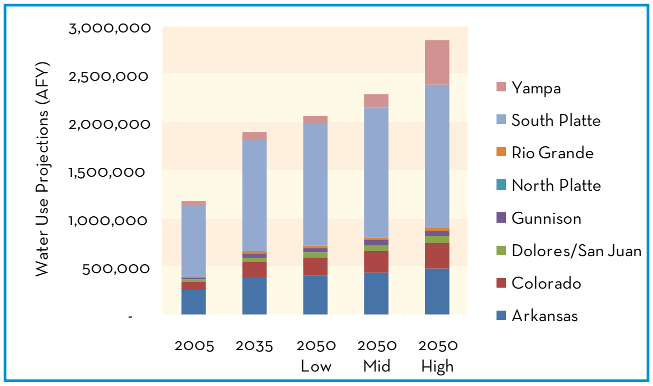

Figure 4. Total M&I water demands by basin – Baseline scenario.

Baseline Results

Municipal water demands in Colorado are projected to increase dramatically over the next 40 years, with growth in the South Platte basin as the main driver (Figure 4). The South Platte is the most populous of Colorado's river basins, and it is projected to make up 50-60% of total statewide demands in 2050 (Table 4). The large range in water demands at 2050 is primarily a function of the future uncertainty surrounding Colorado oil shale development; where oil shale has the potential to increase future demands in the Yampa basin by as much as 400,000 AF annually. Without any reduction in demand due to conservation efforts, it is estimated that future demands in Colorado at 2050 will range between 2.1 and 2.9 million AF.

Basin	2005	2035	2050 Low	2050 Mid	2050 High
Arkansas	251,900	380,200	411,500	442,000	483,600
Colorado	89,100	170,300	189,900	227,700	269,400
Dolores/San Juan	24,800	47,400	50,900	58,600	66,200
Gunnison	20,100	38,600	42,600	47,600	53,000
North Platte	500	600	700	800	900
Rio Grande	17,900	24,500	26,800	29,000	32,100
South Platte	741,400	1,151,200	1,268,000	1,349,700	1,483,200
Yampa	35,000	88,000	86,300	140,100	467,700
Statewide	1,180,700	1,900,800	2,076,700	2,295,500	2,856,100

Table 4. Total M&I water demands by basin – Baseline scenario.

Methodology

This analysis uses a simple "rate times driver" approach to estimate future water demands. This is the current methodology used by CWCB, and is the standard approach for many utilities in Colorado for estimating future demands. In short, per capita water use values (the rate) are multiplied by population projections (the driver) to determine future water demands. A detailed discussion of each variable is provided below.

[1] Colorado Water Conservation Board. 2009. State of Colorado 2050 Municipal and Industrial Water Use Projections. http://cwcb.state.co.us/IWMD/COsWaterSupplyFuture/CosWaterSupplyFuture.htm.

GPCD Water Use

The "updated" M&I water use factors presented in Table 3-1 of CWCB's report are used throughout this analysis.[2] These estimates of gallons per capita per day (gpcd) water use are population-weighted, county-wide averages from varying years between 2000 and 2008. The majority of Colorado's population is covered by water use values that were reported in 2007 or later.

Population Projections

WRA's analysis uses population data published by the Colorado Department of Local Affairs (DOLA) for the years 2000 through 2035 to drive estimates of future demand.[3] DOLA provides population estimates in 1-year and 5-year increments for every county in Colorado, updating their estimates on an annual basis. For CWCB's report, Harvey Economics was hired to estimate population past 2035 under a low, medium, and high growth scenario because DOLA does not estimate population more than 30 years into the future. Harvey Economics' 2050 population projections are used in WRA's analysis and no estimates of population are used for the years between 2035 and 2050.[4]

WRA's analysis uses different population data between 2005 and 2035 than what is used in CWCB's draft report for two reasons: 1) DOLA released more recent population projections that supersede the original DOLA data used in CWCB's report, and 2) this analysis uses a 5-year time step to capture changes in demand at a finer scale than is available in the CWCB report.[5] The updated population data is generally within ± 1% of the older data, which translates into differences of 10,000 AF or less per basin in estimates of future demand (Figure 5).[6]

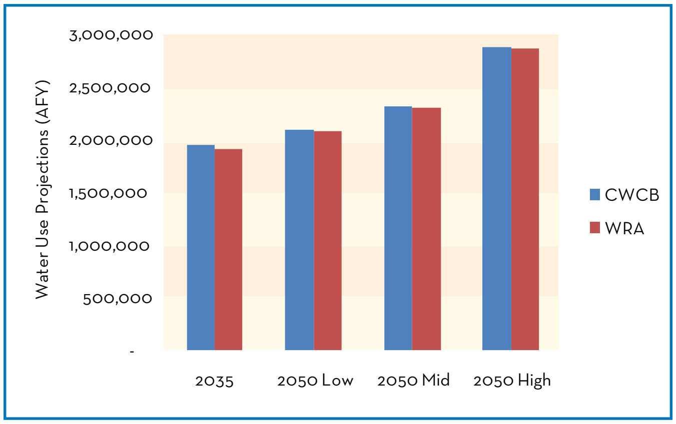

Figure 5. Comparison of statewide water demands using old (CWCB) and new (WRA) population projections.

Demand Calculation

Baseline M&I demands are calculated for each county in 5-year increments by multiplying the updated gpcd value by the population forecast for that year. A conversion factor of 892.15 is then applied to translate results from gallons per capita

2 The 5th column of Table 3-1.

3 Colorado Department of Local Affairs, Division of Local Government, State Demography Office. 2008. Population Forecasts for Colorado Counties. November. http://www.dola.state.co.us/dlg/demog/pop_cnty_forecasts.html.

4 Colorado Water Conservation Board. 2009. State of Colorado 2050 Municipal and Industrial Water Use Projections. Appendix B: 2050 Population Projections for the State of Colorado Municipal and Industrial Water Use Projections, by Harvey Economics, May 5, 2009. http://cwcb.state.co.us/IWMD/COsWaterSupplyFuture/CosWaterSupplyFuture.htm.

5 The main body of CWCB's report provides population estimates at 2008 and 2035. These estimates are based upon work by Harvey Economics (Appendix B), which provides population estimates at 2005, 2020, and 2035.

6 It is unclear why demands at 2050 are different between CWCB and WRA's analyses because the underlying data is exactly the same – the differences are approximately 10,000 AF. Two potential explanations for the difference include: 1) different approaches used in rounding off numbers; and 2) inconsistencies in calculating the demand projection for certain basins introduced by Harvey Economics (see WRA Comment Letter to CWCB, October 2009).

per day to acre feet per year (AFY). For the year 2000, demands are taken directly from SWSI I; analogous to the practice followed in CWCB's draft report.

Self-supplied industrial (SSI) water demands include large industry, snowmaking, thermo electric power generation, and direct energy development. These were estimated in CWCB's report for 2008, 2035, and 2050 and are translated to this analysis in the following manner: year 2000 demands are taken from SWSI I; CWCB's 2008 demands are used as a proxy for 2005 and 2010; SSI demands for 2035 and 2050 are taken directly from CWCB's report; and linear interpolation is used to calculate demands between 2010 and 2035.

Total M&I demands are calculated by adding M&I demands and SII demands together – this analysis only presents total M&I demands. An example is provided below for purposes of illustration.

Baseline Demands Calculation Example

County	2020 Population	Water Use Factor (gpcd)	Conservation Level	Savings at 2020	SSI Demands at 2020 (AF)
El Paso	755,000	178	2	5.3%	0
Summit	41,000	252	2	5.3%	2,100

El Paso County demands at 2020: (755,000 * 178 / 892.15) + 0 = 150,600 AF

Summit County demands at 2020: (41,000 * 252 / 892.15) + 2,100 = 13,700 AF

Level 1 Conservation Scenario

Level 1, or passive conservation, is defined as the natural replacement of indoor plumbing fixtures over time. The U.S. Energy Policy Act of 1992 specifies maximum flow requirements for the manufacture of various indoor plumbing fixtures, including 1.6 gallon per flush toilets and 2.5 gallon per minute showerheads. As homeowners gradually replace their older, broken, or out-of-date fixtures with new, more water-efficient options, per capita water use will "naturally" be reduced.

SWSI I estimated the impacts of *Level 1* conservation by analyzing several utility studies from across the nation, and concluded that *Level 1* conservation would reduce demand by about 6% over the course of 30 years.[7] In effect, *Level 1* conservation is mandated by national law and will happen regardless of any utility efforts. Recent technology improvements, such as 1.28 gallon per flush toilets and 1.5 gallon per minute showerheads, make it increasingly likely that state or U.S. plumbing codes will be updated at sometime during the next 40 years, leading to even more passive demand reductions.

