

Front Range Water Supply Planning Update

Increased Storage, Increased Demands, Increased Transmountain Diversions



Otero Pumpstation (Colo. Springs Utilities)

January 7, 2011

RUEDI WATER & POWER AUTHORITY

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Preface

The issue of transmountain water diversions in Colorado is both extremely complex and controversial. In the former respect, it must be noted that this report provides only a general review of the potential for increased transmountain diversions from the Roaring Fork Watershed, examining existing conditional rights, undeveloped and underutilized project infrastructure, and the potential utility of increased diversions on the Front Range for the corresponding owners on local transmountain diversion systems. The hydrologic availability of such increased diversions – with, for example, increasing West Slope water demands and changes to the nature and volume of runoff – is a technical matter necessarily beyond the scope of this report. General, widely accepted assumptions regarding hydrology are applied where appropriate, but as the report’s recommendations make clear, additional technical research is needed to confirm the physical availability of the increased transmountain diversions that this report explains are legally available. Some of the potential additional diversions discussed in this report, for example with the Busk-Ivanhoe System, may be relatively small and occur only in years with above-average precipitation. Yet this report is intended to provide a comprehensive overview of the potential for additional transmountain diversions, and thus does not overlook potential additional diversions, even if they may be individually small.

With respect to the controversy surrounding the topic at hand, this report is intended to be a neutral examination of the legal feasibility of additional transmountain diversions from the Roaring Fork Watershed, which necessarily must be viewed from the larger, statewide context. Thus, the discussion of current developments among Front Range water providers is intended solely to explain that both the physical capacity and practical need for increased transmountain diversions exist on the East Slope – and are increasing.

The purpose of this paper is not to prevent additional transmountain diversions or even to raise alarm over such a possibility, but rather to spur local water interests in the Roaring Fork Watershed, especially local governments, to remain active and committed to this issue. With the current economic downturn, the financial and human resources of local governments are becoming increasingly limited, and all indications suggest the current economic situation must be viewed as “the new normal.”¹ Despite increasingly constrained budgets, the pressures and demands on these institutions are growing, as the region’s population and demand for public services continues to expand. Issues such as aging public infrastructure, land-use planning, and economic development all compete for the time and attention of local officials, which means that issues like transmountain diversions can easily be lost amid the clamor of local politics. Yet the current status and nature of statewide water supply planning requires that local interests remain vigilant and active in this area.

As this report explains, under the Interbasin Compact Process, water supply planning in Colorado is now based on cooperative efforts at the local level. Thus the ability of water interests on the West Slope to respond to transmountain diversion proposals depends on local interests working together as a collective force to negotiate with powerful Front Range water interests. For example, as Denver Water and the Northern Colorado Water Conservancy District have pursued their respective plans to divert additional water from the headwaters of the Colorado River via the Moffat Collection System and Windy Gap Firming projects, local public institutions and water interests in Grand County have collaboratively worked to identify a range of measures to mitigate the potential impacts of the proposed increased diversions.² Though the process has been at times contentious and is still far from complete, the collaboration among local interests has proven key to having their concerns with the project adequately addressed.

While there are no current specific proposals for diverting additional water from the Roaring Fork Watershed, as this report explains, the plans and legal conditions for such diversions do exist, and local interests can rightly expect such proposals to eventually surface. Therefore, local interests should continue to collaborate in planning and preparing for this possibility, for which intergovernmental entities like the Ruedi Water & Power Authority constitute an effective and cost-efficient means of cooperating on this issue

Executive Summary

Three major transmountain diversions currently operate in the Roaring Fork Watershed – the Fryingpan-Arkansas Project (“Fry-Ark Project” or “Fry-Ark”), the Busk-Ivanhoe System, and the Independence Pass Transmountain Diversion System (“Twin Lakes System”) (see inset). At present, these three systems collectively divert over forty percent of the flow in the headwaters of the Roaring Fork and Fryingpan rivers for use in the Arkansas and South Platte basins. Although these diversions have been in operation for decades, each of the projects are still incomplete, with undeveloped conditional water rights, excess diversion capacity, and even major structural components that could yet be built.

According to the Colorado Water Conservation Board’s most recent estimates, the Arkansas and South Platte basins are facing a combined shortfall in water supply of at least 130,000 acre-feet of water (and potentially as great as 470,000 acre-feet) by 2050, due to the influx of another 3.2 to 4.5 million new residents by that time.³ To meet this projected gap, Front Range water providers are scrambling to secure additional sources of water. For many of them, the options for new water supplies are limited: most of the rivers on the East Slope are already over-appropriated; groundwater supplies are declining in some areas due to excessive well pumping; and in recent decades, the costs and uncertainty surrounding new transmountain diversions have prevented many such projects from being built.

For many Front Range water providers, firming up existing transmountain water rights and maximizing the diversion capacity of existing infrastructure is likely to represent one of the most cost-effective, publicly acceptable means of developing additional water supplies. Local interests in the Roaring Fork Watershed should therefore expect Front Range water providers to eventually attempt to firm up undeveloped water rights and excess diversion capacity associated with the Fry-Ark Project, Busk-Ivanhoe System, and Twin Lakes System. In fact, such efforts may already be underway on the East Slope.

Water Supply Developments on the Front Range Relevant to Local Firming Efforts:

- Demand for increased East Slope storage capacity in order to allow for the diversion and carryover storage of “surplus flows” from years with above-average precipitation as protection against times of severe drought.
- Recent discussions by board of directors for the Southeastern Colorado Water Conservancy District concerning structural improvements to the Fry-Ark’s West Slope collection system, in order to make up for the 14,400-acre-foot “gap” in the project’s current yield.

Existing Transmountain Diversions from the Roaring Fork Watershed

Fryingpan-Arkansas Project

- *Ownership* – Bureau of Reclamation, Southeastern Colorado Water Conservancy District, as project’s local sponsor, owns project’s water rights and is responsible for repayment of reimbursable portion of project costs.
- *Average annual yield* – 54,800 a.f.
- *Key structures* – Boustead Tunnel (1,000 c.f.s.); Turquoise Reservoir (120,478 a.f.); Twin Lakes Reservoir (140,855 a.f.), and Pueblo Reservoir (294,828 a.f.).

Independence Pass Transmountain Diversion System

- *Ownership* – Colorado Springs (54.7%), Pueblo (23.1%), Pueblo West (11.7%), Aurora (5%), and other minor shareholders.
- *Average annual yield* – 40,589 a.f.
- *Key structures* – Grizzly Reservoir (582 a.f.); Tunnel No. 1 (625 c.f.s.); Tunnel No. 2 (322 c.f.s.).

Busk-Ivanhoe System

- *Ownership* – Pueblo (50%); Aurora (47.5%); and other minor shareholders.
- *Average annual yield* – 5,209 a.f.
- *Key Structures* – Ivanhoe Reservoir (1,200 a.f.):

- Potential opportunities to expand Busk-Ivanhoe diversions arising from the City of Aurora’s recent application for the change of use of its portion of the Busk-Ivanhoe System water rights.
- The likelihood of increased Twin Lakes System diversions in years with above-average precipitation, due to increased East Slope storage capacity and water demands – as well as in years with average and below-average precipitation, with continued improvements to the Twin Lakes System’ West Slope collection infrastructure, including the development of the system’s remaining conditional water rights.

Recommendations for the Ruedi Water & Power Authority

- Continue to serve as the collective voice of local water interests in the Roaring Fork Watershed, particularly in negotiating with Front Range water providers over their use of local water supplies (*Recommendation 1.1*).
- Continue to support water-related research and analysis (*Recommendation 1.2*).
- Encourage, support, and facilitate the lawful appropriation of local water resources for beneficial use, such as, for example, recreational in-channel diversions (*Recommendation 1.3*).

Short-term Options (2010-2015)

- Support technical research on the following issues:
 - Potential hydrologic impacts to flows in the Roaring Fork Watershed with pending and proposed changes to East Slope water storage and conveyance infrastructure; and
 - Potential economic impacts to the local economy associated with future releases from Ruedi Reservoir under full contract demand (*Option 2.1*).
- Procure financial and technical support for local watershed planning and management efforts (*Option 2.2*).
- Support and advocate for the watershed’s interests at the State and Federal level (*Option 2.3*).
- Investigate the possibility of allocating a portion of water in Ruedi Reservoir to meet the state’s Colorado River Compact delivery obligations (*Option 2.4*).

Medium-term Options (2015-2025)

- Pursue potential opportunities to improve flows below the Busk-Ivanhoe System and Twin Lakes System (*Option 3.1*).
- Consider potential reformatted uses of the water rights connected to the Basalt Project (*Option 3.2*).

Introduction

In the wake of the severe drought in 2002, municipal water providers along Colorado's Front Range have come full circle in their search to secure additional water supplies. With the state's population boom following World War II, Front Range cities and regional water providers built several major transmountain projects that diverted water from the Colorado River Basin to the Front Range.⁴ However with rising costs, increased governmental regulation, and growing environmental opposition to such projects, water providers instead turned to buying up agricultural water rights on the East Slope and transferring them to municipal use.⁵ This practice worked for the most part for major Front Range water providers, at least until the drought of 2002.

The summer of 2002 exposed Colorado's vulnerability to severe drought and added a sense of urgency to municipal water providers seeking to secure adequate supplies to meet their long-term needs.⁶ In particular the drought exposed the susceptibility of existing Front Range water supplies to extreme hydrologic conditions – years when existing sources may only generate a fraction of their historical yield.⁷ In addition to revealing the clear need to secure new water supplies for future population growth, the summer of 2002 also demonstrated the critical importance of developing additional East Slope water storage capacity, in order to allow for carryover storage of excess flows from years with above-average precipitation to years when runoff is inadequate to meet all demands.⁸

To assist local water providers in the development of new supplies and increased storage capacity, in 2005 the State of Colorado established the Interbasin Compact Process ("IBCC"), an innovative, bottom-up approach to statewide water supply and management planning.⁹ Beyond allowing local interests to assume a greater role in the planning process, the IBCC has generated new research into the state's potential long-term water supply shortages.¹⁰ This research has not only helped further quantify the state's future water needs, but also begun the process of evaluating the efficacy of various potential sources of new water supplies and additional storage capacity.¹¹

According to the State's most recent estimates, developed as part of the IBCC, Colorado's population is projected to nearly double by 2050, which will require local water providers to develop between 760,000 and 1.1 million acre-feet of new municipal water supplies by that time.¹² At the regional level, more than three-quarters of the statewide increase in municipal water demand is projected to occur in the South Platte and Arkansas basins, primarily due to these two areas gaining between 3.2 and 4.5 million additional residents by mid-century.¹³ While many Front Range water providers have already started to identify and develop new supplies, the Arkansas and South Platte basins are still expected to face annual water shortages of at least 130,000 acre-feet by 2050, assuming only low levels of population growth and the full implementation (100 percent of expected yield) of all water supply projects that are currently being planned.¹⁴ Should the relative yield of new water supply projects continue at "status quo" levels (between 40 and 75 percent of expected yield), the potential gap on the East Slope, under the most conservative population growth estimates, would be just shy of 300,000 acre-feet of water.¹⁵

Amidst these daunting predictions, the IBCC has led to the general consensus that meeting future statewide municipal water demands will require a combination of three general strategies: conservation, agricultural transfers, and new water supply development.¹⁶ The later strategy has drawn criticism from some West Slope water interests, as it would primarily entail major new transmountain diversions to the East Slope.¹⁷ However, much of the controversy surrounding the three supply options has focused on the potential effect to Colorado's agricultural sector.¹⁸ As local water providers scramble to secure new water sources, there is suddenly growing public and political opposition to the practice of fallowing agricultural lands and transferring the associated water rights to municipal use.¹⁹

With the mounting opposition to "ag-to-municipal" water transfers, Front Range water providers are once again returning their attention to the West Slope, and particularly to the underutilized infrastructure and undeveloped senior conditional water rights associated with existing transmountain diversion projects. The most notable example of this kind of "firming" project is the Northern Colorado Water Conservancy District's Windy Gap

Firming Project.²⁰ While no specific firming measures have yet been identified for the three transmountain diversion projects operating in the Roaring Fork Watershed, it seems likely to be only a matter of time before such proposals arise. In fact, the initial steps towards such firming efforts may already be underway on the Front Range.

While the economics for Front Range water providers looking for new supplies may currently favor agricultural transfers over additional transmountain diversions, the balance appears to be shifting, particularly with the growing public and political opposition to fallowing agricultural lands. With this shift, the likelihood for firming efforts related to the three transmountain projects operating in the Roaring Fork Watershed appears to be increasing, particularly in light of some of the recent developments in Front Range water supply planning.

Front Range water supply planning activities that should be of particular concern to local interests in the Roaring Fork Watershed include: increased demands for East Slope water storage capacity to allow for the capture and carryover storage of “surplus flows” from years with above-average precipitation; recent discussions by the Southeastern Colorado Water Conservancy District’s board of directors about possible structural improvements to the Fry-Ark’s West Slope collection system; the City of Aurora’s pending application for changing the use of its portion of the Busk-Ivanhoe System water rights; and the potential for increased Twin Lakes System diversions due to increased East Slope storage capacity and water demands, combined with continued improvements to the Twin Lakes System’ West Slope water collection system. Each of these developments create the potential for increased transmountain diversions from the Roaring Fork Watershed, and collectively, they suggest a continuing – and perhaps greater – role for the Ruedi Water & Power Authority in serving as the collective voice of local water interests in the Roaring Fork Watershed.

Increased East Slope Storage Capacity & Firming Efforts

Front Range Drought Protection – Carryover Storage Capacity for “Surplus Flows”

In planning for and evaluating potential new water supplies, a key statistic for water providers is the water source’s estimated “firm yield.” Firm yield generally refers to the minimum amount of water that a particular water source can be expected to produce on an annual basis, based on historical hydrological conditions.²¹ Water providers must build their supply and distribution systems around the firm yield of their various water sources, in order to ensure that their customer’s water demands are always met.²² If a water source fails to meet its expected firm yield, absent surplus supplies, system-wide water shortages can generally be expected.²³ One major implication of the drought of 2002 is that it exposed the vulnerability of Front Range water supplies to extreme hydrologic events – years when the firm yield of water sources can be far less than previously predicted.²⁴

In the wake of the 2002 drought, research carried out as part of the Interbasin Compact Process has confirmed the likelihood of Colorado suffering similar droughts in the future and the distinct possibility that global climate change could ultimately reduce the state’s overall long-term water supply.²⁵ While such forecasts require Front Range water providers to prepare for a number of associated potential consequences, for many of them this situation points to one undeniable conclusion: the need for additional East Slope storage capacity.²⁶ In order to compensate for years when existing supplies may produce only a fraction of their historical yield – even far below their predicted firm yield – Front Range water providers must be capable of storing the surplus water available in years with above-average precipitation.²⁷ While historically, there has been little interest among Front Range water providers in developing the capacity to divert and store these “surplus flows,” the drought of 2002 demonstrated not only that such flows may represent one of the few remaining undeveloped sources of water in the state, but more importantly, that they may be the only real safeguard against the inevitable severe drought.

