Fly fishing and canoeing on Dillon Reservoir in Summit County, Colorado.

Acceptable Planned Projects

Front Range water providers are pursuing a wide range of water supply development options, such as more fully exercising existing water rights, building new pipelines, enlarging reservoirs, and transferring water from agriculture. This section identifies the specific projects that Front Range communities are planning that Western Resource Advocates, Trout Unlimited, and the Colorado Environmental Coalition could accept, **if designed and implemented pursuant to our "smart" principles.** We call these projects Acceptable Planned Projects (APPs). We estimate that APPs can provide 102,000 acre-feet of additional water supply annually by 2050.

The "Smart" Principles

In *What the current drought means for water management in Colorado*[12] and *Facing Our Future: A Balanced Water Solution for Colorado*,[13] we recommended that future water supply management and development efforts adhere to a set of basic smart principles. We offered those smart principles as a guide to assure protection of rivers and other natural resources against damage that often results from structural water supply projects. The smart principles are:

- Make full and efficient use of existing water supplies and reusable return flows before developing new diversion projects.

- Improve use of existing water supply infrastructure by integrating systems and sharing resources among water users to avoid unnecessary new diversions and duplication of facilities.

- Recognize the fundamental political and economic inequities and the adverse environmental consequences of new transbasin diversions.

- Expand or enhance existing storage and delivery before building new facilities in presently undeveloped sites, and expand water supplies incrementally to better utilize existing diversion and storage capacities.

- Recognizing that market forces now drive water reallocation from agricultural to municipal uses, structure such transfers, where possible, to maintain agriculture and in all cases to mitigate the adverse impacts to rural communities from these transfers.

These principles are as relevant today as they were six years ago.

- Involve all stakeholders in decision-making processes and fully address the inevitable environmental and socioeconomic impacts of increasing water supplies.

These principles are as relevant today as they were six years ago.

To account for our growing understanding of the possible effects of climate change on water supplies, we add an additional principle to the list:

- Design and operate water diversion projects to leave adequate flows in rivers to support healthy ecosystems under all future scenarios, even if water availability diminishes in the future as a result of climate change or other factors.

Issues Associated with Structural Projects

Reservoirs have been part of Colorado's water development strategy since the late 1800s, in response to our highly variable stream flows. Today, Colorado has more than 7.5 million acre-feet of reservoir storage. About 25% of this capacity directly supports municipal water uses and this fraction is growing, mostly as cities acquire agricultural water rights with their associated storage. The South Platte Basin is second only to the Colorado River Basin in the amount of storage in place.

The traditional purpose for building reservoirs has been to capture excess runoff, which occurs in large volumes relatively infrequently. Consequently, traditional reservoirs are fairly large and located directly in a stream channel. In addition to their environmental impacts, such large, on-stream reservoirs have other major limitations:

- Reservoirs are costly to build and cannot easily be expanded incrementally in response to growing demands. Rather, they must be paid for and constructed "up front," which increases their financial risk and diminishes their economic feasibility.

- As a basin becomes over-appropriated, additional storage produces ever-diminishing returns, in terms of water yield, because unappropriated runoff occurs less frequently and storage carry-over periods become longer.

- Evaporation losses compound the diminishing yield problem, becoming a major limiting factor in reservoirs' ability to provide relief, both over extended drought conditions and during severe droughts that occur every few decades.

- Sedimentation of reservoirs further decreases yield and can only be remedied through the manual removal of accumulated sediment, which is both time-intensive and very costly.

The Moffat Pipeline, part of Denver Water's Gross Reservoir Enlargement project. Photo: Mark Conlin.

- Given the diminishing returns for new storage projects, storage-yield ratios for reservoirs designed to store wet-year water for drought protection are, at best, 5-to-1. This means that for 100,000 acre-feet of additional firm annual supply, the reservoir would have to store over 500,000 acre-feet and would cost well over one billion dollars.