Level 1 Results

Including the effects of *Level* 1 conservation will reduce statewide water demands at 2050 to between 2.0 and 2.7 million AF (Figure 6, Table 5). Compared to baseline demands at 2035, *Level 1* conservation will reduce demands by 55,000 AFY in

[7] CWCB. 2004. Statewide Water Supply Initiative Report. November. http://cwcb.state.co.us/IWMD/SWSI-TechnicalResources/.

the South Platte basin, by more than 16,000 AFY in the Arkansas basin, and by as much as 87,000 AFY statewide (Table 6). By 2050, *Level 1* conservation will save upwards of 135,000 AFY statewide. The amount of water saved by *Level 1* conservation is significant and will play an important role in statewide water planning.

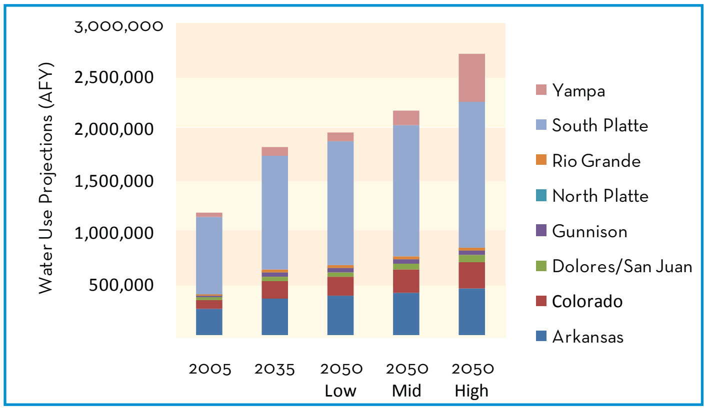

Figure 6. Total M&I water demands by basin – Level 1 scenario.

Basin	2005	2035	2050 Low	2050 Mid	2050 High
Arkansas	251,900	363,800	390,000	418,900	458,100
Colorado	89,100	161,600	178,300	213,800	252,900
Dolores/San Juan	24,800	45,100	48,000	55,300	62,500
Gunnison	20,100	36,600	40,000	44,700	49,700
North Platte	500	600	600	700	900
Rio Grande	17,900	23,200	25,100	27,200	30,100
South Platte	741,400	1,096,300	1,195,600	1,272,800	1,398,700
Yampa	35,000	87,000	84,900	138,400	465,500
Statewide	1,180,700	1,814,200	1,962,500	2,171,800	2,718,400

Table 5. Total M&I water demands by basin – Level 1 scenario.

Basin	2005	2035	2050 Low	2050 Mid	2050 High
Arkansas	-	16,400	21,500	23,100	25,500
Colorado	-	8,700	11,600	13,900	16,500
Dolores/San Juan	-	2,300	2,900	3,300	3,700
Gunnison	-	2,000	2,600	2,900	3,300
North Platte	-	-	100	100	-
Rio Grande	-	1,300	1,700	1,800	2,000
South Platte	-	54,900	72,400	76,900	84,500
Yampa	-	1,000	1,400	1,700	2,200
Statewide	-	86,600	114,200	123,700	137,700

Table 6. Conservation savings attributable to Level 1 conservation.

Methodology

This analysis calculates demands under a *Level 1* conservation scenario using the same methodology as CWCB used in SWSI I.

Conservation Levels

It is necessary to estimate conservation savings over time in order to approximate future demands. SWSI I estimated the percent demand reductions for five conservation levels from 2000 to 2030. Demand reductions for any one level gradually decrease over time as conservation programs penetrate the customer base and fewer opportunities remain available at that level of effort. This pattern of decreasing effectiveness over time is used to further project SWSI I estimates of demand reductions from 2030 to 2050 (Table 7, Figure 7).

Conservation Level	2000	2010	2020	2030	2040	2050
Level 1	0.0%	2.5%	4.5%	6.0%	7.0%	7.5%
Level 2	0.0%	6.5%	8.5%	10.0%	12.0%	13.0%
Level 3	0.0%	7.5%	12.5%	16.0%	19.5%	22.0%
Level 4	0.0%	12.5%	19.5%	26.0%	32.0%	36.5%
Level 5	0.0%	17.5%	29.5%	41.0%	50.0%	55.0%
1% per Year	0.0%	9.6%	18.2%	26.0%	33.1%	39.5%

Table 7. Demand reductions associated with each conservation level.

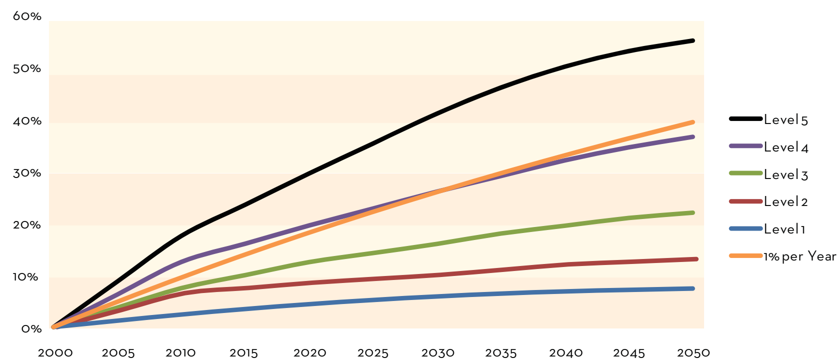

Figure 7. Demand reductions associated with each conservation level.

Reducing Demands with Conservation

Future demands that incorporate *Level 1* conservation savings are lower than baseline demands. The percent demand reductions described above assume savings start in the year 2000, but baseline demands in this analysis are calculated using a gpcd value that was reported in 2007. Reducing demands through conservation should reflect the *future effects* of conservation, so to correct for the difference in time periods, WRA assumed that all counties achieved a 1.3% drop in water use – commensurate with following the "path" of *Level 1* conservation from 2000 to 2005.[8] Accordingly, we adjust the potential savings (%) for each level of conservation to those shown in Table 8.

Conservation Level	2000	2010	2020	2030	2040	2050
Level 1	0.0%	1.3%	3.3%	4.8%	5.8%	6.3%
Level 2	0.0%	3.3%	5.3%	6.8%	8.8%	9.8%
Level 3	0.0%	3.8%	8.8%	12.3%	15.8%	18.3%
Level 4	0.0%	6.3%	13.3%	19.8%	25.8%	30.3%
Level 5	0.0%	8.8%	20.8%	32.3%	41.3%	46.3%
1% per Year	0.0%	4.7%	13.3%	21.1%	28.2%	34.6%

Table 8. Adjusted demand reductions with 2005 baseline.

[8] In fact, several basins achieved much greater reductions in water use than 1.3% from 2000 to 2007. For instance, providers in the Arkansas River and South Platte River basins reduced per capita water use by 12% and 13%, respectively. However, the Colorado, Dolores/San Juan, North Platte, and Rio Grande basins all increased their per capita water use over the same time period.

Level 1 demands are calculated by multiplying baseline M&I demands by the percent demand reduction described above. SSI needs are then added to calculate total demands. An example is provided for illustrative purposes.

Level 1 Demands Calculation Example

County	2020 Population	Water Use Factor (gpcd)	Conservation Level	Savings at 2020	SSI Demands at 2020 (AF)
El Paso	755,000	178	2	3.3%	0
Summit	41,000	252	2	3.3%	2,100

El Paso County demands at 2020: (755,000 * 178 / 892.15) + (1-0.033)+0=145,700 AF
Summit County demands at 2020: (41,000 * 252 / 892.15) + (1-0.033)+2,100=13,300AF

Current Conservation Scenario

According to SWSI I, two-thirds of Colorado counties – including all of the most populous ones – report to be engaged in "active" water conservation programs (i.e. Level 2 or 3).[9] Level 2 conservation includes the savings achieved through passive conservation (*Level 1*), plus the savings associated with metering and leak detection. Level 3 includes all of the Level 2 programs plus the savings achieved through education, rebates, audits, and increasing-block rate structures. These active water conservation programs will reduce future water demands by an even greater amount than described for the *Level 1* scenario.

Given today's current statewide efforts aimed at improving water conservation and the growing recognition that conservation and efficiency will play an important role in meeting the future water needs of this state, it is likely that Colorado water providers will continue their existing conservation efforts.