Increased East Slope storage capacity is needed for a number of purposes in addition to carryover storage of current and new transmountain diversions. Additional storage capacity is critical to Front Range water providers’ ability to store former agricultural water rights for use outside the historical irrigation season.²⁸ New storage would

also allow Front Range water providers to maximize the use of the reusable return flows from transmountain diversions and transferred agricultural water rights.²⁹ Expanded storage capacity is also needed for augmentation releases required for plans of exchange for transferred agricultural water rights and reusable return flows from transmountain diversions.³⁰ Thus, demands for additional East Slope storage capacity are not solely confined to the need for carryover storage of new transmountain diversions.

Yet for local interests in the Roaring Fork Watershed, increased East Slope storage capacity can be seen as a necessary prelude to firming efforts, particularly as related to the Busk-Ivanhoe System and Twin Lakes System. Diversion records indicate that in years with average and below-average runoff, these two systems appear to already be capable of diverting most if not all the water that is physically available for diversion, given their existing infrastructure and absolute water rights (as discussed in detail in following sections). However, with additional East Slope storage capacity, Front Range water providers may be able to divert surplus flows available to these systems for carryover to years when the natural runoff is insufficient to meet demands. Thus, increased East Slope storage capacity would allow for and encourage the very diversions that are most likely to be available from firming efforts. While additional transmountain diversions from the Roaring Fork Watershed may ultimately require improvements to existing collection and diversion infrastructure (particularly for the Busk-Ivanhoe System) and the development of senior conditional rights (for the Twin Lakes System), increased East Slope storage is the essential first step to such firming efforts.

Plans for Increased East Slope Storage Capacity

As part of the Interbasin Compact Process, in 2006 the Colorado Water Conservation Board (“CWCB”) reported that there were 914,000 acre-feet of conditional water storage rights in the Arkansas Basin, the primary destination for most of the current transmountain diversions from the Roaring Fork Watershed.³¹ Approximately one-third (306,533 acre-feet) of these rights were located in the headwaters of the Arkansas River, above the town of Salida.³² While the CWCB’s report noted that a majority of these rights could not feasibly be developed for the purpose of storing new in-basin sources of water, given the lack of surplus unallocated flows within the Arkansas Basin, these conditional rights could be used to “store water during very wet periods if cost-effective storage can be developed.”³³ In addition to offering protection against “low flow periods,” the report explained, “[d]evelopment of additional storage to capture unappropriated water can potentially reduce the pressure to transfer water from additional sources (i.e., agricultural water) to meet future water needs.”³⁴ Although the CWCB’s report did not specifically identify additional transmountain diversions as a potential source of water to fill conditional storage rights, the report assumed that the “full utilization” of existing transmountain supplies would be needed by 2030 to meet in-basin water demands.³⁵

Plans for increased storage in the Arkansas Basin currently center on the Preferred Storage Options Plan (“PSOP”), which in part proposes expanding Turquoise and Pueblo reservoirs by 19,600 and 54,000 acre-feet respectively.³⁶ This added storage capacity would be made available to entities within the Southeastern Colorado Water Conservancy District for the storage of non-Fry-Ark Project water through long-term, “firm” storage contracts.³⁷ (See Appendix I for further explanation of PSOP and its relation to local transmountain diversions.)

PSOP represents a regional storage solution for water interests in the Arkansas Basin, but there are also individual storage projects being planned, including by major water providers that currently divert water from the Roaring Fork Watershed. The City of Pueblo, which takes deliveries from all three transmountain diversions from the Roaring Fork Watershed, holds a conditional right to expand Clear Creek Reservoir, located between Twin Lakes and Pueblo reservoirs with a current capacity of 11,439 acre-feet, by up to 18,561 acre-feet.³⁸ The City of Aurora, which owns almost half the Busk-Ivanhoe System and five percent of the Twin Lakes System, also has conditional right to build a 56,000 acre-foot reservoir at a site in between Turquoise and Twin Lakes reservoirs, slated to be called the “Box Creek Reservoir.”³⁹ In the Fountain Creek Valley, the City of Colorado Springs, which receives water from the Fry-Ark Project and over half the annual yield from the Twin Lakes System, is contemplating building a 30,500

acre-foot reservoir on Upper Williams Creek, which would be used in part for carryover storage of transmountain diversions.⁴⁰ The Upper Williams Creek Reservoir would be part of the pending “Southern Delivery System,” a new 53-mile long pipeline, expected to be complete by 2016, capable of conveying up to 78 million gallons per day from Pueblo Reservoir to an area just east of Colorado Springs.⁴¹

In 2008, the Arkansas Basin Roundtable released an updated analysis of in-basin consumptive use needs, which identified a 70,700 acre-foot gap between existing and future in-basin “firm” storage needs (i.e., excluding storage needs that can be met through contracts for “excess capacity” storage space in Fry-Ark East Slope reservoirs; for further explanation of these contracts, *see* Appendix I).⁴² Although much if not all of this demand for additional firm storage capacity could potentially be met through the expansion of Pueblo and Turquoise reservoirs, as PSOP proposes, the roundtable’s report indicated that the need for individual storage projects, like the expansion of Clear Creek Reservoir and the construction of Box Creek Reservoir, would not be obviated by the implementation of PSOP.⁴³ “Development of storage,” the basin roundtables update concluded, “will be needed to ensure full utilization of existing as well as future supplies.”⁴⁴

As the City of Aurora can transfer transmountain diversions, once across the Colorado Divide, from the Arkansas Basin to the South Platte Basin via the Homestake Pipeline, the potential storage locations for new transmountain diversions from the Roaring Fork Watershed also includes any of Aurora’s existing and proposed reservoirs in the South Platte Basin.⁴⁵ Reservoirs in which Aurora currently stores transmountain diversions include Spinney Mountain (53,651 acre-feet of capacity available to the city), Aurora (31,679 acre-feet), Quincy (2,698 acre-feet), Rampart (1,295 acre-feet), and Strontia Springs (700 acre-feet) reservoirs.⁴⁶ The city is also planning on being able to store transmountain diversions in Chatfield Reservoir, which is owned and operated by the U.S. Army Corps of Engineers.⁴⁷ Originally built for flood control purposes, Chatfield Reservoir is currently slated for re-operation under which up to 20,600 acre-feet of the reservoir’s flood control storage capacity would be reallocated to active storage for municipal and agricultural water supplies.⁴⁸ Aurora also has plans for a number of unconventional water storage projects, including aquifer recharge systems in Adams and Weld counties and retrofitted gravel pits along the South Platte River.⁴⁹

In the widespread plans for additional East Slope storage capacity, local water interests in the Roaring Fork Watershed should see the opportunity for firming efforts for the Busk-Ivanhoe System and Twin Lakes System. Increased storage capacity in the Arkansas and South Platte Basins is needed, in part, to allow Front Range water providers to carryover surplus water from years with above-average precipitation to years when runoff is inadequate to meet all demands. Such surplus flows are likely to represent the bulk of new diversions potentially available in connection with firming efforts for the Busk-Ivanhoe System and Twin Lakes System. Although the historical lack of demand for supplemental water in years with above-average precipitation has resulted in there being little interest in developing the diversion infrastructure and storage capacity to capture these surplus flows, in the future, with additional East Slope storage capacity, such diversions will be key to Front Range water providers ability to meet new demands and ensure against inescapable threat of severe drought.

The Fry-Ark Gap – Structural Improvements & the Deferred Area Rights

Southeastern’s Concerns with the Fry-Ark Project’s Shortcomings

Since 1981, when the last of the Fry-Ark’s West Slope diversions became operational, project diversions have averaged approximately 54,800 acre-feet annually, a yield roughly 14,400 acre-feet below the amount that was authorized in the Fry-Ark Operating Principles.⁵⁰ The Southeastern Colorado Water Conservancy District (“Southeastern” or “Southeastern District”), which owns the water rights associated with the Fry-Ark, has recently taken notice of this gap between the project’s current yield and what the project was originally expected to produce, and is exploring the options for increasing the existing West Slope diversions.

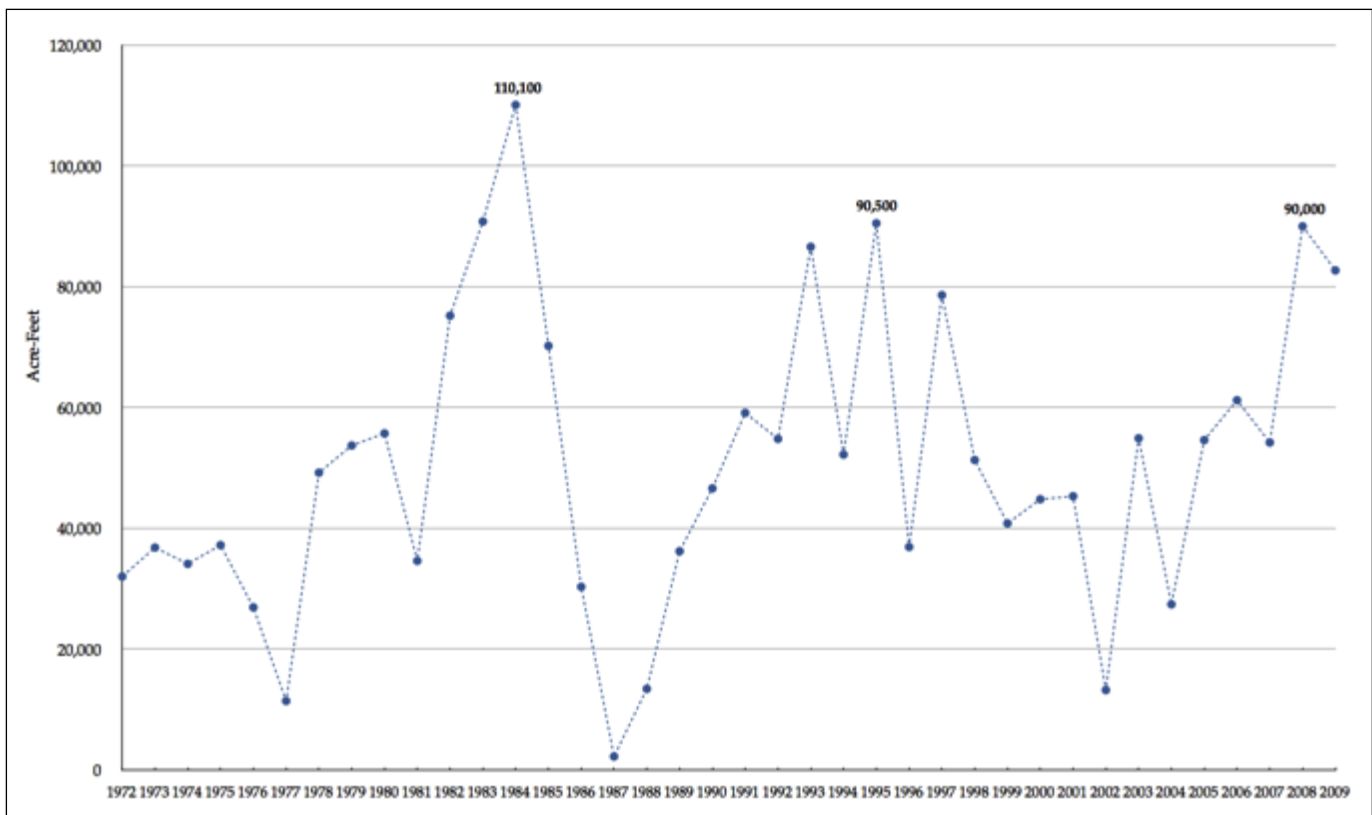


Figure 1. Fry-Ark Project diversions from 1972-2009 (2009 Fry-Ark Project Annual Operating Plan Report).

Prior to the Fry-Ark’s federal authorization in 1962, the Bureau of Reclamation (“Reclamation”) estimated the potential yield of the Fry-Ark’s West Slope collection system to be around 72,000 acre-feet per year.⁵¹ When Congress authorized the Fry-Ark Project in 1962, the legislation directed that the project be operated in accordance with a set of Operating Principles that had been agreed upon in 1959 by the CWCB, Southeastern, the Colorado River Water Conservation District, and the Southwestern Colorado Water Conservation District, and which imposed volumetric limitations on the project’s West Slope diversions.⁵² The Fry-Ark Operating Principles stipulate that annual diversions from the Colorado Basin can neither exceed 120,000 acre-feet in any one year, nor 2,352,800 acre-feet in any consecutive 34-year period (equivalent to an average of 69,200 acre-feet per year).⁵³ In 38 years of operation, Fry-Ark Project diversions have rarely approached either limitation, having only exceeded 100,000 acre-feet once (1984) and 60,000 acre-feet in less than a third of the years (see Figure 1).⁵⁴

Unlike the Busk-Ivanhoe System and Twin Lakes System improving the yield of the Fry-Ark Project is not likely a matter of simply capturing the surplus flows available in years with above-average precipitation, as the project already appears to be capable of diverting most the water physically available for diversion with the existing infrastructure and absolute water rights, even in years with above average precipitation. For example in 1984 and 1995, the two years with the largest annual runoff in the Roaring Fork Watershed since Fry-Ark diversions began in 1972, the Fry-Ark Project diverted 110,120 acre-feet and 90,500 acre-feet of water respectively, the two largest annual diversion totals on record.⁵⁵

At least part of the current “Fry-Ark gap” can be explained by a historical lack of demand for supplemental water on the East Slope in years with above-average precipitation, which is unlikely to exist in the future. The Bureau of Reclamation, which operates the Fry-Ark Project, does not reduce project diversions based on the expected demand for project water in the Southeastern District, but rather stores unallocated diversions in East Slope reservoirs for use in subsequent years.⁵⁶ In the past, lack of demand for Fry-Ark Project water in years with above average precipitation, like 1984 and 1995, has allowed Reclamation to fill East Slope reservoirs and subsequently reduce diversions in subsequent years, such as 1986-1988, 1996, and 1998-1999.⁵⁷ As demand for Project water increases in the coming decades, particularly as is predicted among municipal entities, there will be fewer

opportunities for Reclamation to carryover Project water and thus less instances when stored, unallocated water curtails new diversions.⁵⁸

The fact that Reclamation has curtailed Fry-Ark diversions in the past due to a lack of available storage capacity on the East Slope suggests that expanding Fry-Ark reservoirs could be one way of increasing the Project's yield. Currently, there is 305,355 acre-feet of collective storage capacity reserved for Fry-Ark Project water between Turquoise, Twin Lakes, and Pueblo reservoirs, well in excess of the 69,200 acre-feet the project is entitled to divert on average from the West Slope.⁵⁹ Yet up to 159,000 acre-feet of this total storage amount is available to municipal entities within the Southeastern District for carryover storage of allocated Project water, which when occupied, reduces space for new Project diversions (i.e., carried-over, allocated water is not spilled to make room for Project diversions).⁶⁰ As the amount of Project water allocated to municipal entities increases in the coming decades, use of this carryover space could likewise increase, thus further limiting storage capacity for new Project diversions. Yet despite the current and potential constraints on storage capacity, there are no current plans for increasing the storage space dedicated to Fry-Ark diversions. While PSOP proposes expanding Turquoise and Pueblo reservoirs by a combined 73,600 acre-feet, none of this new storage capacity is intended for storing Fry-Ark Project diversions.⁶¹ Rather Southeastern officials apparently see improvements to the Fry-Ark's West Slope collection system as the most effective means of increasing the Project's yield.