New pipeline proposals—becoming more popular in the traditional water supply planning dialogue—are marred by the same problems because reservoirs are still needed to store any water transferred through a pipeline. Pipelines are also extremely costly to build; the CWCB estimates that six potential pipeline proposals being considered today would each cost in the range of $8-10 billion for capital costs alone.[14] In addition, any new pipeline will require a significant amount of energy to pump water over great distances. Furthermore, these proposals require pumping large quantities of water from remote areas of Colorado or other states, where compact entitlement concerns, water quality issues, relationships with neighboring states, and the local political unpopularity of these projects add to the list of hurdles.

With these limitations in mind, some water providers are increasingly developing "smart storage"—smaller reservoirs designed to optimize already-developed supplies, and capture unappropriated peak-season runoff, to some extent. Smart storage is now commonly developed as a means for capturing and re-regulating reusable return flows, increasing the yields of exchange rights and augmentation plans, re-regulating the yields of changed irrigation rights to meet municipal demand patterns, and increasing yields from existing water rights and transbasin diversions. In some cases, existing traditional storage capacity has been rededicated to smart storage purposes, with resulting increases in yields.

Gross Reservoir is located near Boulder, CO.

Front Range Acceptable Planned Projects

The CWCB refers to water supply projects that are currently in the planning and initial implementation phases as Identified Projects and Processes (IPPs). Because some IPPs do not meet our smart principles, this report does not utilize the complete list of Front Range IPPs. Instead, we present a subset of "Acceptable Planned Projects" (APPs) that are listed and described in Table 1. Note that the far right column of the table identifies issues that must be resolved before we could accept these projects.

CWCB's SWSI 2010 report provides estimates of potential yield for the APPs, even though yield estimates are in flux for some projects.[15] Using the CWCB's estimates, and excepting the Prairie Waters and WISE Partnership Projects, which are included in the Reuse Strategy section of this report, our APPs could collectively produce approximately 102,000 acre-feet of new water supply annually by 2050. This is represented by the APP wedge in Figure 5.

FIGURE Nº 5 ESTIMATE OF FRONT RANGE NEEDS INCLUDING THE ACCEPTABLE PLANNED PROJECTS STRATEGY.

APPs could collectively produce approximately 102,000 acre-feet of new water supply annually by 2050.

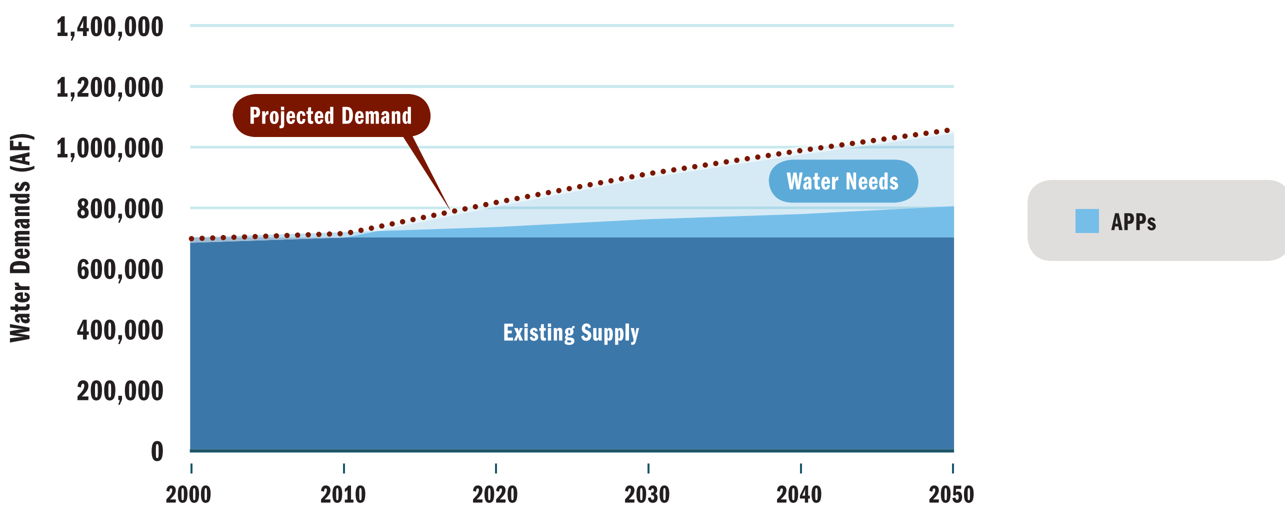


TABLE Nº 1 FRONT RANGE ACCEPTABLE PLANNED PROJECTS.