Current Conservation Results

Including the impacts of existing conservation programs will reduce statewide water demands at 2050 to between 1.8 and 2.5 million AF (Figure 8, Table 9). Compared to baseline demands at 2035, existing conservation efforts will reduce future water demands by 135,000 AFY in the South Platte basin, by almost 25,000 AFY in the Arkansas basin, and by more than 190,000 AFY statewide (Table 10). By 2050, current conservation programs in the rapidly growing Colorado River basin will save almost 45,000 AFY, surpassing the savings achieved in the Arkansas basin, and statewide savings could be as high as 328,000 AFY.

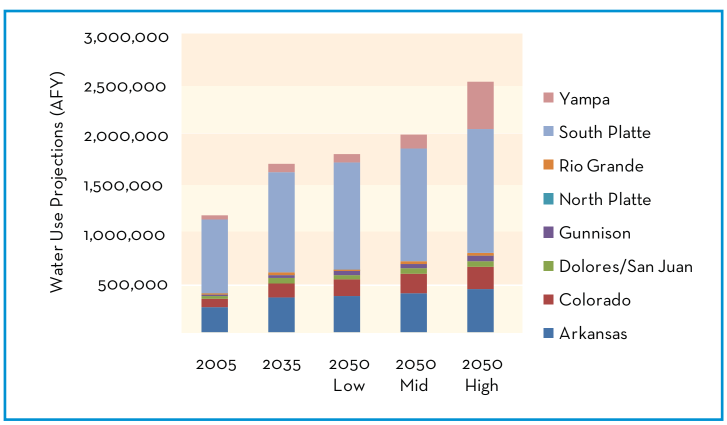

Figure 8. Total M&I water demands by basin – Current Conservation scenario.

9 Each county's estimated conservation level is indicated in Table 16, Appendix E of SWSI I.

Basin	2005	2035	2050 Low	2050 Mid	2050 High
Arkansas	251,900	302,800	292,700	313,900	342,600
Colorado	89,100	129,400	125,800	150,700	178,300
Dolores/San Juan	24,800	36,700	34,900	40,100	45,500
Gunnison	20,100	29,200	28,100	31,400	34,900
North Platte	500	500	400	500	600
Rio Grande	17,900	18,500	17,500	19,000	21,000
South Platte	741,400	892,700	867,200	923,900	1,015,300
Yampa	35,000	83,300	78,700	130,500	455,300
Statewide	1,180,700	1,493,100	1,445,300	1,610,000	2,093,500

Table 9. Total M&I water demands by basin – Current Conservation scenario.

Basin	2005	2035	2050 Low	2050 Mid	2050 High
Arkansas	-	24,700	34,100	36,700	40,500
Colorado	-	22,100	31,800	38,000	44,900
Dolores/San Juan	-	4,300	5,800	6,700	7,500
Gunnison	-	2,800	3,900	4,400	4,900
North Platte	-	-	100	100	-
Rio Grande	-	1,500	2,000	2,200	2,400
South Platte	-	135,200	192,000	204,100	225,000
Yampa	-	1,300	1,900	2,300	2,900
Statewide	-	191,900	271,600	294,500	328,100

Table 10. Conservation savings attributable to Current Conservation programs.

These water savings likely represent a low-end estimate. The *Current Conservation* scenario is based on data presented in SWSI I, describing programs that were active in the years before and after 2002. Many utilities have increased their conservation efforts since this time period, due in part to the 2002 drought, and this advancement is not captured in this report.

Methodology

Calculating demands under the *Current Conservation* scenario follows a parallel methodology to the *Level 1* scenario, with slight modification. Instead of applying a set percent demand reduction for all counties, in the *Current Conservation* scenario, future demands are reduced according to each specific county's conservation level, as identified in SWSI I.[10] SSI demands are then added to calculate total demands. An example is provided below for illustrative purposes.

Current Conservation Demands Calculation Example

County	2020 Population	Water Use Factor (gpcd)	Conservation Level	Savings at 2020	SSI Demands at 2020 (AF)
El Paso	755,000	178	2	5.3%	0
Summit	41,000	252	2	5.3%	2,100

El Paso County demands at 2020: (755,000 * 178 / 892.15) * (1-0.053) + 0 = 142,700 AF

Summit County demands at 2020: (41,000 * 252 / 892.15) * (1-0.053) + 2,100 = 13,000 AF

[10] Each county's conservation level is indicated in Table 16, Appendix E of SWSI I. The demand reduction percentages using a 2005 starting point are described in Table 8.

1% per Year Scenario

A 1% per year reduction in demand is a reasonable and achievable goal for Colorado Utilities

Based on the current planning goals of several municipal water providers across the Southwest and the continuing improvement of technology in the water use sector, WRA believes that a one-percent per year reduction in demand over the next 40 years is a reasonable and achievable goal for Colorado utilities. In this context, "*1% per Year*" means a one percent reduction in demand from the year immediately prior. Over the course of 50 years, a *1% per Year* reduction in demand is equivalent to a 39.5% reduction in water use, not a 50% decrease. Like the other levels of conservation described previously, this scenario accounts for the fact that demand reductions gradually decrease over time as conservation programs penetrate the customer base.

Many utilities across the nation are setting goals to reduce water use at one-percent per year or greater, suggesting that this strategy has merit. In addition, a recent executive order from President Obama directed federal agencies to "improve water use efficiency and management by reducing potable water consumption intensity by two percent annually through fiscal year 2020."[11] Denver Water is aiming to reduce water use 22% from 2001 levels by 2016, a goal of almost 1.5% per year.[12] St. George, Utah is planning to lower their per capita water use by 1.5-2% per year.[13] The town of Cary, North Carolina, set a goal to reduce water consumption 20% from 1995 levels by 2015.[14] Seattle Public Utilities and their purveyor partners approved a 1% conservation program as the approach to programmatic conservation across the utility's regional service area.[15] Finally, the Southern Nevada Water Authority is planning to reduce 2008 water use by more than 50 gpcd by 2035, equivalent to the *1% per Year* reduction described in this report.[16]

It is reasonable to assume that conservation savings can follow a *1% per Year* reduction for the next 40 to 50 years for several reasons. First, Front Range utilities have demonstrated a significant reduction in water use over the past several years. Between 2000 and 2007, water use in the Arkansas and South Platte basins declined by 12% and 13%, respectively – a reduction of 1.75% per year. Secondly, water conservation technologies will continue to advance over the coming decades, as they have over the past several. In fact, today's water-smart housing that incorporates existing technology can already achieve a 35-50% reduction in water use compared to normal residential developments, suggesting that a majority of the conservation savings can be achieved using current technologies.[17]

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11 The White House, Office of the Press Secretary. 2009. Executive Order: Federal Leadership in Environmental, Energy, and Economic Performance. October, 5.

12 Denver Water. Conservation Plan. http://www.denverwater.org/Conservation/ConservationPlan/ (accessed October 26, 2009).

13 City of St. George. 2008. City of St. George Water Conservation Plan Update. January. http://www.sgcity.org/conservation/2008%20Conservation%20Plan%20Update.pdf.

14 Town of Cary. Integrated Water Resources Management Plan. http://www.townofcary.org/Departments/Public_Works_and_Utilities/Conservation/Water_Conservation/Integrated_Water_Resources_Management_Plan.htm (accessed October 26, 2009).

15 Seattle Public Utilities. 2002. Ten Year Conservation Program Plan. September. http://www.seattle.gov/util/stellent/groups/public/@spu/@csb/documents/webcontent/cos_002837.pdf.

16 Southern Nevada Water Authority. 2009. Water Resource Plan 09. http://www.snwa.com/assets/pdf/wr_plan.pdf.

17 Western Resource Advocates. 2009. New House, New Paradigm: A model for How to Plan, Live, and Build Water-Smart. http://www.westernresourceadvocates.org/water/newparadigm/report.php.

Demand reductions of *1% per Year* are a step above most current conservation programs and would involve additional Level 3 activities, plus programs such as strong conservation-oriented rate structures, landscape retrofit rebates, increased coordination between land use agencies and water providers, and full-scale integrated water supply and demand planning. It is important to remember that all of these programs do not need to be initiated right away; most every utility has the ability to reduce water use by one-percent per year over the next few years by starting with small, easy-to-implement programs, and building up to more comprehensive programs over time. This level of conservation is likely achievable across the state and should be looked at as a viable solution to reducing our future water needs.

1% per Year Results

Achieving a *1% per Year* reduction in water use will reduce statewide demands at 2050 to between 1.4 and 2.1 million AF (Figure 9, Table 11). Compared to baseline demands at 2035, a *1% per Year* scenario will reduce future water demands by almost 260,000 AFY in the South Platte basin, by more than 77,000 AFY in the Arkansas basin, and by almost 408,000 AFY statewide (Table 12). By 2050, statewide savings could be as high as 763,000 AFY.