In August of 2009, Jim Broderick, the executive director of Southeastern, identified lowering the Fry-Ark gap as a long-term priority for increasing the district's water supplies.⁶² At that meeting, Southeastern's board began to identify potential improvements to the Project's West Slope collection system that could help to close the Fry-Ark gap, including development of the project's remaining conditional rights and even the construction a new reservoir above Ruedi Reservoir in order to overcome the physical limitations on the Boustead Tunnel.⁶³

In Southeastern's April 2010 board meeting, Jim Broderick confirmed that the district is studying the feasibility of improvements and additions to the West Slope Fry-Ark infrastructure.⁶⁴ Southeastern's board members are committed to pursuing these options. "We should not do anything as a board that implies we are not serious about any part of the project," stated Harold Miskel, the El Paso County representative on board, "We have no intention of abandoning any of our water rights."⁶⁵

At least one board member for Southeastern, Vera Ortegon, representative for Pueblo County, recognizes the potential West Slope opposition that proposals for structural improvements to the project's collection system could face. In the district's August 2009 board meeting, Ms. Ortegon emphasized that the "most important thing is to optimize the infrastructure we have."⁶⁶ From Ms. Ortegon's perspective, "The biggest issue is environmental, and it's insurmountable."⁶⁷

The specific environmental barrier Ms. Ortegon was likely referring to is the permitting authority that counties and municipalities have gained over major extensions of existing domestic water systems with the enactment of House Bill 1041 in 1974.⁶⁸ In several notable cases, local "1041 powers" have enabled local interests on the West Slope to effectively block new and expanded transmountain diversions on environmental grounds.⁶⁹

Although Southeastern may face serious technical and legal obstacles in trying to expand and improve the Fry-Ark's West Slope collection system, the critical point is that Southeastern has begun to move in this direction. The sizable deficit in the Fry-Ark's current yield, amidst growing water demands in the Arkansas Basin, is forcing the district to consider all available options for increasing project diversions, even controversial infrastructural additions.

The Fry-Ark's Deferred Diversions

While Southeastern could attempt to improve the efficiency and capacity of the Fry-Ark's existing collection system, such improvements seem unlikely to make up for the Fry-Ark gap, given that only three of the project's existing diversion structures are currently operating below their designed capacity, with remaining undeveloped conditional rights (at Carter and No Name Creek and the Fryingpan River)(*see* Table 2, following page). Closing the

Fry-Ark gap may ultimately require Southeastern to expand the project’s West Slope collection infrastructure, using the existing conditional rights that Southeastern still holds in connection with the project. Among these rights are a group of five proposed diversions in the project’s North Fork Subsystem that were never constructed, in what is commonly referred to as the Fry-Ark’s “Deferred Area” (see Figure 2, following page). In its recent meetings, Southeastern’s board has identified developing the conditional rights associated with the project, including the Deferred Area diversions, as one means of increasing the Fry-Ark’s current yield.⁷⁰

The likelihood of Southeastern attempting to expand the Fry-Ark’s West Slope collection system is ultimately a question of feasibility. In this respect, it is important to understand why the remaining conditional rights for the project were never completed. In 1976, as construction on the Fry-Ark Project proceeded, Southeastern filed for several changes to the project’s West Slope Collection System, including expanded diversions from the Hunter Creek headwaters.⁷¹ In the final change decree, the water court referee noted that the construction of diversions on Lime and Last Chance creeks, as well as other intercept canal diversions, “has been held in abeyance inasmuch as hydrologic data now available indicates that both the average and maximum annual diversions permitted by the Operating Principles can be obtained without the construction of those features.”⁷² The referee noted that Southeastern had no intent of abandoning the conditional rights connected to diversion structures that were not built.⁷³ “The actual operation of the Fryingpan-Arkansas Project, when construction of the other features is completed, will determine whether or not construction of [deferred] features will become necessary.”⁷⁴

Four years later, in December 1980, as work on the Fry-Ark’s West Slope collection system was nearing completion, Congress designated roughly 113,000 acres in the White River National Forest as part of the new Holy Cross Wilderness area, including portions of the Deferred Area.⁷⁵ The act specifically provided that the designation would not affect the completion of Colorado Springs and Aurora’s Homestake Project, but Congress included no similar protections for the undeveloped conditional rights of the Fry-Ark Project.⁷⁶ As the construction of water supply infrastructure is prohibited in federal wilderness areas, Southeastern could not now

Table 2. Fry-Ark Project water rights. (All rights have appropriation date of July 29, 1957.) (See District Court, Water Div. 5, Case No. 09CW040.)

| Tributary Source | Water Year First Diverted | Absolute Right (c.f.s.) | Conditional Right (c.f.s.) | Minimum Bypass (c.f.s.) |
|-------------------------------------|---------------------------|-------------------------|----------------------------|-------------------------|
| NORTH SIDE COLLECTION SYSTEM | | | | |
| North Fork Subsystem | | | | |
| Lime Creek | - | - | 50 | - |
| Unnamed Tributary to Slim’s Gulch | - | - | 85 | - |
| Slim’s Gulch | - | - | 85 | - |
| Last Chance Creek | - | - | 135 | - |
| South Side Intercept of Last Chance | - | - | 10 | - |
| Carter Creek | 1981 | 83 | 17 | 2 |
| North Side Intercept of North Fork | - | - | 10 | - |
| North Fork of Fryingpan River | 1980 | 30 | - | 1 |
| Mormon Creek Subsystem | | | | |
| South Side Intercept of North Fork | - | - | 15 | - |
| Mormon Creek | 1979 | 60 | - | 2 |
| Cunningham Creek Subsystem | | | | |
| North Cunningham Creek | 1979 | 30 | - | 1 |
| North Cunningham Creek Intercept | - | - | 15 | - |
| Middle Cunningham Creek | 1979 | 50 | - | 1 |
| South Cunningham Creek | 1980 | 20 | - | 0 |
| Unnamed Tributary to S. Cunningham | - | - | 30 | - |
| Ivanhoe Creek Subsystem | | | | |
| Ivanhoe Creek | 1974 | 150 | - | 2 |
| Ivanhoe Creek Intercept | - | - | 30 | - |
| Granite Creek | 1981 | 50 | - | 0 |
| Lily Pad Creek | 1974 | 35 | - | 0 |
| Fryingpan Intercept Canal | - | - | 10 | - |
| SOUTH SIDE COLLECTION SYSTEM | | | | |
| Hunter Creek Subsystem | | | | |
| No Name Creek | 1980 | 85 | 10 | 4 |
| Midway Creek | 1980 | 85 | - | 5 |
| Hunter Creek | 1980 | 140 | - | 12 |
| Sawyer-Chapman Subsystem | | | | |
| Sawyer Creek | 1972 | 40 | - | 0 |
| Chapman Creek | 1972 | 300 | - | 3 |
| South Fork Subsystem | | | | |
| South Fork Fryingpan | 1972 | 250 | - | 6 |
| Fryingpan River | 1972 | 395 | 5 | 12 |

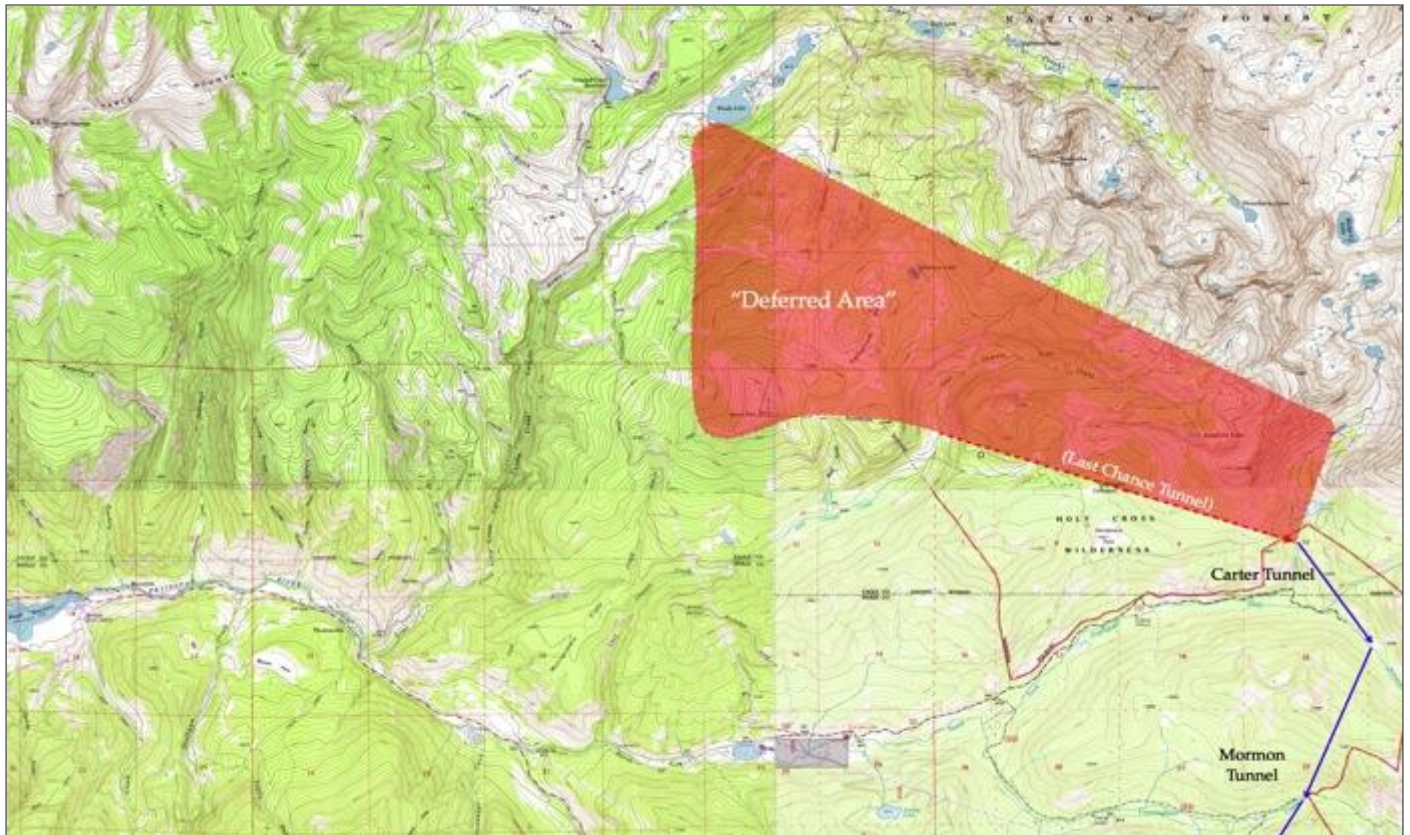


Figure 2. Approximate location of the Fry-Ark “Deferred Area,” which includes proposed diversions (with conditional water rights) on Lime Creek (50 c.f.s.), Slim’s Gulch (85 c.f.s.), an unnamed tributary to Slim’s Gulch (85 c.f.s.), Last Chance Creek (135 c.f.s.), and a “South Side Intercept of Last Chance Creek” (10 c.f.s.). Other conditional rights for the Fry-Ark Project include: North and South Side Intercepts of North Fork of Fryingpan River (10 and 15 c.f.s. respectively); North Cunningham Creek Intercept (15 c.f.s.); Unnamed Tributary to South Cunningham Creek Canal (30 c.f.s.); and the Fryingpan Intercept Canal (10 c.f.s.) (See District Court, Water Div. 5, Case No. 09CW040.)

feasibly construct the five Deferred Area diversions as originally proposed (see Figure 2, following page).⁷⁷ Yet, Colorado water law allows a water right owner to change the point of diversion for an absolute or conditionally decreed water right, as long as the new location does not injure other decreed water rights, so Southeastern could potentially develop the Fry-Ark’s remaining conditional rights at alternative locations.⁷⁸

In the late 1990s, amidst the proliferation of pump and pipeline proposals around the state, a new idea surfaced for the development of alternate diversion points for the Fry-Ark conditional rights. A report on water needs in the Arkansas Basin, completed in cooperation between Reclamation, BLM, Forest Service and the Colorado Department of Natural Resources, stated that “Southeastern holds plans for a collection system located on Last Chance Creek and Lime Creek in the Holy Cross Wilderness Area.”⁷⁹ However, the report noted that there was “the possibility that a pumping plant at Ruedi [Reservoir] could serve as an alternative to undeveloped portions of the project.”⁸⁰ The “Ruedi Pumpback” concept is partly intended to overcome the minimum flow requirements below the confluence of the North Fork and Fryingpan River, which at times in the past has been a limiting factor on Fry-Ark diversions.⁸¹

In 1999 Aurora and Colorado Springs commissioned a study on the feasibility of pumping water from Ruedi Reservoir during the winter months, when the reservoir is normally drawn down in anticipation of spring snowmelt runoff.⁸² With the support of the Colorado River Water Conservation District (“River District”), Aurora and Colorado Springs pitched the concept as an alternative to development of the Homestake II Project in the Eagle River Watershed, which the cities announced in 2010 they now intend to finally complete.⁸³ The feasibility study estimated that the concept could yield approximately 20,000 acre-feet per year, with a maximum annual diversion capacity of 24,000 acre-feet of water.⁸⁴

In 2009 the CWCB released a report on potential strategies for meeting the state's future water demands, which addressed the feasibility of various proposed transmountain diversion projects.⁸⁵ One of the "small-to-medium" projects that the CWCB was asked to consider was a so-called "Enhanced Ruedi Pumpback" concept, which entailed both a pipeline from Ruedi Reservoir for pumping water back up to the Boustead Tunnel, including "additional flows within the Lime Creek addition."⁸⁶ According to the report, "This would be a controversial project from an environmental perspective; however, the yield may be fairly significant since the Roaring Fork River joins the Colorado River below the Shoshone Power Plant call."⁸⁷

While plans for increasing the Fry-Ark's yield are still in the conceptual stages, Southeastern's board of directors has begun to evaluate the district's options for closing the Fry-Ark gap. Given that only three of the project's existing diversions are operating at below their decreed capacity, Southeastern is likely to seriously consider developing the remaining conditional rights it holds in connection with the project. Development of these rights could come in the form of piecemeal additions to the existing diversion infrastructure, or a major project like the Ruedi Pumpback concept. Any structural improvements to the Fry-Ark's West Slope collection system would likely face significant hurdles in the approval process, including local 1041 permitting requirements and a water court change decree adjudication, yet Southeastern is committed to improving the Fry-Ark's yield and holds the rights to accomplish this objective.