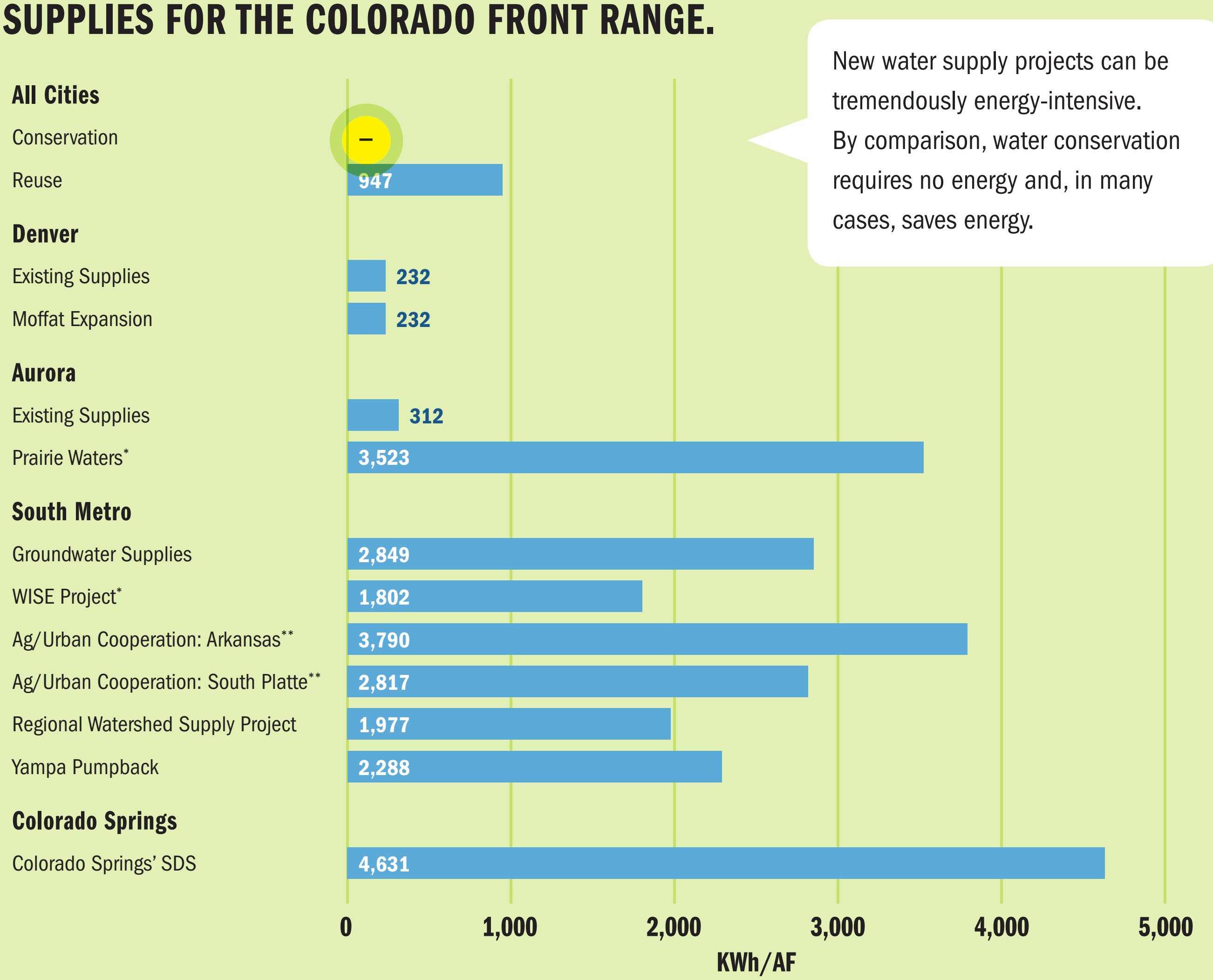
Project Name (Beneficiary)	Potential Yield (AF/year)	Description	Issues To Be Resolved
Reservoirs			
Chatfield Reservoir Reallocation (several central South Platte water suppliers)	8,000	Modify recreational facilities; reallocate 20,600 AF of storage from flood control to urban, agricultural, and instream uses.	Assess and minimize impacts of reservoir fluctuation on recreational facilities, wetlands, and bird habitats.
Gross Reservoir Enlargement (Denver Water)	18,000	Increase storage in existing reservoir by 72,000 AF.	Implement urban efficiency measures first. Adopt adequate, enforceable measures to protect/restore affected upper Colorado River Basin streams, and South Boulder Creek water quality and flows.
Halligan Reservoir Enlargement (Fort Collins)	7,000	Increase storage in existing reservoir by 33,500 AF.	Implement urban efficiency measures first. Protect/restore N. Fork Poudre and Poudre River water quality and flows.
Rueter-Hess Reservoir Enlargement (Parker and other south Denver metro area providers)	15,000	Increase storage in existing reservoir by 54,000 AF.	Maximize use of in-basin surface water supplies, reuse, and conservation savings.
Seaman Reservoir Enlargement (Greeley)	10,000	Increase storage in existing reservoir by 38,000 AF.	Implement urban efficiency measures first. Protect/restore N. Fork Poudre and Poudre River water quality and flows.
Windy Gap Firming Project (Municipal Subdistrict of Northern Water)	32,000 (depends on “pre-positioning”)	Construct new reservoir at Chimney Hollow to ensure reliable supplies of Windy Gap water.	Implement urban efficiency measures first. Adopt adequate, enforceable measures to protect/restore affected upper Colorado River Basin flows.
Other			
Northern Project Pipeline, Phase II+ (East Cherry Creek Valley WSD, south Denver metro area providers)	5,000	Purchase of additional water rights and construction of reverse osmosis treatment plant.	Brine disposal. Assess and minimize potential impacts to stream flows and water quality.
South Platte and Beebe Draw Aquifer Recharge Project (Brighton)	7,000	Use Beebe Draw alluvium for storage, with pipeline and treatment for delivery of potable water.	Assess and minimize potential impacts to stream flows and water quality.
TOTAL	**102,000**		