Methodology

Calculating demands under the 1% per Year scenario follows the same methodology as the Level 1 scenario, but uses one-percent per year demand reductions. An example is provided for illustrative purposes.

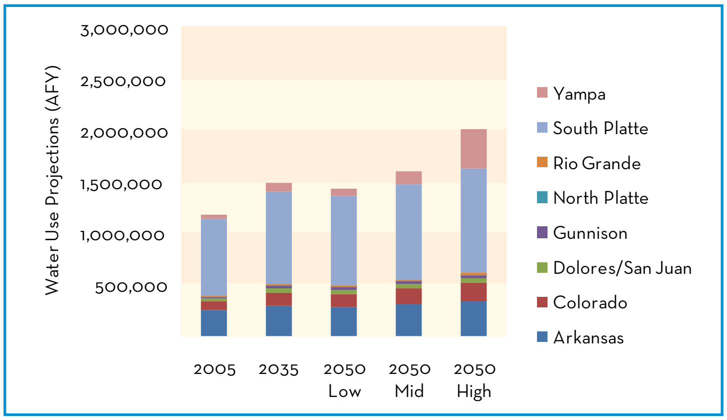


Figure 9. Total M&I water demands by basin – 1% per Year scenario.

Basin	2005	2035	2050 Low	2050 Mid	2050 High
Arkansas	251,900	302,800	292,700	313,900	342,600
Colorado	89,100	129,400	125,800	150,700	178,300
Dolores/San Juan	24,800	36,700	34,900	40,100	45,500
Gunnison	20,100	29,200	28,100	31,400	34,900
North Platte	500	500	400	500	600
Rio Grande	17,900	18,500	17,500	19,000	21,000
South Platte	741,400	892,700	867,200	923,900	1,015,300
Yampa	35,000	83,300	78,700	130,500	455,300
Statewide	1,180,700	1,493,100	1,445,300	1,610,000	2,093,500

Table 11. Total M&I water demands by basin – 1% per Year scenario.

Basin	2005	2035	2050 Low	2050 Mid	2050 High
Arkansas	-	77,400	118,800	128,100	141,000
Colorado	-	40,900	64,100	77,000	91,100
Dolores/San Juan	-	10,700	16,000	18,500	20,700
Gunnison	-	9,400	14,500	16,200	18,100
North Platte	-	100	300	300	300
Rio Grande	-	6,000	9,300	10,000	11,100
South Platte	-	258,500	400,800	425,800	467,900
Yampa	-	4,700	7,600	9,600	12,400
Statewide	-	407,700	631,400	685,500	762,600

Table 12. Conservation savings attributable to 1% per Year scenario.

1% per Year Demands Calculation Example

County	2020 Population	Water Use Factor (gpcd)	1% per Year Savings at 2020	SSI Demands at 2020 (AF)
El Paso	755,000	178	13.3%	0
Summit	41,000	252	13.3%	2,100

El Paso County demands at 2020: (755,000 * 178 / 892.15) * (1-0.133) + 0 = 130,600 AF
Summit County demands at 2020: (41,000 * 252 / 892.15) * (1-0.133) + 2,100 = 12,100 AF

Comparing Conservation Scenarios

Estimates of future water demand in Colorado will be very different depending on how conservation is incorporated. Cleary, the baseline scenario presents a maximum demand estimate that will likely never be reached due to federally-mandated and existing conservation programs that will reduce future demands. Both the *Level 1* and *Current Conservation* scenarios do not incorporate potential future updates to plumbing codes or potential improvements to conservation planning across the state, so they too may overestimate demands. Although the *1% per Year* scenario will require additional funding and planning efforts to implement, it may also not reflect the lowest possible future demand; the state's population growth may not be as great as projected, new technologies may be invented that cut water use dramatically, and perceptions may change about the value of water all of which would result in lower than projected demand. Forty years is a long time from now, and significant changes to current demand projections are possible.

Under mid-population growth projections, Colorado's future demands at 2050 could be as high as 2,296,000 AF under a baseline scenario, but will likely be closer to 2,001,000 AF due to passive and active conservation efforts (Figure 10). Under a *1% per Year* conservation scenario, total demand at 2050 could be as low as 1,610,000 AF, average system-wide municipal water use would be greater than 115 gpcd for every basin, and only a handful of individual counties' water use would average less than 100 gpcd (Figure 11). These water use values may seem low, but consider that in 2006, system-wide water use in Aurora, Boulder, and Evans was 152 gpcd, 148 gpcd, and 111 gpcd, respectively.[18] These values are comparable with projected water use rates at 2050 under the *Current Conservation* scenario for several counties, indicating that even lower targets are achievable.

18 Western Resource Advocates. 2007. Front Range Water Meter. November. http://www.westernresourceadvocates.org/watermeter/.

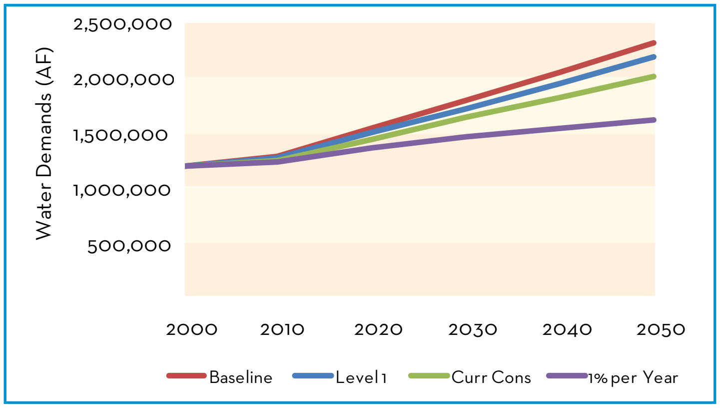


Figure 10. Estimate of statewide municipal water demands using a middle population growth rate.

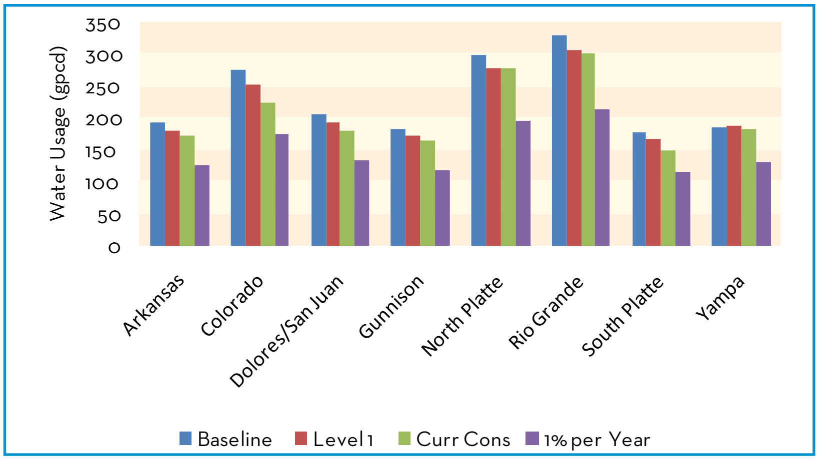


Figure 11. Population-weighted water use by basin at 2050.

Reassessing the "Gap"

Over the past several years, CWCB has released reports that estimate Colorado's future municipal water demands, comparing them to identified projects and processes (IPPs) that will increase existing water supplies. The remaining demand not met by IPPs is often referred to as the "Gap" – most recent CWCB reports call it "water needs" – and this deficit is a major focus of CWCB's current planning efforts. Presently, CWCB is engaging water providers and other stakeholders in the Basin Roundtable and Interbasin Compact Committee processes to identify the best ways to increase future municipal water supplies. Recent meetings suggest that these groups are focusing on three major supply options: agricultural transfers, transbasin diversions, and conservation.

As discussed earlier in this analysis, CWCB's draft report assumes all future residents will use water at the same rate as today, which is unlikely. Existing residents will decrease their water use through passive conservation, and many water providers are currently engaged in active conservation programs well above this "*Level 1*" amount that will further reduce per capita water use. Finally, new developments that are necessary to house Colorado's future residents can be built in a water-smart manner to achieve much lower use rates than existing developments.[19]

By better incorporating conservation savings into future demand projections, CWCB can show that demands are likely to be lower than originally anticipated.

[19] A recent report by Western Resource Advocates demonstrates that new water-smart residential developments are capable of reducing water use by 35-50% compared to existing housing stock. WRA. 2009. New House, New Paradigm. http://www.westernresourceadvocates.org/water/newparadigm/report.php.