Allocation of Undeveloped Waters in the Fryingpan River Sub-watershed

All eleven of the Fry-Ark diversion structures that were never built were to be components of the project's North Side Collection System, diverting from the headwaters of the Fryingpan River. As constructed, the North Side Collection System was designed to collect and divert approximately 18,400 acre-feet per year, less than half the amount the South Side System was intended to yield (50,800 acre-feet).⁸⁸ The incomplete construction of the North Side System - in contrast to the South Side Collection System (diverting from the headwaters of Hunter Creek), which was fully completed and even expanded from the original design - is likely partly explained by the controversy surrounding the Fry-Ark's proposed diversions from the headwaters of the Fryingpan River.

In 1958, after proponents of the Fry-Ark Project had already submitted preliminary engineering plans for the project to the State Engineers Office, the River District sought and received conditional water right decrees for two large water projects in the Roaring Fork Watershed - the Basalt Project and the West Divide Project.⁸⁹ The River District planned to build the two systems as "participating projects" under the Colorado River Storage Project Act, a federal law designed to support water development in the Upper Colorado River Basin.⁹⁰ Proponents of the Fry-Ark Project, which had yet to submit any water court filings for the project, did not contest the River District's applications and a decree for the Basalt and West Divide Projects was entered on June 28, 1958.⁹¹ Upon learning of the River District's new rights, water interests in the Arkansas Basin quickly realized that the Basalt and West Divide projects jeopardized the feasibility of the planned Fry-Ark Project.⁹² The filing for the Basalt Project in particular would obtain a prior right to water in the Fryingpan River, with its 140,697 acre-foot storage right and a direct flow right of 450 c.f.s.⁹³ Proponents of the Fry-Ark Project petitioned the Garfield County district court to re-open the general decree for the two projects, which the court granted in light of the earlier submission of engineering plans for the Fry-Ark Project to the State Engineers Office.⁹⁴

The decision to re-open the decree prompted Colorado's Governor, Stephen McNichols, to personally request that the River District and proponents of the Fry-Ark work to find some kind of settlement to the dispute.⁹⁵ After nearly a year of negotiations, the two sides finally reached a compromise, wherein they agreed to add a stipulation to the decrees for each of the projects designed to accommodate the water demands of both projects.⁹⁶ The court-approved stipulation was included in a supplemental decree on August 3, 1959, thus making it a permanent part of the State's administration of the water rights associated with both projects.⁹⁷

The stipulation agreement declared that "the facilities of the Fryingpan-Arkansas Project ... and the facilities of the Basalt Project ... are actually features and units of one overall project, whereby the fullest possible beneficial

use of water may be made in both the Arkansas Valley in Colorado and Western Colorado.”⁹⁸ Accordingly, the stipulation provided that the two projects “should have the same priorities by date and number, neither being senior or junior to the other...”⁹⁹

The stipulation also included specific restrictions intended to allocate the waters available under the two decrees. For the Fry-Ark Project, these restrictions included the same annual volumetric limitations that would later that year be re-adopted in the project’s Operating Principles, as well as a combined minimum bypass on the project’s diversion structures in the Fryingpan watershed and minimum gage standards below the confluence of the North Fork and Fryingpan River.¹⁰⁰ These restrictions were intended to allow for “storage in Ruedi Reservoir to the extent of its actual capacity, which is contemplated to be not less than 100,000 acre-feet.”¹⁰¹

As the stipulation in the decrees for the Basalt and Fry-Ark projects envisioned a roughly equal division of the available water in the Fryingpan headwaters between the two projects, Southeastern may have elected to forgo some of the diversions in the North Side Collection System, and likewise add new diversions to the South Side Collection System, on account of Basalt Project’s potential demand for water in the Fryingpan River. However, regardless of the exact reasons, Southeastern clearly believed that the “deferred” diversions were not necessary for the Fry-Ark Project to achieve its maximum legally allowed yield. This statement remains the most definitive statement of Southeastern’s long-term plans for developing the bulk of the Fry-Ark Project’s remaining conditional rights.

The history behind the deferred diversions in the North Side Collection System suggests that Southeastern’s decision not to develop these rights may have been due in part to concerns that the Basalt Project could command an equal share of the flows in the Fryingpan River, which has largely never occurred (a portion of the rights are used for augmentation purposes by the Basalt Water Conservancy District).¹⁰² The renewed interest in the Ruedi Pumpback concept and Southeastern’s recent concerns with the Fry-Ark gap indicate that development of these rights remains a serious possibility. While Southeastern is legally entitled to develop the conditional rights associated with the Fry-Ark Project and to increase project diversions up to the decreed volumetric limits, the stipulation that was included in the final decrees for both the Fry-Ark and Basalt projects indicates that West Slope water interests may have an equally valid claim to the remaining undeveloped flows in the Fryingpan River.

Aurora’s Busk-Ivanhoe Change Case – Opportunity for New Rights Filings

Aurora’s Busk-Ivanhoe Change Case

While the Busk-Ivanhoe System is the smallest of the three transmountain diversions in operation in the Roaring Fork Watershed, the system still diverts an average of 5,209 acre-feet of water per year from the headwaters of the Fryingpan River to the Arkansas Basin.¹⁰³ The Busk-Ivanhoe’s yield, however, is constrained by legal and structural limitations on the system’s West Slope diversions – limitations that the City of Aurora appears poised to overcome.

The Busk-Ivanhoe’s West Slope collection system consists of three ditches, diverting from Lyle, Pan, and Hidden Lake creeks, that drain into Ivanhoe Reservoir, a glacial lake on Ivanhoe Creek that has been dammed and expanded to a current capacity of 1,200 acre-feet.¹⁰⁴ The system’s diversions are located above the Fry-Ark’s collection system, with associated absolute water rights that are senior to those for the Fry-Ark Project, with the earliest priority on the system being June 27, 1921 (*see inset*).¹⁰⁵ There are no required bypasses on the Busk-Ivanhoe System’s diversion structures, allowing for the system to collect and divert most of the available water.¹⁰⁶

Busk-Ivanhoe System Water Rights

- *Ivanhoe Reservoir* – 1,200 a.f. (Jun. 27, 1921)
- *Ivanhoe Tunnel* – 35 c.f.s. (Jun. 27, 1921)
- *Lyle Creek Ditch* – 50 c.f.s. (Sept. 28, 1924)
- *Pan Creek Ditch* – 25 c.f.s. (Oct. 5, 1924)
- *Hidden Lake Ditch* – 70 c.f.s. (Aug. 30, 1927)

Built by businessman Albert E. Carlton in 1921 for irrigation purposes, the rights to the Busk-Ivanhoe System were purchased in 1949 by the High Line Canal Company, before later being sold off for municipal purposes.¹⁰⁷ The Busk-Ivanhoe System's water rights are now divided primarily between the cities of Pueblo and Aurora, with Pueblo having purchased half the system's associated rights in 1971 and Aurora having acquired a 47.5 percent interest in the system in separate purchases in 1987 and 1999.¹⁰⁸ In recent years, Aurora has acquired Pueblo's half of the Busk-Ivanhoe System's annual yield under a long-term lease agreement.¹⁰⁹

In 1990 the Pueblo Board of Water Works sought a decree for a change of use for its half of the Busk-Ivanhoe water rights from irrigation purposes to municipal and industrial use.¹¹⁰ Several West Slope water interests challenged the proposed change of use, contending that it would allow additional transmountain diversions, particularly outside the irrigation season.¹¹¹ In response to such concerns, the district court for Water Division 5 imposed seasonal and volumetric limits on Pueblo's use of its half of the Busk-Ivanhoe water rights.

In the final decree, Pueblo's half of the Busk-Ivanhoe water rights were limited to use between March 24 and November 25 of each year, and restricted to an annual maximum diversion of 5,041 acre-feet.¹¹² The decree also imposed 10-, 20-, and 60-year volumetric limitations, of which the latter was the most restrictive, limiting Pueblo on average to only 2,593 acre-feet per year.¹¹³ The 60-year volumetric limitation will go into effect in 2013, and to meet that restriction, Pueblo has had to reduce its diversions from the system in recent years, cutting back from its average yield of 2,700 acre-feet to only 1,000 acre-feet in 2009.¹¹⁴

Aurora, not limited by such restrictions on its portion of the Busk-Ivanhoe rights, has imported more than 3,000 acre-feet through the Ivanhoe Tunnel in the past few years.¹¹⁵ In December 2009, Aurora finally filed for a change of use for its portion of the system's water rights, requesting a new decree that would allow the city to use the water rights for municipal and industrial purposes in the South Platte Basin.¹¹⁶

The River District has filed a statement of opposition in the case, as have Pitkin and Eagle counties, the Grand Valley Water Users Association, and the Basalt Water Conservancy District.¹¹⁷ It is unclear what precedential effect the volumetric limitations in Pueblo's earlier decree will have on Aurora's current change application, though it is likely that similar, if not identical, restrictions will be imposed on Aurora's share of the Busk-Ivanhoe rights. However, even if volumetric limitations are imposed on Aurora's portion of the system's rights, Aurora may be able to overcome such limitations simply by subsequently claiming new junior rights for the system.

Volumetric limits imposed on Aurora's senior Busk-Ivanhoe rights would have no applicability to new junior rights subsequently claimed for the system. For Aurora, there may be no difference, in terms of overall yield, between operating the Busk-Ivanhoe with a combination of senior rights (bearing volumetric limits) and new junior rights (without such limitations). Volumetric limits may only prevent water diversions in years with above-average precipitation, when the available water supply allows transmountain diversions to operate at their maximum capacity. Although new water rights for diversions above and beyond decreed volumetric limits will necessarily be junior to existing rights in the basin of origin, junior rights may still allow for essentially the same diversions as would be possible under senior rights without any volumetric limitations, given the availability of unappropriated water in years with above-average precipitation.

Aurora is familiar with this approach to overcoming the volumetric limits imposed on transmountain diversions in a change decree, having recently employed it for one the city's newest acquisitions, the Columbine Ditch. The Columbine Ditch is a small transmountain diversion system that diverts water from several streams in the headwaters of the Eagle River. Originally decreed for agricultural purposes, the ditch was purchased by the Pueblo Board of Water Works in the early 1950s, before finally being transferred to municipal and industrial use in a change decree entered in 1993.¹¹⁸ The 1993 change decree imposed seasonal and volumetric limitations on the ditch, which are expected to ultimately lower the ditch's average yield from around 1,700 acre-feet to 1,300 acre-feet per year.¹¹⁹

In 2009, Aurora and the Climax Molybdenum Company purchased the Columbine Ditch from the Pueblo Board of Water Works for \$30.48 million. Aurora and Climax Molybdenum have since formed the Fremont Pass Ditch Company for operating the ditch, and in December 2009, the company filed two separate water court

applications on the ditch, one seeking to change the type and place of use for the existing rights, and the other requesting an additional 60 c.f.s. conditional water right.¹²⁰ The new conditional right would allow the ditch to divert at its maximum carrying capacity, above and beyond the volumetric limits imposed in Pueblo's 1993 change decree.¹²¹

Although the final decree for the change of use of Aurora's portion of the Busk-Ivanhoe water rights is likely to include seasonal and volumetric limitations on diversions, Aurora can readily overcome such restrictions simply by subsequently filing for new conditional rights for the system, which may allow for essentially the same diversion as were possible with the senior rights prior to the change decree. It may therefore make sense for local water interests in the Roaring Fork Watershed, in conjunction with Aurora's current change application, to negotiate with the city on the assumption that any volumetric limits imposed on Aurora's portion of the Busk-Ivanhoe water rights could be followed by an application for a new, junior water right. Such a junior right would not necessarily be limited to only Aurora's portion of the Busk-Ivanhoe rights, and therefore could lead to a significant increase in diversions from historical levels.

Transmountain Diversions - Increasingly Valuable to Aurora

In its change application Aurora listed fifteen different potential storage sites for its share of Busk-Ivanhoe water rights, including both existing and proposed reservoirs throughout the Arkansas and South Platte basins.¹²² Within the Arkansas Basin, Aurora identified its proposed Box Creek Reservoir and the City of Pueblo's Clear Reservoir as potential storage sites for Busk-Ivanhoe diversions.¹²³ Within the South Platte Basin, Aurora included all five of its primary reservoirs - Spinney Mountain, Aurora, Quincy, Rampart, and Strontia Springs - as potential destinations for Busk-Ivanhoe water, as well as Chatfield Reservoir.¹²⁴ Aurora also listed its proposed aquifer recharge systems in Adams and Weld counties and retrofitted gravel pits along the South Platte River.¹²⁵

While it is difficult to gauge the likelihood of Aurora completing the vast water collection and storage system that it describes in its Busk-Ivanhoe change application, the exact implications of Aurora's long-term plans for local water interests in the Roaring Fork Watershed are perhaps best understood through the context of the city's latest water supply project - the Prairie Waters Project.