Reuse			
Prairie Waters Project [PWP] (Aurora)	10,000 (ultimate capacity of 50,000 if and when needed)	Thirty-four-mile pipeline capturing reusable water rights, junior South Platte water rights, and agricultural water rights.	Brine disposal. Assess and minimize potential impacts to stream flows and water quality.
WISE Partnership (Denver Water [DW], Aurora, south Denver metro area providers)	10,000 (up to 18,000 with full build-out of PWP)	Uses PWP to capture DW’s reusable transbasin return flows when capacity is available; water delivered in most years to south Denver metro area providers.	Brine disposal. Assess and minimize potential impacts to stream flows and water quality. DW must have agreement with Aurora about when capacity is available.

Water-Energy Nexus[16]

The water supply strategies Colorado chooses to pursue come with large implications for energy use and greenhouse gas emissions. Energy is used to pump, treat, distribute, and heat water, as well as to treat and discharge wastewater. The *energy intensity* of Colorado's water supplies, or the energy embedded in each acre-foot of water delivered for use, varies considerably across the Front Range. Cities, such as Denver and Fort Collins, that rely on high-quality, gravity-fed supplies use very little energy to supply customers with water. But many south Denver metro area cities use tremendous amounts of energy to pump water from deep Denver Basin aquifers. New supply projects, such as Colorado Springs' Southern Delivery System, will rival the most energy-intensive water supplies in the West today. Water supplied via conservation and efficiency uses no energy and actually saves energy in many cases.

ENERGY INTENSITY OF EXISTING AND PROPOSED SUPPLIES FOR THE COLORADO FRONT RANGE.



* Water delivered through Aurora's Prairie Waters Project will be mixed with water stored in Aurora Reservoir, making the overall energy intensity approximately 1,200 kWh/AF. Similarly, Denver Water expects the WISE project will mix Prairie Waters Project water and its gravity-fed supplies for an overall energy-intensity of 1,050 kWh/AF.

** Both ag/urban cooperation strategies include the energy used for reverse osmosis treatment and pumping from a point in eastern Colorado.