Statewide "Gap" Results

The first results presented below assume that 100% of IPPs will be implemented successfully. CWCB is currently reassessing the IPPs identified in SWSI I and will be tracking their implementation in the future through the Basin Needs Decision Support System. Because some of the originally identified IPPs are not moving forward as planned, there is concern that all IPPs may not be implemented. Consequently, results assuming a 50% and 25% success rate of IPPs are presented later, but without extended discussion.

Under the baseline scenario, unmet water needs will occur in 2030, starting at 76,000 AFY (Table 13). By 2050, unmet needs will range between 370,000 AFY and 1.15 million AFY and total demands will range between 2.08 and 2.86 million AFY, depending on population growth scenarios (Figure 12). As discussed earlier, this represents a maximum demand scenario because conservation efforts will likely reduce future demands.

Under the Level 1 conservation scenario, unmet water needs will also begin to occur in 2030, but they will be much lower, at only 3,000 AFY (Table 13). By 2050, unmet needs will range between 256,000 AFY and 1.01 million AFY, and total demands will range between 1.96 and 2.72 million AFY (Figure 13).

Under the Current Conservation scenario, unmet water needs occur at the same time and magnitude as under the Level 1 scenario – 3,000 AFY in 2030 (Table 13). This is because many providers identified active conservation as an IPP in their planning processes, and conservation is not double-counted in this analysis as both a reduction in demand and an IPP. The shrinking of the IPP wedge by about 82,000 AF between Figure 13 and Figure 14 illustrates this impact. By 2050, unmet needs will range between 181,000 and 904,000 AFY, and total demands will range between 1.81 and 2.53 million AFY (Figure 14).

Under the 1% per Year scenario, unmet water needs do not exist at 2050 for the low and medium population growth projections (Table 13) – i.e. there is no "Gap." To be clear, this is a statewide projection and does not take into account basin-specific water demands and IPPs that are tied to local needs. That is, certain basins may still experience water shortages, while others have surplus water supplies. At 2050 under the high growth scenario, unmet needs may be as great as 470,000 AFY. Total demands at 2050 range between 1.45 and 2.09 million AFY (Figure 15).

Year	Baseline	Level 1	Current	1% per Year
2000	-	-	-	-
2005	-	-	-	-
2010	-	-	-	-
2015	-	-	-	-
2020	-	-	-	-
2025	-	-	-	-
2030	76,300	3,000	3,000	-
2035	194,500	108,000	84,900	-
2050 Low	370,300	256,200	181,200	-
2050 Med	589,300	465,500	377,100	-
2050 High	1,149,800	1,012,000	904,100	469,500

Table 13. Statewide projected quantity and timing of unmet water needs by conservation scenario – 100% IPPs.

Figure 12-15. Statewide projected total water demands, supplies, and water needs.

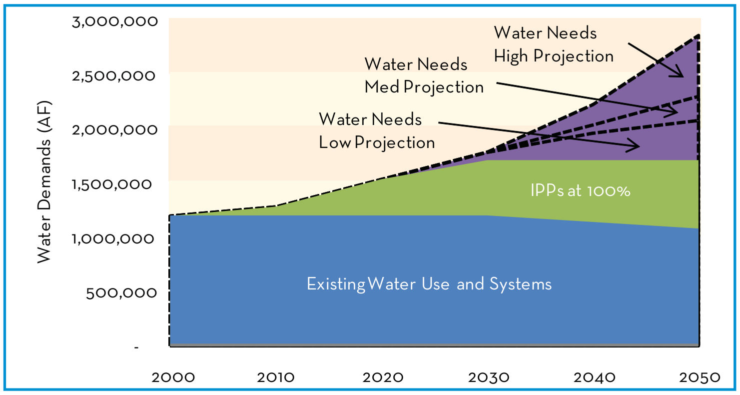


Figure 12. Baseline scenario.

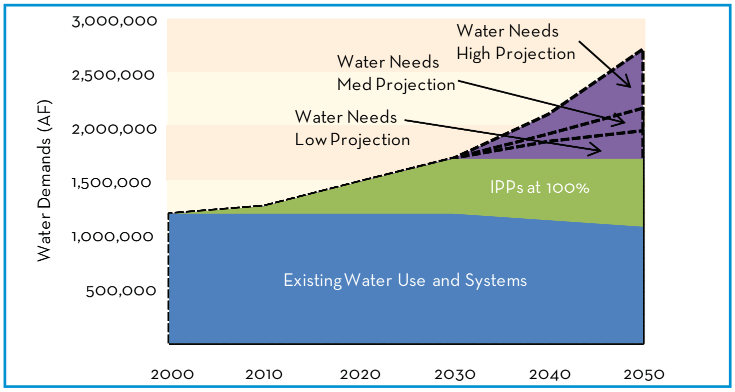


Figure 13. Level 1 scenario.

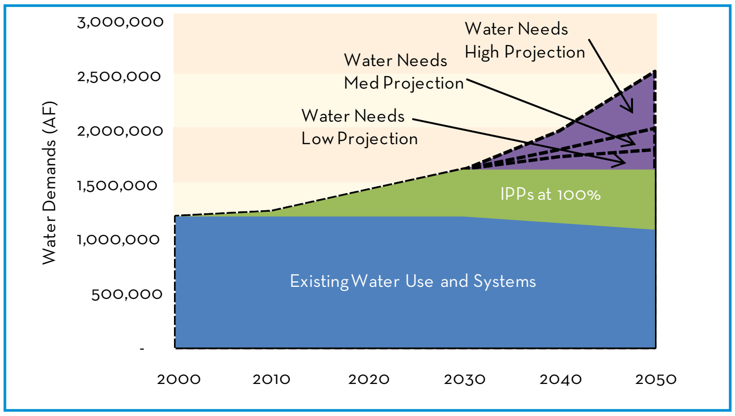


Figure 14. Current Conservation scenario.

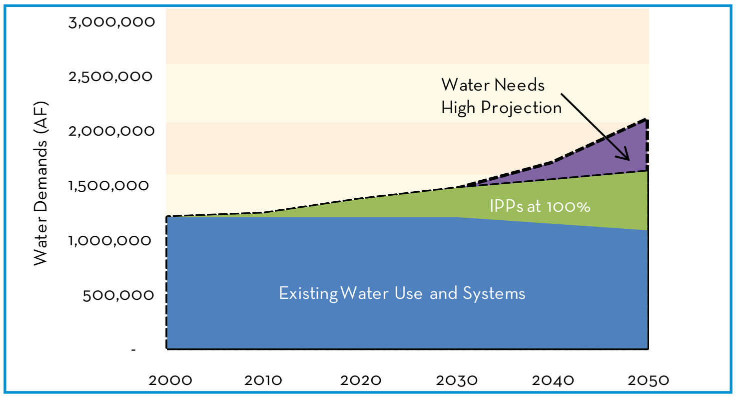


Figure 15. 1% per Year scenario.

50% of IPPs Results

If only 50% of IPPs are successfully implemented, unmet water needs start approximately 10 years earlier – in 2020, rather than 2030 (Table 14, Figure 16, Figure 17, Figure 18). In the 1% per Year scenario, additional water supply is needed in 2025 (Figure 19). Under the Current Conservation scenario, total unmet water needs at 2050 range from 396,000 AFY to 1.12 million AFY rather than 181,000 to 904,000 AFY if 100% of IPPs are successful.

Year	Baseline	Level 1	Current Conservation	1% per Year
2000	-	-	-	-
2005	-	-	-	-
2010	-	-	-	-
2015	-	-	-	-
2020	81,400	38,600	25,300	-
2025	209,500	152,200	125,400	2,500
2030	332,000	258,700	217,500	47,300
2035	450,200	363,700	299,300	83,500
2050 Low	626,000	512,000	395,700	35,800
2050 Med	845,000	721,200	591,600	200,500
2050 High	1,405,500	1,267,700	1,118,600	684,000

Table 14. Statewide projected quantity and timing of unmet water needs by conservation scenario – 50% IPPs.

Figures 16-19. Statewide projected total water demands, supplies, and water needs with 50% IPPs.

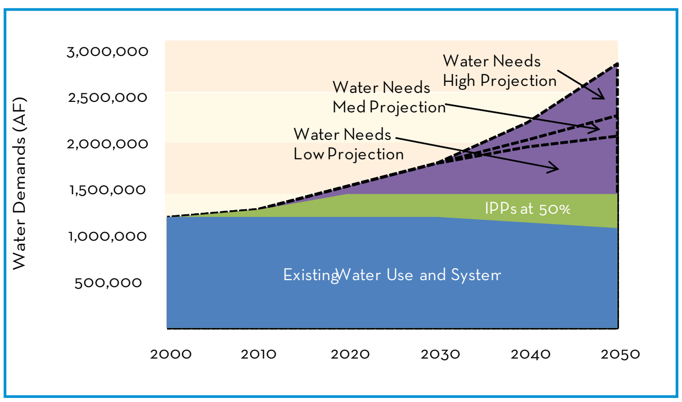


Figure 16. Baseline scenario w/ 50% IPPs.