The Prairie Waters Project is a state-of-the-art \$659 million water treatment system that will allow the city to recycle up to 10,000 acre-feet of its reusable, transbasin water supplies each year.¹²⁶ The project is over 90 percent complete and expected to be online by the end of 2010.¹²⁷ As Aurora continues to grow, the Prairie Waters Project is also designed to allow for incremental expansion to a maximum recycling capacity of 50,000 acre-feet of water per year.¹²⁸

For local water interests in the Roaring Fork Watershed, one way to view the potential storage system described in Aurora's change application for Busk-Ivanhoe water is to assume that any new storage capacity

Aurora's Transbasin Water Rights Portfolio

Homestake Project

- Diverts from headwaters of the Eagle River
- Aurora owns 50% interest; built and operated in conjunction with Colorado Springs Utilities
- *Aurora's average annual yield - 12,780 a.f. (Homestake I)*

Busk-Ivanhoe Project

- Diverts from headwaters of the Fryingpan River
- Aurora owns 47.5% interest; operated with Pueblo Board of Water Works by Busk-Ivanhoe, Inc.
- *Aurora's average annual yield - 2,600 a.f.*

Independence Pass Transmountain Diversion Project

- Diverts from headwaters of the Roaring Fork River
- Aurora owns 5% interest; operated by the Twin Lakes Reservoir & Canal Co.
- *Aurora's average annual yield - 2,090 a.f.*

Columbine Ditch

- Diverts from headwaters of the Eagle River
- *Aurora's average annual yield - 1,337 a.f. (not including pending application for new junior rights)*

Rocky Ford Ditch

- Former agricultural rights from lower Arkansas Basin
- *Aurora's average annual yield - 13,200 a.f.*

Colorado Canal System

- Former agricultural rights from lower Arkansas Basin
- *Aurora's ownership - Colorado Canal (28.7%); Lake Meredith (32.2%); Lake Henry (13.0%)*
- *Aurora's average annual yield - 7,900 a.f.*

High Line Canal

- Interruptible, short-term lease of agricultural rights from lower Arkansas Basin
- *Aurora's average annual yield - 8,200 a.f.*

Burroughs Ranch

- Former agricultural rights from upper Arkansas Basin
- *Aurora's average annual yield - 260 a.f.*

Buffalo Park Ranch

- Former agricultural rights from upper Arkansas Basin
- *Aurora's average annual yield - 324 a.f.*

Hayden Ranch

developed by the city will likely be used in conjunction with the Prairie Waters Project, therefore potentially allowing the city to extend its existing supplies. On the other hand, however, the Prairie Waters Project also makes transbasin water supplies all the more valuable to Aurora (*see inset*), as water from such sources can legally be reused to extinction. In this respect, the network of water storage that Aurora described in its Busk-Ivanhoe change application, particularly in the upper Arkansas Basin, means increased capacity for storing additional transmountain diversions, which are becoming increasingly valuable to the city.

Between these opposite conclusions, however, is the clear message that Aurora is prepared to go to great lengths to keep adequate supplies flowing to its vast water service area, encompassing 151 square miles.¹²⁹ Although Aurora has yet to identify any specific firming measures related to the Busk-Ivanhoe System, its change application for its portion of the system's water rights may mark the beginning of such efforts, as Aurora seeks to maximize the yield from its existing transbasin water sources.

Resolving Structural Limitations of the Busk-Ivanhoe System

One option available to Aurora for increasing the Busk-Ivanhoe's yield would be to repair the Ivanhoe Tunnel. Historically, diversions by the Busk-Ivanhoe System have been transported to the Arkansas Basin through Ivanhoe Tunnel, located at the southeast end of Ivanhoe reservoir; however the tunnel has been plagued by structural failures for most of its existence, which have limited its carrying capacity.¹³⁰ Used by Midland Railroad Company for almost three decades, until the railroad ceased operations in 1921, the Ivanhoe Tunnel was then converted into a toll road and renamed the Carlton Tunnel.¹³¹ Diversions for the Busk-Ivanhoe System began that same year, through a wooden flume with a capacity of 85 c.f.s running the length of the tunnel.¹³² A partial tunnel collapse in 1943 permanently closed the Ivanhoe Tunnel to auto traffic, allowing water to be carried through the main shaft, with an estimated capacity of 300 c.f.s.¹³³ More recent failures, however, limit the tunnel's capacity to about 60 c.f.s. through a 36-inch concrete pipe installed on the floor of the tunnel (*see Figure 3*).¹³⁴

In order to ensure a backup means of conveyance for Busk-Ivanhoe water, the Pueblo Board of Water Works has contracted with the Bureau of Reclamation to take deliveries of its half of Busk-Ivanhoe diversions through the Boustead Tunnel.¹³⁵ Pueblo pays \$21,690 per year under this contract for the right to convey up 750 acre-feet of Busk-Ivanhoe water through the Boustead Tunnel, with the option of conveying additional water at a higher rate (Pueblo has not exercised this option since 2003, when 1,262 acre-feet of Busk-Ivanhoe water was carried through the Boustead Tunnel).¹³⁶ Aurora, however, has no such contract for conveyance through the Boustead Tunnel, leaving the city subject to the threat of additional tunnel failures.¹³⁷

In 1994 the Pueblo Board of Water Works investigated the possibility of rehabilitating the Ivanhoe Tunnel, and estimated the potential cost of such a project at more than \$33 million.¹³⁸ Driving a new 8.5-foot tunnel, on the other hand, would cost only \$11 million.¹³⁹ The most feasible option for improving the tunnel's capacity would be "slip-lining" the existing pipe; however, that fix would still cost \$5.78 million and would not stem the risk of additional tunnel collapses.¹⁴⁰ Aurora has also planned to carry out its own engineering study on repairing the tunnel, going so far as to allocate \$300,000 for the project in the 2005.¹⁴¹ The funding, however, did not survive budget cuts, and the city has yet to undertake any such investigation.¹⁴²

The structural problems with the Ivanhoe Tunnel do not appear to have significantly reduced the yield from the Busk-Ivanhoe System, only curtailing diversions in years with above-average precipitation (most recently in 1983 and 1984).¹⁴³ Yet additional structural failures are an ever-present threat, and the tunnel will likely need to be repaired or stabilized at some point in the future.¹⁴⁴ Such repairs could be designed to increase the tunnel's capacity, even if only by allowing for diversions through the tunnel's main shaft.

Another possibility is that repairs to the Ivanhoe Tunnel could be combined with structural improvements to other diversion structures in order to increase the Busk-Ivanhoe's yield. For example, the Pan Creek Ditch has an absolute water right of 25 c.f.s., the ditch's designed capacity; however, during periods of high runoff, water often runs over the sides of the ditch, as it was "never quite large enough to hold the peak runoff."¹⁴⁵ Any additional diversions through the Pan Creek Ditch would have to be made under a new water right, which would necessarily be junior to the Fry-Ark Project's 150 c.f.s. absolute water right on Ivanhoe Creek.¹⁴⁶ But with improvements to the system, there could be additional water available for diversion in years with above-average precipitation, an opportunity that may be especially appealing to Aurora as transbasin water becomes increasingly valuable to the city.



Figure 3. Ivanhoe Tunnel. A pipeline currently comprises the tunnel's diversion capacity, releasing water into Busk Creek, a tributary to Lake Fork Creek.

Twin Lakes System Firming Efforts – Storage, Demand, & Structural Improvements

Increased Twin Lakes System Diversions Due to Additional Front Range Storage & Demand

While the Twin Lakes System is currently operating at near maximum legal capacity, the system's long-term yield is still slightly below what the system is lawfully entitled to divert. Since 2005, the Twin Lakes System has diverted approximately 56,500 acre-feet of water each year from the headwaters of the Roaring Fork River, well above the system's historical average yield of 40,589 acre-feet.¹⁴⁷ The Twin Lakes System is comprised of diversions from the Roaring Fork River, Lost Man Creek, Lincoln Creek, and Grizzly Creek, as well as three small tributaries to Lincoln Creek – New York, Tabor, and Brooklyn gulches. Diversions are collected in Grizzly Reservoir, before being transported via Tunnel No. 1 to the Lake Creek drainage of the Arkansas Basin.

Built in the mid-1930s by the Twin Lakes Reservoir & Canal Company ("Twin Lakes"), the Twin Lakes System was originally intended to provide supplemental irrigation water to approximately 550 farmers in Crowley County.¹⁴⁸ In 1972, however, Twin Lakes shareholders voted to separate the water rights for the Twin Lakes System from the land, so that farmers could market their share of the system's yield.¹⁴⁹ After three decades of such sales, today Colorado Springs holds approximately 54.7 percent of the stock in Twin Lakes, along with Pueblo Board of Water Works (23.1 percent), Pueblo West (11.7 percent), Aurora (5 percent), and various other minor shareholders.¹⁵⁰

In the 1977 judicial decree changing the use of the Twin Lakes System water rights from irrigation purposes to municipal and industrial use, specific volumetric limitations were imposed on the system's diversions.¹⁵¹ Under this decree, diversions through Tunnel No. 1 can neither exceed 68,000 acre-feet in any one year, nor 570,000 acre-feet in any consecutive 10-year period.¹⁵²

Transmountain diversions through the Twin Lakes System have already been steadily increasing in recent years. After two subpar decades of diversions (1980-1999), from 2000 to 2009 the Twin Lakes System diverted an average of 47,166 acre-feet of water each year, the greatest decade of diversions on record, despite severe drought conditions at the beginning of the decade (*see* Table 3).¹⁵³ The 2008 water year represented the highest annual diversion on record – 64,535 acre-feet of water (*see* Figure 4, following page).¹⁵⁴ For Twin Lakes, closing the gap between the system’s current yield and its 10-year running-average volumetric limits will likely be a matter of maximizing diversions in years with above-average precipitation, in order to offset years when the natural production on the West Slope causes diversions to fall below the system’s legal limits.

The diversion records for the Twin Lakes System indicate that historically in years with above-average precipitation, limited East Slope storage capacity and/or a lack of demand for supplemental transmountain water has caused a reduction in Twin Lakes System diversions. For example, in 1984 and 1995, the two years with the highest runoff in the Roaring Fork Watershed since 1972, the Twin Lakes System diverted only 8,790 and 32,218 acre-feet of water respectively, well below the system’s historical average yield.¹⁵⁵ In those years, Twin Lakes was bypassing water that was physically and legally available for diversion.¹⁵⁶

More recently, however, diversion records for the Twin Lakes System indicate that even in years with above-average precipitation, there is plenty of demand and available storage capacity to make full use of the potential diversions. Thus in 2007 and 2008, two years with extremely high runoff, the Twin Lakes System diverted well above average historical levels (*see* Figure 5, following page). Part of the demand for water on the Front Range in those years, despite a large runoff, can likely be explained by the need to rebuild storage reserves in the wake of the drought at the beginning of the decade.¹⁵⁷ Yet with this pattern of extreme hydrologic variability expected to continue in the future, the past decade can likely be seen as the new normal, wherein Twin Lakes System diversions are maximized, even in years with above-average precipitation.

Additional East Slope storage capacity and the increased demands associated with regional population growth in the coming decades will likely further add to Twin Lakes interest in and ability to divert water in years with above-average precipitation. Therefore, without any infrastructural changes to the Twin Lakes System’ West Slope water collection system, the system is likely to continue to expand transmountain diversions over the foreseeable future.

Firming Efforts on the Remaining Twin Lakes System Conditional Rights

Twin Lakes is not constrained to only increasing diversions in years with above-average precipitation. As recent water court filings in connection with the Twin Lakes System reveal, Twin Lakes appears to also be taking steps to maximize the system’s diversion capacity for years with average and below-average precipitation, through the continued expansion of and improvement to the Twin Lakes System’ West Slope collection system, including the development of the system’s remaining conditional rights.

In 2007, Twin Lakes requested a judicial decree to make absolute a 20 c.f.s. conditional right on the Lincoln Gulch Connection Canal, a structure that is primarily intended to convey water diverted from Lost Man Creek and the Roaring Fork River from the outflow of Tunnel No. 2 to Grizzly Reservoir, but which is also designed to intercept runoff from the adjacent hillside (approximately 1.2 square miles).¹⁵⁸ Originally constructed as an open-channel, unlined earthen ditch, in the late 1980s Twin Lakes replaced the last section of the canal with a pipe (approximately 12 feet in diameter), and in 1996 and 1997 lined the rest of the canal with concrete.¹⁵⁹ In addition to the safety and maintenance reasons for these improvements, the changes also serve to reduce the loss of water due to overflow and seepage.¹⁶⁰ To allow for the canal to continue to intercept runoff from the adjacent hillside, the concrete-lined section includes drains in the canal wall and the piped section contains inlets at each of the small unnamed streams it crosses.¹⁶¹ Flow measurements in 1997 and 2003 showed that during a short runoff that can last one or two days, the canal can divert upwards of 40 to 50 c.f.s. of inflow from the adjacent hillside, well above the 20 c.f.s. conditional right

that was originally decreed for the structure.¹⁶² The runoff collected by the canal is sent through Tunnel No. 1 with the rest of the water destined for use in the Arkansas Basin.¹⁶³

With the conditional right associated with the Lincoln Gulch Connection Canal absolute, Twin Lakes could now look to complete the other five remaining conditional rights for the system. Two of these rights have a 1930 appropriation date, including rights of 24 c.f.s. for the Lost Man Diversion and 28 c.f.s. for Tunnel No. 2.¹⁶⁴

There are also several conditional rights connected to the Twin Lakes System with a 1973 appropriation date, part of what Twin Lakes calls the “New York Connection Canal Supplement.” These supplemental rights are the result of Twin Lakes continued efforts to improve and expand the Twin Lakes System West Slope collection system, and by firming up these rights, Twin Lakes could further increase diversions, even in years with average or below-average precipitation.