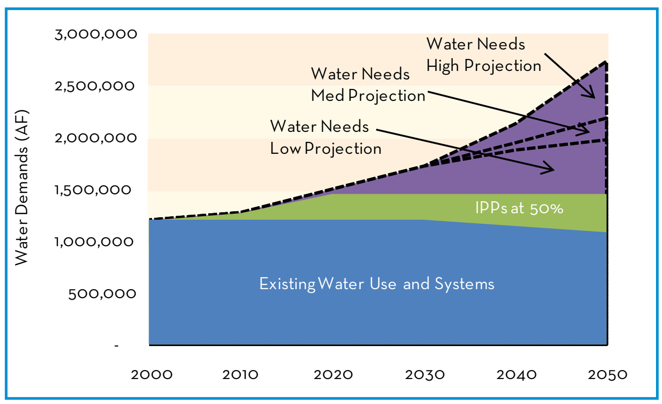


Figure 17. Level 1 scenario w/ 50% IPPs.

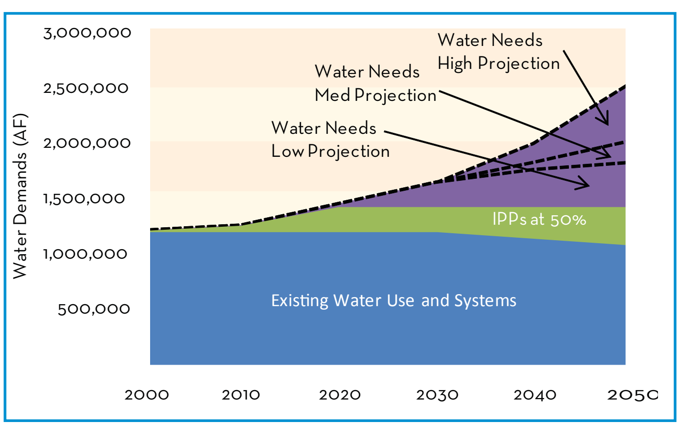


Figure 18. Current Conservation scenario w/ 50% IPPs.

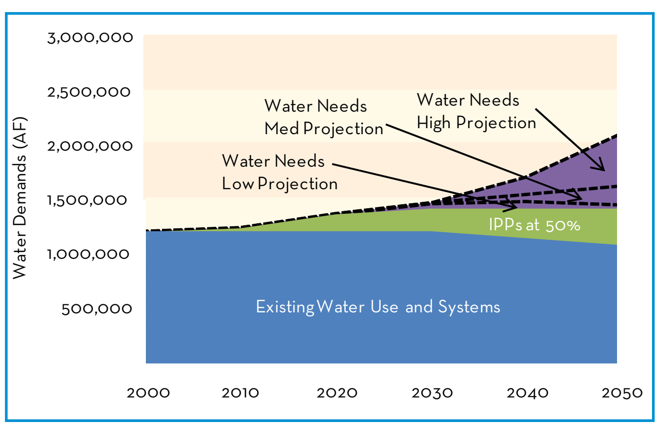


Figure 19. 1% per Year scenario w/ 50% IPPs.

25% of IPPs Results

If only 25% of IPPs are successfully implemented, unmet water needs occur in 2015 under the Baseline and Current Conservation scenarios, and under the 1% per Year scenario, unmet demands occur in 2020 (Table 15, Figure 20, Figure 21, Figure 22, Figure 23). Under the Current Conservation scenario, total unmet water needs at 2050 range from 503,000 AFY to 1.23 million AFY, rather than 181,000 to 904,000 AFY if 100% of IPPs are successful.

Year	Baseline	Level 1	Current Conservation	1% per Year
2000	-	-	-	-
2005	-	-	-	-
2010	-	-	-	-
2015	79,200	52,200	34,500	-
2020	209,300	166,400	132,500	54,400
2025	337,300	280,000	232,600	109,700
2030	459,900	386,600	324,700	154,500
2035	578,000	491,500	406,600	190,800
2050 Low	753,800	639,8000	503,000	143,100
2050 Med	972,900	849,000	698,800	307,800
2050 High	1,533,400	1,395,600	1,225,800	791,200

Table 15. Statewide projected quantity and timing of unmet water needs by conservation scenario – 25% IPPs.

Figures 20-23. Statewide projected total water demands, supplies, and water needs with 25% IPPs.

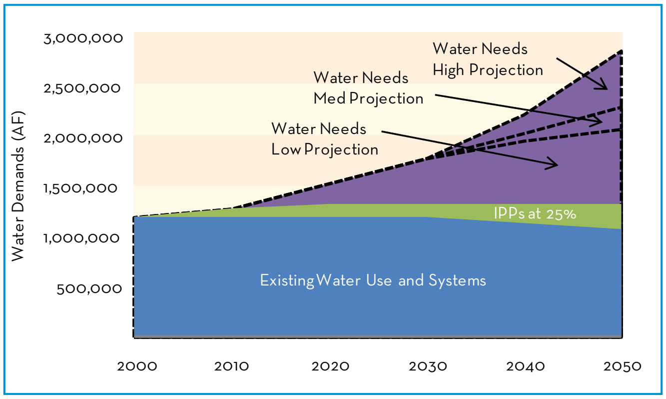


Figure 20. Baseline scenario w/ 25% IPPs.

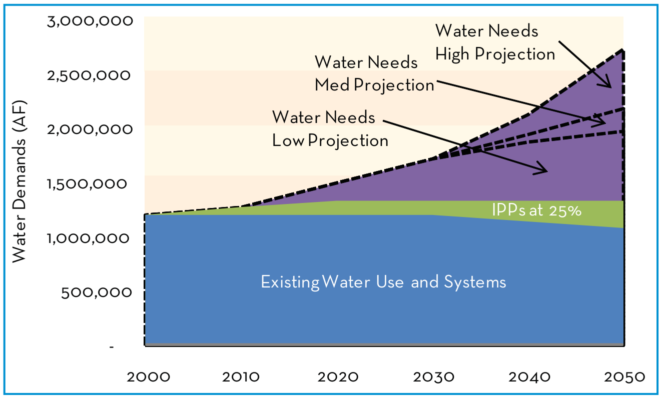


Figure 21. Level 1 scenario w/ 25% IPPs.

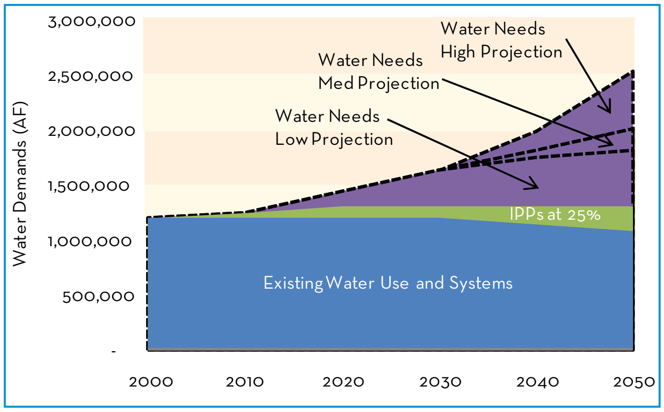


Figure 22. Current Conservation scenario w/ 25% IPPs.

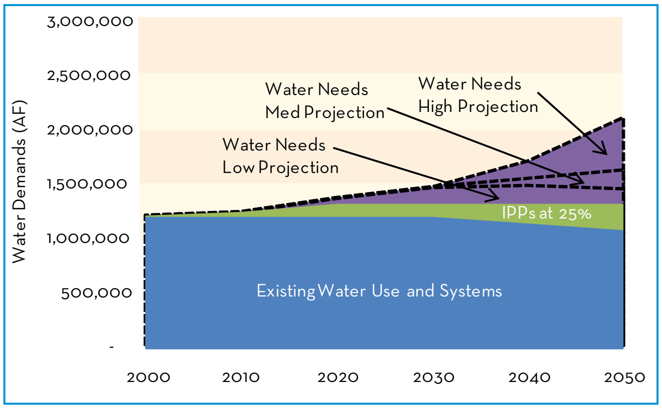


Figure 23. 1% per Year scenario w/ 25% IPPs.