The New York Connection Canal is 4-mile long system that collects runoff from three small tributaries to Lincoln Creek – New York, Brooklyn, and Tabor gulches.¹⁶⁵ These three diversions drain a combined area of approximately 9.3 square miles, and intercept around 30 percent of each basin’s flows.¹⁶⁶ Diversions are conveyed to Grizzly Reservoir via a 72-inch pipe that, like the Lincoln Gulch Connection Canal, is designed to intercept runoff from the adjacent hillside (draining an area of roughly 1.1 square miles).¹⁶⁷

In 1973, Twin Lakes sought a decree for new, supplemental water rights at each of the diversion points along the New York Connection Canal, after measurements indicated that the canal was physically capable of conveying more water than the 171 c.f.s. decreed at the Headgate No. 3 (Tabor Gulch), which represents the cumulative flow from the combined diversions along the length of the canal.¹⁶⁸ In particular, measurements taken by the company in 1970 and 1974 indicated that the canal was diverting 185.5 c.f.s. and 191 c.f.s. at times in June of those respective years.¹⁶⁹ At that point, Twin Lakes already had conditional rights at each of the diversion points along the New York Connection Canal, including 77 c.f.s. decreed for Headgate No. 1 (New York Gulch), 127 c.f.s. for Headgate No. 2 (Brooklyn Gulch), and the aforementioned 171 c.f.s. for Headgate No. 3.¹⁷⁰

Initially Twin Lakes requested a 1930 appropriate date for the three new conditional water rights it claimed as part of the New York Connection Canal Supplement, including an additional 20 c.f.s. at Headgate No. 1, 50 c.f.s. at Headgate No. 2, and 100 c.f.s. at Headgate No. 3.¹⁷¹ However, the district court for Water Division 5 initially rejected the Twin Lakes’ claim, holding that the company had lacked the requisite intent to make the any such appropriation when it commenced work on the system in 1930.¹⁷² Before successfully appealing the court’s decision to the Colorado Supreme Court, Twin Lakes agreed to appropriation date of April 30, 1973 for the rights it claimed as part of the New York Connection Canal Supplement.¹⁷³

While the district court did not examine the issue, the increased capacity of the New York Connection Canal was likely due in part to the improvements and structural changes that Twin Lakes had made to the canal’s original design. As originally constructed in the early 1930s, the New York Connection Canal consisted of a 4-foot deep, 9- to 13-foot wide, open-channel, unlined earthen ditch.¹⁷⁴ Starting in the summer of 1970, Twin Lakes began to replace portions of the canal with sections of corrugated steel pipe, and had completed this work for all but the canal’s final segment (from Tabor Gulch to Grizzly Reservoir) by the time it filed for the New York Connection Canal Supplement.¹⁷⁵ By 1986 the entire length of the canal had been replaced by piping.¹⁷⁶ Since then, Twin Lakes has continued to make improvements to the New York Connection Canal, such as installing retaining walls on the headgates in order to improve head pressure in piped sections.¹⁷⁷

Remaining conditional rights on the New York Connection Supplement include 20 c.f.s. at Headgate No. 1 (New York Gulch), 35 c.f.s. at Headgate No. 2 (Brooklyn Gulch), and 61 c.f.s. at Headgate No. 3 (Tabor Gulch).¹⁷⁸ In recent due diligence filings, Twin Lakes has made clear that it fully intends to pursue developing these remaining conditional rights, through continued structural improvements to the New York Connection Canal. In court filings made in 2007, Twin Lakes reported that, in order to further minimize water loss, it had replaced the diversion structure on Headgate No. 2 and “concrete grouted” the diversion dam foundation at Headgate No. 1.¹⁷⁹

While the Twin Lakes System may be operating in recent years at near its legal limits, the system's diversion records show that it has historically failed to maximize diversions in years with below-average or even average precipitation. Firming up the system's last five remaining conditional rights through continued structural improvements could allow Twin Lakes to increase diversions in such years and further close the gap between the system's current yield and the volumetric limits imposed in the 1977 change decree.

Conclusion

With increased East Slope storage capacity, added West Slope diversions, improvements and repairs to existing collection and diversion infrastructure, and development of conditional rights, the three transmountain diversion systems operating in the Roaring Fork Watershed could each potentially be expanded, a possibility that must be viewed in light of the rapidly growing municipal water demands on the Front Range. Though the opportunity for increased diversions from the Roaring Fork Watershed would primarily exist in years with above-average precipitation, the ability to divert and store such surplus flows is now widely seen by Front Range water providers as the key to both developing new supplies for future population growth and protecting against water shortages during the inevitable times of severe drought.

Large conditional water rights remain for several features of the Fry-Ark Project that were never completed, and which may have only been deferred in anticipation of the Basalt Project eventually calling for an equal share of the flows in the Fryingpan River and its tributaries. The Southeastern District is committed to ensuring that the Fry-Ark Project yields the full 69,200 acre-feet per year that the project was originally contemplated diverting, and thus may decide to pursue developing the project's deferred conditional rights, either through adding new diversions or a project like the Ruedi Pumpback concept.

While the diversions of the Busk-Ivanhoe System are constrained by legal and structural limitations, Aurora's increasing reliance on the Busk-Ivanhoe and other transmountain diversions suggests that the city may be prepared to try to overcome these limitations. In recent years Aurora has diverted more than 3,000 acre-feet through the Ivanhoe Tunnel, in addition to contracting for Pueblo's half of the system's yield, and with development of the Prairie Waters Project, transmountain diversions are becoming increasingly valuable to the city. Even if Aurora's diversions through the Busk-Ivanhoe System are constrained by seasonal and volumetric limitations in the pending change decree for the city's portion of the system's water rights, those restrictions may only be a precursor to a subsequent filing for new water rights for the system. Combining new water rights with long-anticipated structural repairs to the Ivanhoe Tunnel, as well as potential improvements to other diversion structures, could allow Aurora to further expand Busk-Ivanhoe diversions, particularly in years with above-average precipitation.

While Twin Lakes System diversions have increased in recent years, the system has yet to reach its legally entitled average diversion capacity of 57,000 acre-feet of water per year. With additional East Slope storage capacity and water demands, however, Twin Lakes is unlikely, as it has in the past, to curtail diversions in years with above-average precipitation. Thus without any structural improvements, average annual diversions by the Twin Lakes System are likely to continue to increase. Twin Lakes could also expand diversions during years with average and below-average runoff with continued improvements to the Twin Lakes System's West Slope collection system, including development of the five remaining conditional rights associated with the system.

Admittedly, increased transmountain diversions through the Fry-Ark Project, Busk-Ivanhoe System, and Twin Lakes System are by no means certain. For example, this possibility arises in part due to conditional water rights that have remained undeveloped for decades. Similarly, new water rights filings and structural improvements for any of these systems would be costly and legally difficult endeavors. But the confluence of recent events on the Front Range - from the sudden demand for increased East Slope carryover storage, to the recent discussions among

Southeastern's board of directors about the Fry-Ark gap, to Aurora's request for a change decree on the Busk-Ivanhoe System, to the continued improvements to the Twin Lakes System's West Slope collection system – makes the potential for increased transmountain diversions from the Roaring Fork Watershed a possibility that local water interests must now actively prepare for. As the collective representative of local governments in the Roaring Fork Watershed with respect to water issues, the Ruedi Water & Power Authority is in a unique position to help lead a unified response to proposals that could lead to increased transmountain diversions from the watershed.

Local Options & Recommendations

The following recommendations and options are means by which local communities in the Roaring Fork Watershed could solidify and protect their common water interests through the Ruedi Water & Power Authority.

General Recommendations

1.1 Reassess RWAPA's Role in Local Water Management

As lead sponsor of the Roaring Fork Watershed Plan, RWAPA has devised a new model for local water management. The initiative provides this organization with a good deal of credibility, in terms of demonstrating the organization's commitment to the sustainable, long-term management of local water resources. RWAPA's standing is likewise bolstered by its connection to entities like the Roaring Fork Conservancy, an organization with a commitment to water-based education that brings a degree of authenticity to what local interests are trying to do in the watershed.

Now, as Colorado plans for the allocation of the last of the state's legally developable water resources, local interests in the Roaring Fork Watershed are preparing to implement their own plan for the future of local water resources. As development of the Watershed Plan comes to completion, RWAPA needs to reconsider its role in local water management, in light of the plan's recommendations and objectives.

There are practical reasons why an entity like the RWAPA is well situated to help in local water resource planning and management. Besides the benefit of the economy of scale, RWAPA has the advantage of being a largely independent organization – founded in formal agreement, but based primarily on collaboration and cooperation.

RWAPA also has the advantage of its connection to Ruedi Reservoir, which has always been intended to help meet the needs of the Roaring Fork Watershed and the larger Colorado Basin. The reservoir represents one of the key sources for meeting the West Slope future water demands, and yet currently is undersubscribed. As the latter condition is likely only a short-term phenomenon, it is critical that local interests set a precedent now as to the reservoir's intended purpose, use, and future operations. Ruedi Reservoir's potential role in meeting Colorado's long-term water needs should place RWAPA at the center of local, regional, and statewide discussions over major water management decisions relating to the Roaring Fork. RWAPA needs to continue to develop its influence within these discussions.

In this respect, RWAPA should look to further strengthen its local ties to organizations and entities here in the valley, particularly the Roaring Fork Watershed Collaborative and the Roaring Fork Conservancy. Considering the basis and purpose behind each of these organizations, when combined with RWAPA, the three groups can represent the major stakeholders in the watershed. RWAPA may also want to consider providing assistance to the Roaring Fork Watershed Collaborative, to help extend the group's influence and involvement in local water management. Given the group's role in helping to develop the Watershed Plan, the Collaborative needs to be as

strong as the both RWAPA and the Roaring Fork Conservancy – both in terms of strategy and organizational structure.

Outside the watershed, RWAPA should coordinate with the Water Quality & Quantity Program of the Northwest Colorado Council of Governments (NWCCOG). During the recent recession, as local governments have continued to see declining budget projections, there have been reports that some local governments are considering cutting their ties to such organizations, given the high cost and arguably discretionary nature of such expenditures.¹⁸⁰ In the case of NWCCOG this would be a mistake, given the valuable water-related services provided by council’s Water Quality & Quantity Program. The NWCCOG’s efforts to protect the interests of its West Slope constituent entities from transmountain proposals of Front Range entities pays off dividends that are long-term and often unnoticed.¹⁸¹ And as local governments in the watershed fall subject to federal and state water quality permitting programs for stormwater runoff, the value of the NWCCOG’s services is likely to become all the greater.¹⁸²

RWAPA should also seek to collaborate with the Colorado River District. The River District has always been aggressive in protecting the water resources of the Roaring Fork Watershed, but the River District has many constituents and interests throughout the Colorado Basin. Local governments must, however, fully utilize the River District’s experience and resources. For its part, the River District is designed to work with groups like RWAPA, including the power to act on their behalf and establish joint action entities with other water interests.¹⁸³

RWAPA is setting the example for a new kind of locally based water resource management, one built on collaboration and cooperation. In this respect, RWAPA potentially offers a powerful means by which local interests can participate in statewide water planning and negotiate even-handedly with the likes of Aurora Water and Colorado Springs Utilities – entities with economic and legal resources that dwarf those of West Slope communities. As the Roaring Fork Watershed Plan comes to completion, RWAPA should continue to reassess its role and its priorities in local water management, and seek to maximize its potential benefits for member entities.

1.2 Continue to Support Water-related Research & Analysis

Research and analysis – of legal, engineering, and environmental issues – is perhaps one of the most valuable uses of RWAPA’s resources. Any kind of major or long-term initiative requires detailed planning, knowledge, and forethought, but in the water management context, the cost of these types of studies and reports can often be prohibitive for local governments. Given the increasing demands on their budgets, local governments are missing an opportunity to coordinate and economize their necessary water-related research and analysis.

As previously stated, the Roaring Fork Watershed Plan will be a valuable tool in guiding future water management decisions, for both public and private interests. With that endeavor nearing completion RWAPA should begin to identify priorities for additional follow-up studies and investigations. In this respect, RWAPA may want to consider some of the more interesting and effective recent examples of water-related studies that have been completed by various entities in Colorado.

For example, in December 2009, the Front Range Water Council – a organization representing most of the major water providers in the Denver Metro Area, including Denver and Aurora – released its latest study, titled “Water and the Colorado Economy,” which attempts to quantify the relative value of water when used in various parts of the state.¹⁸⁴ Looking only at the total regional sales of goods and services as the measure of productivity, the report estimated that every acre-foot of water used on the Front Range generated \$132,269 in sales. At the other end of the spectrum, according to the report, was the San Luis Valley, where water generated only \$1,209 in sales per acre-foot. In Western Colorado water was estimated to generate \$7,200 in sales per acre-foot, compared to \$12,326 in the Central Mountains.

While the Front Range Water Council’s report represented a crude analysis of the issue, it could be used to help justify transmountain water development proposals that the council’s member entities bring forward in the future. The report was prepared as a response to what the Front Range water providers see as the “monetization” of

recreational water use and environmental flows, and thus was unambiguous attempt to create disparity in the perceived value of water on the two sides of the Continental Divide.¹⁸⁵

RWAPA needs to take the knowledge and direction it has gained in conjunction with the Watershed Plan and use further research and analysis to continue to shape the debate surrounding the future of local water resources. This work further needs to be made accessible through public, non-technical reports.

Research could come in the form of general analysis, like this report, or RWAPA could elect to follow the example set by Front Range Water Council, and take a more direct route in its research. RWAPA, for example, could fund efforts to identify and publicize alternate sources for future Front Range water supplies, like water conservation. Likewise, RWAPA could advocate for the CWCB to research further opportunities for water recycling and conservation, as opposed to pipeline feasibility studies.

Regardless of the exact focus, RWAPA needs to continue to define the context of water supply management and development in the watershed. As the lead sponsor of the Roaring Fork Watershed Plan, RWAPA will be a primary stakeholder in the future of water management discussions, including those related to new transmountain diversion projects affecting local water resources. By conducting research and analysis on related water issues, RWAPA can ensure that local interests have the information to address the potential impacts related to additional transmountain diversions.

1.3 Encourage & Support Local RICD Filings

Beyond research and analysis, RWAPA needs to encourage and even consider supporting the beneficial use of the watershed's resources. Colorado water law has come to recognize the full spectrum of water-related uses – whether agricultural, municipal, industrial, recreational, or environmental. Yet water users have no assurance in the future availability of sufficient water supplies without first taking the legal steps necessary to secure a proper legal decree for their activity.