Conservation as an IPP

At the time of writing, CWCB is treating conservation as an IPP – providing additional supply – rather than a decrease in demand. This approach is contrary to how the majority of water providers model conservation. None the less, graphs showing conservation as an IPP “wedge” are provided below to align with CWCB’s current efforts. Reporting conservation as a reduction in demand or as an IPP does not affect the magnitude or timing of unmet future water needs. Therefore, the data presented in the tables for each scenario listed above (Table 13, Table 14, Table 15) also holds true for the following figures which show an IPP success rate of 100% (Figure 24, Figure 25, and Figure 26).

Figures 24-26. Statewide projected total water demands, supplies, conservation and water needs.

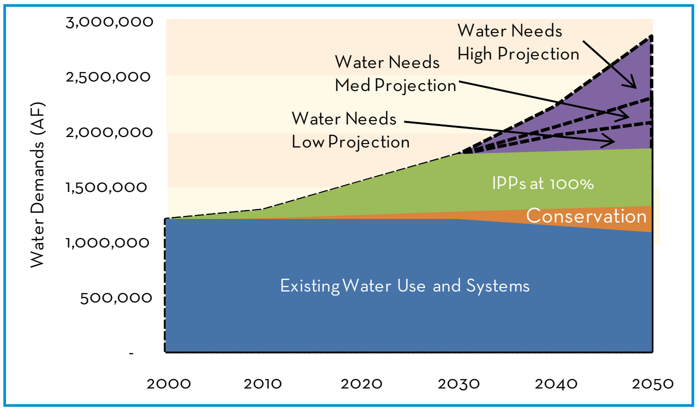


Figure 24. Level 1 scenario.

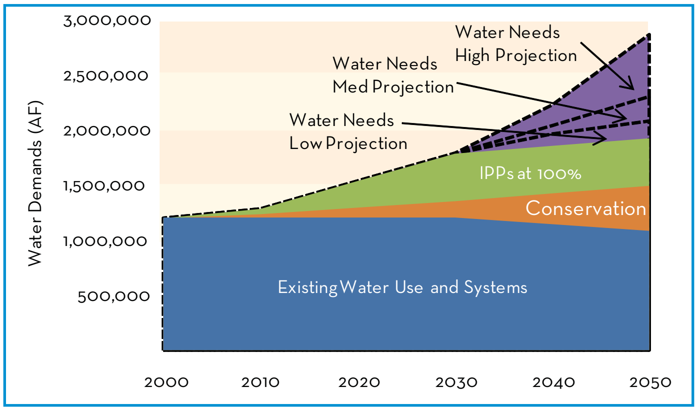


Figure 25. Current Conservation scenario.

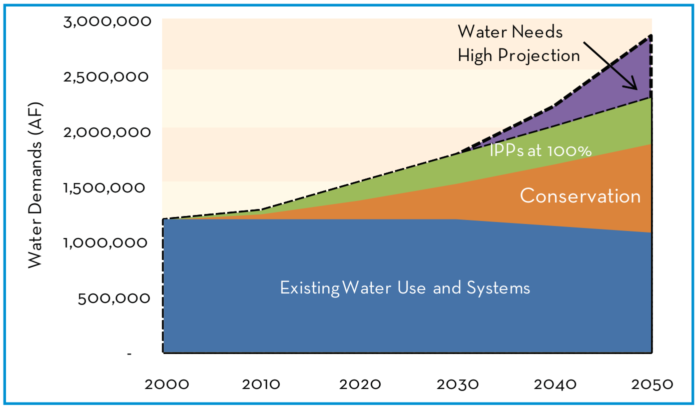


Figure 26. 1% per Year scenario.

Single Basin Targeted Analysis

Estimating future demands at a statewide level is useful for general planning and gaining a full perspective of the issue, but estimates at the river basin level are likely more important for on-the-ground efforts. The following figures provide an estimate of future demands with a 50% success rate of IPPs under the Current Conservation scenario, and future demands under the 1% per Year scenario with a mid population growth projection.

In the Arkansas basin, unmet water needs begin to occur in 2020 at approximately 7,000 AF (Figure 27). By 2050, unmet needs range between 89,000 and 149,000 AFY. Achieving a 1% per Year reduction would delay the occurrence of unmet needs until 2030, and significantly reduce total needs at 2050.

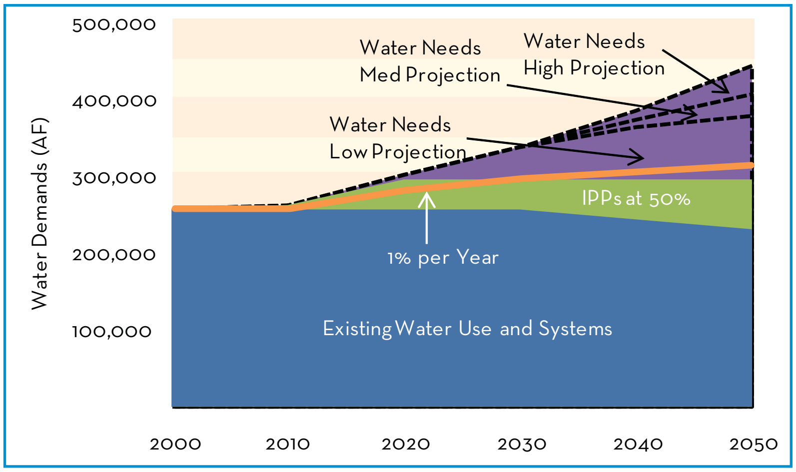


Figure 27. Arkansas basin projected total water demands, supplies, and water needs – Current Conservation scenario w/ 50% IPPs and demands under a 1% per Year conservation scenario.

In the Colorado River basin, unmet water needs of approximately 8,000 AF begin to occur as soon as 2015 (Figure 28). By 2050, unmet needs range between 60,000 and 126,000 AFY. Achieving a 1% per Year reduction does not significantly delay the occurrence of unmet needs, but it does significantly reduce total needs at 2050.

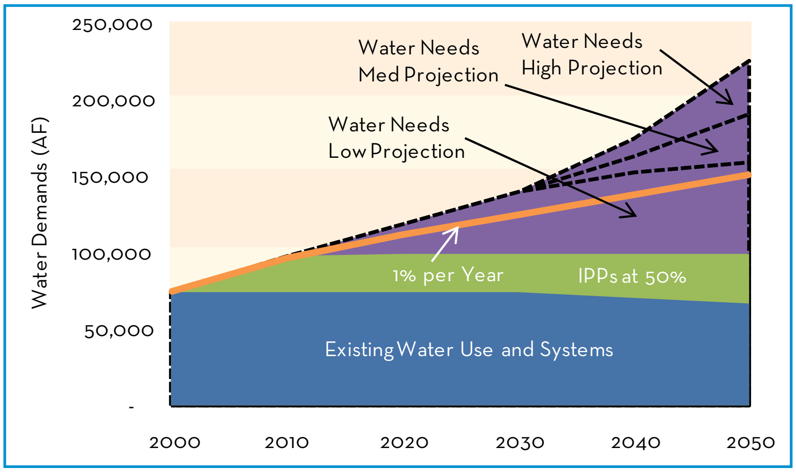


Figure 28. Colorado River basin projected total water demands, supplies, and water needs – Current Conservation scenario w/ 50% IPPs and demands under a 1% per Year conservation scenario.

In the South Platte basin, unmet water needs begin to occur in 2025 at approximately 30,000 AF (Figure 29). By 2050, unmet needs range between 176,000 and 358,000 AFY. Achieving a 1% per Year reduction would delay the occurrence of unmet needs until 2035, and significantly reduce total needs at 2050.

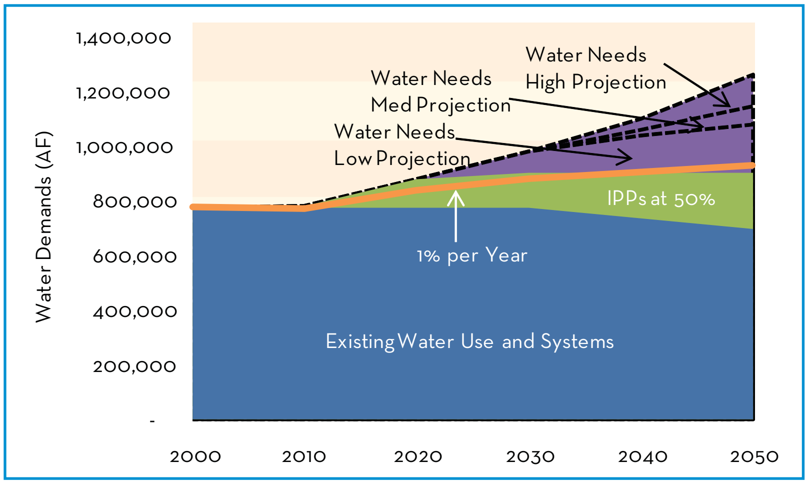


Figure 29. South Platte basin projected total water demands, supplies, and water needs – Current Conservation scenario w/ 50% IPPs and demands under a 1% per Year conservation scenario.

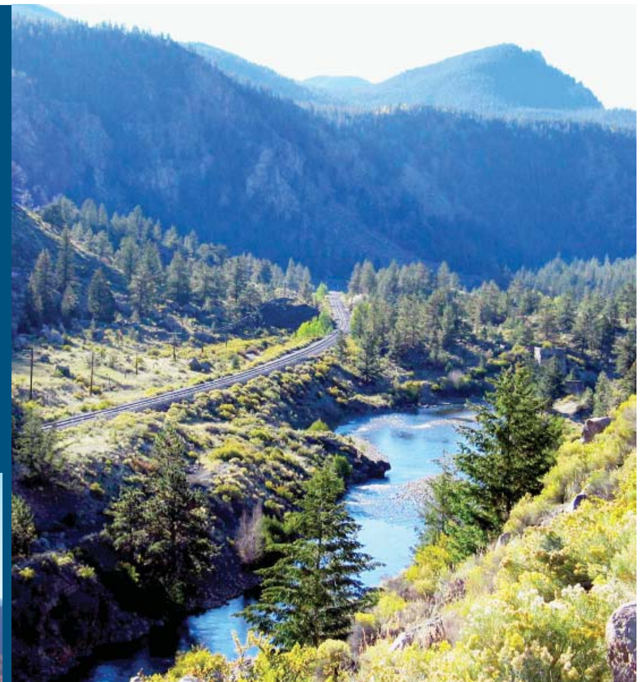
Methodology

In SWSI I, CWCB estimated year 2000 water use in the state to be approximately 1.2 million AFY. The CWCB now evaluates the potential future impact of climate change and/or unsustainable groundwater pumping on the reliability of water supply by modeling a 10% decrease in existing supply from 2030 to 2050.

SWSI I also cataloged the multiple IPPs utilities were planning to boost their existing supplies. If all of these IPPs were successfully implemented, water supplies would increase by just over 500,000 AFY statewide. No effort was made to approximate the timing of implementation of IPPs, so it is assumed that IPPs come online to meet additional demand until all IPPs are realized.The methodology for calculating future demands and estimating the savings attributable to conservation for each scenario is discussed in detail earlier in this report. The estimates of existing water supply, IPP success rate, conservation savings, and future demands are combined in a systematic way to produce the graphs and charts in this section.

While many counties list active conservation (Level 2 or 3 Conservation) as part of their IPPs, SWSI I did not quantify the volumetric amount of this effort. It is necessary to quantify the active conservation portion of IPPs in this analysis so that conservation savings are not double-counted as both an IPP and a reduction in demand. Active conservation is quantified by subtracting Level 1 demands from Current Conservation demands. This estimate provides the volume of water saved by active conservation programs – 82,400 AF – because the Current Conservation scenario includes demand reductions from ongoing conservation while the Level 1 demands do not. One could describe this calculation as separating the IPPs into conservation and "hard infrastructure" projects. Only the supply provided by the hard-infrastructure projects is reduced in the 50% and 25% IPP success-rate graphs.

Water conservation will play an integral role in meeting Colorado's growing water demands. Maximizing conservation helps protect our rivers and watersheds – the lifeblood of this state.



On some graphs (e.g., Figure 12), the low projection of unmet water needs (lowest purple wedge) appears before the IPPs (green wedge) reach their maximum. This is recognizable by a separation between the demand line (black dashed line) and the IPP wedge. This discrepancy is an artifact of graphing on a ten-year time step when the calculations are actually made on a five-year time step. In these cases, the tables presented at the beginning of each results section provide the best information for when unmet water needs are first encountered.

Conclusion

This report builds upon past and current CWCB efforts by exploring the effects of conservation on reducing future needs. The analysis uses updated information provided by CWCB's draft 2050 demands study, but reports the data in a manner consistent with previous CWCB efforts (i.e. SWSI I), enabling a more logical progression for statewide water planning efforts.

The three conservation scenarios evaluated – Level 1, Current Conservation, and 1% per Year – show that incorporating conservation into future demand estimates can significantly reduce those demands. Statewide municipal water demands at 2050 are currently projected to be as high as 2,296,000 AF, but due to the impact of passive and active conservation programs, this analysis estimates that demands will be closer to 2,001,000 AF – a 300,000 AF reduction. If utilities adopt and achieve a one-percent per year conservation goal, demands at 2050 could be as low as 1,610,000 AF – a 700,000 AF reduction.

Incorporating the effects of conservation into future demand projections also reduces the quantity and delays the onset of unmet water needs. Under the baseline scenario, and assuming that only 50% of structural IPPs are implemented successfully, the state is projected to experience unmet needs of 81,000 AF by as soon as 2020. Incorporating current conservation programs into the estimates lowers unmet needs to 25,000 AF – a 55,000 AF reduction. If utilities successfully achieve a one-percent per year conservation goal, unmet water needs could be delayed by five years or more, and by 2050, unmet needs could be as much as 650,000 AF lower. Clearly, conservation can play a major role in filling Colorado's unmet needs.

This report also suggests that a one-percent per year reduction in demand is a reasonable and achievable goal for Colorado utilities over the next 40 years. Several western utilities have already set goals to reduce water use at one-percent per year or more over the coming decades, and presidential action is moving federal agencies to reduce potable water use by two-percent per year. Front Range utilities have demonstrated a significant reduction in water use over the past several years, achieving reductions of 1.75% per year from 2000 to 2007. Moreover, water conservation technologies will continue to advance over the coming decades and today's water-smart housing can already achieve a 35-50% reduction in water use compared to normal residential developments. Forty years is a substantial amount of time to implement effective conservation programs and attain real water savings, but it will be necessary to thoroughly investigate and fund the proper conservation measures for each utility to achieve sustainable water savings.

Recommendations for Future Study

All the analysis described in this report and CWCB's draft report could be improved by addressing issues associated with the accuracy of water use factors, population projections, and percent demand reductions. Each recommendation for improvement is discussed below.

GPCD Water Use Factors

A consistent, defensible, and easily replicable methodology for determining water use rates should be developed and utilized. The values used in this report are from 2000, 2003, 2005, 2006, 2007, and 2008, which are self-reported by utilities, calculated by CWCB consultants, or taken from reports written by various entities. Having such a wide array of data points and methodology – especially over a time period that includes a major drought – may significantly undermine the accuracy of this analysis. Small errors in gpcd (applied over a large population) can lead to large miscalculations in future demands and estimates of unmet water needs.

The New Mexico State Engineer has developed a tool for calculating water use rates in a consistent fashion, which could serve as an example for Colorado.

Population Projections

The population projections should be reevaluated because the current economic downturn in Colorado's economy may have a far-reaching impact on future population growth. Population projections are heavily dependent on the initial rates of population growth, and errors in the first few years are compounded greatly over time. In Appendix B of CWCB's draft 2050 demands report, Harvey Economics argues that the current economic downturn is within the normalcy of Colorado's historic, cyclical economic trends, and therefore, the population projections are sound. However, the data provided in the appendix also suggest that our current economic downturn is the worst Colorado has experienced in the past forty years, with rates of unemployment, foreclosures, and building permits considerably outside the norm. These factors may play a significant role in reducing future population projections across the state and a more up-to-date estimate is worth pursuing.

Percent Demand Reductions

The demand reductions for Level 1, Level 2, and Level 3 percent were estimated in SWSI I. These estimates are based on utility studies from across the West, but it is unknown if similar demand reductions are actually being achieved here in Colorado. Furthermore, Level 1 conservation does not take into account potential updates to future plumbing codes or the current trend in residential building towards lower-water use homes. Analyzing conservation programs in Colorado, and the savings they have achieved here, would provide much needed clarification on this issue.

A related issue is whether or not individual counties are properly identified at their level of conservation. For instance, Denver County is reported to be at Level 3, but one could argue that Denver is engaged in several of the Level 4 conservation activities, including steep rate structures and rebates for irrigation sensors and controllers. Conversely, do all providers in Bent County provide customer education, rebates, audits, and price water in an increasing block structure as suggested by SWSI I? A review of the water conservation plans submitted to CWCB may help address this issue.

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