Recreational water use provides an especially good example of a way in which RWAPA may want to consider supporting local water development. The recent convergence of events in this area appeals for better local coordination. In particular, with the uncertainty surrounding the Shoshone Power Plant on the Colorado River in Glenwood Canyon, local interests should consider securing one or more recreational in-channel diversion (RICD) water rights on the middle or lower Roaring Fork River.¹⁸⁶ Glenwood Springs recently built a whitewater kayak park on the Colorado River, immediately below the confluence with the Roaring Fork. With the City of Aspen's existing recreational rights on the upper Roaring Fork, and previous proposals for similar rights in both Basalt and Carbondale, the situation seems to suggest that a coordinated effort could be far more effective (and economical) in ensuring adequate recreational flows throughout the watershed, including at Glenwood Springs' new whitewater park on the Colorado River.

Developing RICD water rights on the middle and lower Roaring Fork River would be a lengthy, costly, and perhaps even controversial endeavor. In all these respects, an entity like RWAPA would be a better choice to lead such an initiative, rather than several individual efforts. Not only could RWAPA coordinate and streamline the research and analysis phase, but also assist in the necessary permitting and water court adjudicatory process.

There is also the much-publicized right-to-float issue, which should be considered a question primarily of property law, but with obvious water policy implications. The law in this area remains uncertain, but under one early legislative proposal, the State would have been required to make a case-by-case determination of which streams in Colorado have a history of public recreational use. If such an investigation were ever to be carried out, RWAPA would be an ideal entity to lead the effort.

Short-term Option (2011-2016)

2.1 Investigate Potential Impacts of Pending & Proposed East Slope Storage and Conveyance Infrastructure

As previously stated, research allows RWAPA to define the context of water supply management and development in the Roaring Fork Watershed. As the framework of the Watershed Plan comes to completion, generating both general and specific recommendations and objectives, RWAPA needs to take the initiative to shape and spur the next phases of research and analysis. The following are several possible areas of study that RWAPA should consider. Research on these issues would have general utility to any of the recommendations and objectives that are ultimately identified in the Watershed Plan, and therefore are recommended to be completed first.

- Quantify the potential changes to transmountain diversions from the Roaring Fork Watershed with expanded East Slope storage capacity, including: completion of Aurora’s Box Creek Reservoir; expansion of Clear Creek Reservoir; possible improvements to the Otero Pumpstation and Homestake Pipeline; Aurora’s unconventional storage projects in the South Platte Basin, and the completion of the Southern Delivery System. With the CWCB’s Colorado River Availability Study now complete, climate change could and should also be incorporated into this analysis. Likewise, the projections of the Colorado and Yampa/White basin roundtables’ Energy Needs Assessment should be included in the analysis.
- Investigate the potential economic impact of future operations at Ruedi Reservoir, with the likely changes in the timing and quantity of water releases from the reservoir under full contract demand. (This research could also be conducted in coordination with Pitkin County, which recently announced that it planned to carry out a new analysis of the value of the Fryingpan River to the local economy.)

It is critical that, as research like these proposed investigations are carried out, RWAPA continue to work with Front Range water providers to not only gain a better understanding of their long-term water supply plans but also to help shape any proposals that might possibly affect local water resources.

2.2 Procure Financial & Technical Support for Local Watershed Planning & Management Efforts

In conjunction with the specific research efforts, RWAPA should also continue to pursue funding through the Interbasin Compact Process, through either the Colorado Basin Roundtable or the Interbasin Compact Committee. These funds are necessarily limited, and the standards for acceptable projects are being raised. More importantly, in every approved funding request, the State is essentially committing itself to that particular water supply strategy, which means that the projects selected will in large part shape the state’s future water policies, laws, and practices.

RWAPA also needs to think creatively about how to take advantage of other potentially available resources for research and analysis. For example, during the 2010 summer RWAPA and the RFC supported a group of graduate students from Michigan State University in studying current trends in local water management decisionmaking. Likewise, many law schools support summer grant programs that provide funding for law students working in the public-interest sector. There are also programs like the University of Colorado School of Law’s Natural Resources Law Center, Colorado State’s University’s Colorado Water Institute, and even non-profit research organizations like the Western Resource Advocates. RWAPA needs to cultivate new and cost-efficient means of securing the necessary research for the protection of local water resources.

2.3 Support & Advocate for the Watershed’s Interests at the State and Federal Level

When former State Representative Kathleen Curry announced in December of 2009 that she was abandoning her affiliation with the Democratic Party, she commented that the move was important to her despite risking her committee leadership positions, including as chairwomen of the House Agriculture, Livestock and Natural Resources

Committee. Representative Curry explained that she personally valued holding chairmanship to the House Agricultural Committee, but that her constituents “don’t seem to see such positions as terribly important.”¹⁸⁷

Despite Representative Curry’s impression, the forfeiture of her position as chairwomen of the Natural Resources Committee was a serious loss to her West Slope constituents, given her capacity to help shape water policy and law at the state level. Clearly local water interests are not adequately communicating with state officials regarding their water concerns and priorities. RWAPA, as a representative of local governments in the watershed, needs to establish a direct line of contact with State House representatives and State Senators who represent portions of the Roaring Fork Watershed.

The lingering questions and uncertainty surrounding the role of the Interbasin Compact Process in statewide water planning is one issue that RWAPA should address with state representatives. The IBCC is designed to institute a bottom-up approach to statewide water supply planning, and therefore should be of particular value to local governments. Moreover, as the Roaring Fork Watershed Plan was funded in part by the IBCC, RWAPA’s continued support for this process should be seen as part of the Watershed Plan’s overall implementation.

RWAPA should likewise represent local water interests in discussions with federal officials in certain water-related issues. The situation surrounding the future operations at Ruedi Reservoir provides a clear example of a situation where local interests should probably be represented by one voice in negotiations with the Bureau of Reclamation. Although both the Colorado River District and the NWCCOG maintain federal lobbying programs, RWAPA still needs to become directly engaged when federal issues affect the Roaring Fork Watershed.

2.4 Investigate the Possibility of Dedicating Ruedi Reservoir Water for the State’s Colorado River Compact Obligations

In June of 2010, the Arkansas and Gunnison basin roundtables began discussions concerning the possibility of allocating a portion of the water in the Aspinall Unit – a federally-owned water supply project consisting primarily of Blue Mesa, Crystal, and Morrow Point reservoirs – for meeting the state’s Colorado River Compact obligations.¹⁸⁸ Throughout the IBCC, the Gunnison Basin Roundtable has been adamant that the Gunnison Basin should not be the source for new transmountain diversions to the Front Range.¹⁸⁹ Therefore the Gunnison Basin Roundtable is seeking to identify some way in which it can protect local water supplies from additional transmountain diversions, while still helping the state deal with future water supply shortages.¹⁹⁰ The Gunnison Basin Roundtable may have found a means of accomplishing both objectives in what is now being called the “Blue Mesa plan.”

Under the plan conceptually agreed upon by the Arkansas and Gunnison basin roundtables, the State of Colorado would contract with the Bureau of Reclamation for up to 200,000 acre-feet of water in the Aspinall Unit, which could be released from Blue Mesa Reservoir in the case of a call on the Colorado River by the Lower Basin states (California, Arizona, and Nevada).¹⁹¹ The water released from Blue Mesa Reservoir would be intended to satisfy Colorado’s delivery obligations to the Lower Basin, while allowing transmountain diversions, particularly the more junior transmountain diversions to the Arkansas Basin, to continue to operate.¹⁹² The major transmountain diversions to the Arkansas Basin are junior not only to most of the transmountain diversions to the South Platte Basin, but also many of the conditional water rights of energy companies on the West Slope, thus making them particularly vulnerable to a potential Colorado River Compact call.¹⁹³ In October the Arkansas and Gunnison basin roundtables agreed to send a delegation to Washington to discuss with federal officials if the Blue Mesa plan would indeed be feasible.¹⁹⁴

For local water interests, the possibility of dedicating a portion of Ruedi Reservoir’s unallocated water to meeting the state’s Colorado River Compact obligations should be an intriguing option. Such an arrangement could help ensure adequate flows in the Fryingpan and lower Roaring Fork rivers for recreational and environmental purposes during times of low runoff. Similarly, using Ruedi Reservoir to help satisfy the state’s Colorado River Compact obligations could dampen Front Range interest in the Roaring Fork Watershed as a source of additional transmountain diversions. Finally, the contracts to secure the water for such a plan could help pay off the local long-

term repayment obligation for Ruedi Reservoir, thus making the cost of Ruedi water more affordable for local water interests.

Whether such an arrangement would be feasible or even practicable is a very complicated matter. With respect to the question of feasibility, it is unclear whether there would be a large enough amount of water in Ruedi Reservoir for such purposes in light of future local water demands and the possible development of conditional energy rights. One practical concern is that using water from Ruedi Reservoir to meet the state's Colorado River Compact obligations during times of drought may only exacerbate low flow conditions in the upper Roaring Fork by allowing for the Twin Lakes System to continue to divert.

Regardless of these and other potential concerns, RWAPA should fully investigate and pursue this possibility. The negotiations between the Arkansas and Gunnison basin roundtables concerning the Blue Mesa plan are proceeding quickly, and it is therefore essential that local interests, acting through RWAPA as well as their representatives on the Colorado Basin Roundtable, become part of these discussions.

Medium-term Options (2015-2025)

3.1 Follow the River District's Grizzly Reservoir Right Example

In 1995, Twin Lakes Reservoir & Canal Company sought a similar decree to what Aurora and the Climax Molybdenum Company are now seeking in connection with the Columbine Ditch, and which Aurora may try to obtain in the future for the Busk-Ivanhoe System. Having diverted under "free river" conditions in June of 2004, as part of a carefully coordinated plan with the State Engineers Office and the Bureau of Reclamation, Twin Lakes then sought several new absolute water rights to allow the Twin Lakes System to divert in similar conditions in the future – years with above-average precipitation when water is physically available for diversion but precluded by volumetric limitations imposed by the system's senior water rights decree.¹⁹⁵

After objecting to Twin Lakes' application, the River District negotiated for an unusual form of compensation for the increased transmountain diversions.¹⁹⁶ Under the water court's decree, the River District has the right to one-third of the first 2,400 acre-feet of water diverted under Twin Lakes' junior water right.¹⁹⁷ The decree also gives the River District the right to store up to 200 acre-feet of the water acquired under the right in Grizzly Reservoir.¹⁹⁸ In any one year, the River District is permitted to call for the release of up to 100 acre-feet of water from its account in Grizzly Reservoir.¹⁹⁹ Water in excess of 2,400 acre-feet diverted under the junior water right accrues to Twin Lakes.²⁰⁰

The River District plans to use the water it acquires under Twin Lakes' junior right in exchange for bypassed diversions by the Homestake Project, in the headwaters of the Eagle River.²⁰¹ Yet the River District is also lawfully allowed to use the water for augmenting flows in Lincoln Creek in order to help meet decreed CWCB instream flow rights, which are often not met given the lack of any required bypasses from the Twin Lakes System diversion structures.²⁰²

Like the Twin Lakes System, the Busk-Ivanhoe System has no required bypasses at the system's various diversion structures; however, downstream from the Busk-Ivanhoe System, the Fry-Ark diversion structure on Ivanhoe Creek must bypass water at a rate of at least 2 c.f.s. The fact that Aurora owns 47.5 percent the Busk-Ivanhoe System, as well as 5 percent interest in Twin Lakes Reservoir & Canal Company creates the opportunity for a potential water exchange.

If, in Aurora's pending change decree for the Busk-Ivanhoe System, volumetric limitations are imposed on the city's use of its share of the Busk-Ivanhoe water rights and Aurora thereafter files for a new junior right on the system, local interests, led by an organization like RWAPA, could try to negotiate for a portion of the additional diversions, just as the River District did with Twin Lakes' junior right for the Twin Lakes System. This water could then be released to Ivanhoe Creek, or even diverted through the Ivanhoe Tunnel, in exchange for a matching amount

being released from Grizzly Reservoir. While such an agreement may facilitate increased diversions from the Roaring Fork Watershed in years with above-average precipitation, it may prove to be a means for supplementing flows in years when runoff is at or below average.

3.2 Reformat the Basalt Project

As previously explained in detail in the section on the Fry-Ark Deferred Area, the Fry-Ark's water rights require that the project be operated in coordination with the Basalt Project and to the benefit of water users in both the Arkansas and Colorado basins. With Southeastern considering potentially attempting to develop remaining conditional water rights associated with the Fry-Ark Project, RWAPA should initiate discussions among local water interests to consider whether it makes sense to put the Basalt Project water rights to their originally intended purpose, with the construction a conduit from Ruedi Reservoir to somewhere near Basalt. This notion may seem far-fetched, but local interests have already raised this idea as one way of preserving fishing and recreational values in the Fryingpan River below Ruedi Reservoir, with future releases from Ruedi under increased contracting demands.

Such a retrofitted project could focus solely on the construction of a conduit, in the 25 to 35 c.f.s. range, from the outflow on Ruedi Dam down the Fryingpan River, before cutting across the southwest flank of Basalt Mountain, to a power station located somewhere between Basalt and Emma. Water conveyed via the conduit could be used to support local power generation, as well as other water uses, such as recreational in-channel diversion rights on the middle and lower Roaring Fork River. With the water available for conveyance in Ruedi Reservoir, the project's hydropower plant could have a near continual supply of potential energy. The bypassed water could also help ensure optimal flows for fishing in the downstream Gold Medal section of water.

The legal, engineering, economic and environmental barriers to such a project would be considerable, but so would the potential benefits. In addition to supporting the local fishing, tourism, and recreational boating industry, such a project could effectively discourage additional transmountain diversions from the Roaring Fork Watershed. There are questions concerning the feasibility of such a project that are beyond the scope of this report, but the concept is at least one for local interests to consider. As "the kind of project that meets the basin's needs through actions within the basin," this is the kind of proposal that may be supported by East Slope entities.²⁰³

Citations

- ¹ See, e.g., John Stroud, "Carbondale still adjusting to 'new normal' budget," *Glenwood Post Indep.* (Oct. 5, 2010).
- ² See Mark Jaffe, "Colorado water war ends in deal," *Denver Post* (May 1, 2009) (note, however, despite the article's intimation, no deal has yet been struck). See also Catherine Lutz, "Upper Colorado River named sixth most endangered in country," *Aspen Daily News* (Jun. 17, 2010). For more recent developments, see Pamela Dickman, "Rectifying the river: Reservoir proponents see project as a way to right past damage," *Loveland Reporter-Herald* (Oct. 18, 2010).
- ³ Colo. Water Conservation Bd., "Draft Report - 2050 Municipal and Industrial Gap Analysis," table 2.2 (Sept. 2010) (available at <http://cwcb.state.co.us/IWMD/COsWaterSupplyFuture/CosWaterSupplyFuture.htm>).
- ⁴ Examples of such projects include Colorado Springs' Blue River Project, Denver Water's Dillon Reservoir/Roberts Tunnel System, and Colorado Springs and Aurora's Homestake Project (Phase I).
- ⁵ Examples of notable agricultural-to-municipal water transfers include the sale of the Independence Pass Transmountain Diversion System, as well as Colorado Springs and Aurora's purchases of portions of the Colorado Canal System and Rocky Ford Canal.
- ⁶ See Colo. Water Availability Task Force and Impact Task Forces, "2003 drought impact and mitigation report" (Apr. 14, 2003).
- ⁷ Kevin Lusk, water supply principal engineer, Colorado Springs Util., email to Mark Fuller, director, Ruedi Water & Power Auth., (Sept. 30, 2010) (stating that "As was demonstrated by the drought of 2002, yields of all systems are very volatile and vulnerable to extreme hydrologic conditions. 2002 reset all water providers' expectations of firm yield").
- ⁸ *Id.* (stating that, "Looking into the future, with the looming threat of climate change and additional volatility and reduction in hydrology, additional storage is a critical component of water supply planning. We must capture water in wet years when it is available and store it for use in the critical dry years").
- ⁹ For more information on the IBCC, see Roaring Fork Watershed Plan, "Why the Roaring Fork Watershed Plan Matters," (Oct. 15, 2008); see also, Roaring Fork Watershed Plan, "The State of the Roaring Fork Watershed Report," ch. 2 (Nov. 2008) (both available at <http://www.roaringfork.org/sitepages/pid175.php>).
- ¹⁰ For examples of such research, see Colo. Water Conserv. Bd., "Strategies for Colorado's Water Supply Future," (Jun. 2009) (available at <http://cwcb.state.co.us/IWMD/COsWaterSupplyFuture/CosWaterSupplyFuture.htm>).
- ¹¹ See *Id.*
- ¹² Colo. Water Conserv. Bd., "State of Colorado 2050 Municipal and Industrial Water Use Projections," Table 3-1 (Sept. 2010) (available at <http://cwcb.state.co.us/IWMD/COsWaterSupplyFuture/CosWaterSupplyFuture.htm>).
- ¹³ *Id.* at tables 2.2 and 3.2.
- ¹⁴ Colo. Water Conserv. Bd., *supra* n. 3 at table 2.2.
- ¹⁵ *Id.*
- ¹⁶ See Colo. Water Conserv. Bd., *supra* n. 10 at § 1.2.2.
- ¹⁷ See e.g., Joe Hanel, "Reports: Colorado will be crowded, thirsty in future," *Durango Herald* (Aug. 8, 2009) (quoting Eric Kuhn, Director of the Colorado River Water Conservation District, who called the proposed transmountain diversion projects that the state had studied "a recipe for disaster"). See also Chris Woodka, "State plans for multiple water futures," *Pueblo Chieftain* (Sept. 25, 2009).
- ¹⁸ See Chris Woodka, "Water roundtable irked at snub of proposals," *Pueblo Chieftain* (Aug. 13, 2009). See also Chris Woodka, "Lower Ark to look at 'tipping point' in water sales," *Pueblo Chieftain* (Nov. 20, 2009).
- ¹⁹ See e.g. Ark. Basin Roundtable Water Transfer Guidelines Comm., "Considerations for Agriculture to Urban Water Transfers," (Sept. 10, 2008). See also Chris Woodka, "Rep. Salazar stands firm on Aurora deal," *Pueblo Chieftain* (Aug. 29, 2009) and "Senators want Ark Valley protection in deal," *Pueblo Chieftain* (Aug. 29, 2009). See also "Enough!" editorial, *Pueblo Chieftain* (May 27, 2009).
- ²⁰ For more information on the Moffat Collection System Project, see Denver Water, "Moffat Collection System Project," website (<http://www.denverwater.org/SupplyPlanning/Planning/FutureWaterSupply/WaterSupplyProjects/Moffat/>). For information on the Windy Gap Firming Project, see N. Colo. Water Conserv. Dist., "Windy Gap Firming Project," website (http://www.ncwcd.org/project_features/wgp_firming.asp).
- ²¹ See, e.g., U.S. Bur. of Reclamation, "Southern Delivery System Final Environmental Impact Statement," 7, 19 (Dec. 2008).
- ²² *Id.* See also, e.g., Fort Collins Utilities, "Water Conservation Plan," 9-10 (Feb. 12, 2009).
- ²³ *Id.*
- ²⁴ K. Lusk, *supra* n. 7. See also Interbasin Compact Comm., "Annual Report," 19 (Oct. 31, 2009) (quoting Eric Wilkinson, director of the Northern Colorado Water Conservancy District, "2002 gave everyone a glimpse of what a normal, future year would look like if we didn't do adequate planning for the future").

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- ²⁵ See, e.g., Andrea J. Ray, Joseph J. Barsugli, and Kristen B. Averyt, "Climate Change in Colorado: A Synthesis to Support Water Resources Management and Adaptation," 38 (2008); see also, Colo. Water Conserv. Bd., "Colorado River Water Availability Study – Phase I Report" (Jul. 2010).
- ²⁶ *Id.* Also see Chris Woodka, "River study seen as an important planning tool," *Pueblo Chieftain* (Jan. 30, 2010) (quoting Eric Wilkinson, director of the Northern Colorado Water Conservancy District, in response to the preliminary results of the Colorado River Availability Study, "I guess one word strikes me: storage.") Also see, e.g., Colo. Water Conserv. Bd., "Drought & Water Supply Assessment," ch. 6 at 2-3, 5, and 8, ch. 15 at 3-6 (Feb. 17, 2004).
- ²⁷ *Id.* Also see, e.g., Fort Collins Utilities, *supra* n. 22 at 10-11.
- ²⁸ See Colo. Water Conserv. Bd., "Water Supply and Needs Report for the Arkansas Basin," §§ 9.2.3 and 9.2.2.1 (Jun. 2006).
- ²⁹ *Id.* at §§ 9.2.3 and 9.2.5
- ³⁰ *Id.* at § 9.2.3
- ³¹ *Id.* at § 8.4.5.
- ³² *Id.*
- ³³ *Id.*
- ³⁴ *Id.* at § 9.2.3.
- ³⁵ *Id.* at § 8.4.4.
- ³⁶ See Ark. Basin Roundtable, "Arkansas Basin Consumptive Use Water Needs Assessment: 2030, 2008 Update," 6 (Jul. 2008). See also S.E. Colo. Water Conserv. Dist., "Preferred Storage Options Plan Report," 86-87 (Sept. 21, 2000) (available at <http://www.secwcd.org/PSOP/PSOP%20report%209%2021%202000.pdf>).
- ³⁷ *Id.* (S.E. Colo. Water Conserv. Dist.) at 87-88.
- ³⁸ See Dist. Court, Water Div. 2, Case No. 04CW130 (case pending).
- ³⁹ See Tracy Harmon, "Aurora proposes storage in Box Creek," *Pueblo Chieftain* (Apr. 21, 2006).
- ⁴⁰ Colo. Springs Utilities, "Southern Delivery System Fact Sheet" (Aug. 24, 2009).
- ⁴¹ Colo. Springs Utilities, "Southern Delivery System – Draft Fish and Wildlife Mitigation Plan," 1-1 (Mar. 11, 2010). See also Bur. of Reclamation, "Southern Delivery System – Final Environmental Impact Statement," 57-65 (Dec. 2008).
- ⁴² See Ark. Basin Roundtable, *supra* n. 36 at 6 and fig. 2.
- ⁴³ *Id.* at 13 and 25.
- ⁴⁴ *Id.* at 11.
- ⁴⁵ See Aurora Water, "Water Supply Factbook – 2010-2011," 12 (2010).
- ⁴⁶ *Id.* at 8. Note: volumes listed are the amounts of storage capacity that Aurora has rights or interests in.
- ⁴⁷ See Dist. Court, Water Division No. 5, "December 2009 Resume," p. 5-9 (Dec. 2009).
- ⁴⁸ If the Corps of Engineers approves reallocation, the total amount of storage for uses other than flood control will be about 48,000 acre-feet, including Denver Water's current 27,400 acre-feet of contacted storage space. For more information, see Denver Water, "Chatfield Reservoir," website (<http://www.denverwater.org/Recreation/ChatfieldReservoir/>).
- ⁴⁹ See Dist. Court, Water Division No. 5, "December 2009 Resume," p. 5-9 (Dec. 2009).
- ⁵⁰ For a complete record of the Fry-Ark's annual diversions, see U.S. Bur. of Reclamation, "Annual Operating Plan – Fryingpan-Arkansas Project – Water Year 2009 Operations," Table 4, p. 18 (2009) (available at <http://www.usbr.gov/gp/aop/fa/fryarkintpg.cfm>).
- ⁵¹ Colo. Water Conserv. Bd., "Upper Colorado River Basin Information," 2-26 (2007). Although, note that Southeastern's 1979 "Allocation Principles" for Fry-Ark Project water allocations cited and was based upon the Bureau of Reclamation's "Computer Operation Study No. 40051," which estimated that the West Slope water collection and conveyance system was capable of diverting 56,900 acre-feet of water per year from the Colorado Basin. See S.E. Colo. Water Conserv. Dist., "Allocation Principles," ¶ 1 (Nov. 29, 1979).
- ⁵² Pub. L. No. 87-590, 76 Stat. 389 (1962).
- ⁵³ H.R. Doc. 87-130 at 3 (Mar. 15 1961).
- ⁵⁴ See Bur. of Reclamation, *supra* n. 50 at Table 4, p. 18
- ⁵⁵ See Roaring Fork Watershed Plan, "The State of the Roaring Fork Watershed Report," *supra* n. 9 at ch. 2, p. 28 (Nov. 2008).
- ⁵⁶ For example of how the Fry-Ark Project is operated with respect to annual diversions, see U.S. Bur. of Reclamation, *supra* n. 50 at 7.
- ⁵⁷ Roy W. Vaughan, office manager, U.S. Bur. of Reclamation, Pueblo Office, email to author (Dec. 15, 2010).
- ⁵⁸ See, e.g., Colo. Water Conserv. Bd., *supra* n. 28 at § 8.3.1. See also S.E. Colo. Water Conserv. Dist., "Preferred Storage Options Plan Report," 18 (Sept. 21, 2000) (available at <http://www.secwcd.org/PSOP/PSOP%20report%209%2021%202000.pdf>).

⁵⁹ *Id.* (S.E. Colo. Water Conserv. Dist.) at 25.

⁶⁰ *Id.* at 28.

⁶¹ *Id.* at 88.

⁶² Chris Woodka, “SE district looks for ways to fill it up,” *Pueblo Chieftain* (Aug. 30, 2009).

⁶³ *Id.*

⁶⁴ Chris Woodka, “SE District jumps into Super Ditch case,” *Pueblo Chieftain* (Apr. 18, 2010).

⁶⁵ *Id.*

⁶⁶ Woodka, *supra* n. 62.

⁶⁷ *Id.*

⁶⁸ H.B. 1041 is codified as Colo. Rev. Stat. § 24-65.1-101 through -502 (LexisNexis 2009).

⁶⁹ See e.g., *City of Denver v. Grand Co.*, 782 P.2d 753 (Colo. 1989); *City of Colo. Springs v. Bd. of Co. Commrs.*, 895 P.2d 1105 (Colo. App. 1994). See also Geoffrey M. Craig, *House Bill 1041 and Transbasin Water Diversions: Equity to the Western Slope or Undue Power to Local Government?* 66 U. Colo. L. Rev. 791, 799-822 (1995).

⁷⁰ Woodka, *supra* n. 62.

⁷¹ Dist. Court, Water Div. 5, Case No. W-829-76, “In the Matter of the Application for Water Rights of Fryingpan-Arkansas Project in the Roaring Fork and Fryingpan Rivers and their Tributaries in Eagle and Pitkin Counties,” Amended Ruling of Referee (Jul. 13, 1979).

⁷² *Id.* at 16.

⁷³ *Id.*

⁷⁴ *Id.* at 16-17.

⁷⁵ Colorado Wilderness Act of 1980, P.L. 96-560, 94 Stat. 3265, § 102(a)(5) (Dec. 22, 1980).

⁷⁶ *Id.* Note that the Colorado Wilderness Act of 1993, which added 8,330 acres to the Hunter Fryingpan Wilderness area (known as the Spruce Creek Addition), provided that the designation would not “abate, impair, impede, limit, interfere with, or prevent the construction, operation, use, maintenance, or repair of the [Fry-Ark Project’s] facilities and diversion systems to their full extent.” P.L. 103-77, 107 Stat. 756, § (Aug. 13, 1993). This provision, however, only affects Fry-Ark diversions in the South Side Collection System, not the North Side Collection System where most of the Southeastern’s remaining conditional rights are decreed.

⁷⁷ 16 U.S.C. §1133(c).

⁷⁸ Colo. Rev. Stat. § 37-92-305(3)(a) (LexisNexis 2009).

⁷⁹ Teresa Rice and Roy Smith, “Arkansas River Water Needs Assessment,” § 3, p. 92 (Jul. 2000).

⁸⁰ *Id.*

⁸¹ *Id.* at 91.

⁸² Enartech and GEI, “Development of a water delivery system from Ruedi Reservoir to the Boustead Tunnel, a reconnaissance level feasibility assessment” (available from the Colo. River Water Conserv. Dist.) (Jul. 1999).

⁸³ See Roaring Fork Watershed Plan, “The State of the Roaring Fork Watershed Report,” *supra* n. 9 at § 2.2.3. Regarding completion of the Homestake II Project, see Eagle Co. Attys Off., “Water court case reaches settlement,” (available at http://www.eaglecounty.us/Attorney/News/Water_Court_case_reaches_settlement/).

⁸⁴ *Id.*

⁸⁵ Colo. Water Conserv. Bd., *supra* n. 10 at 4-41.

⁸⁶ *Id.*

⁸⁷ *Id.*

⁸⁸ Color. Water Conserv. Bd., *supra* n. 51 at 2-27.

⁸⁹ Dist. Court, Garfield Co., Civil Action No. 4613, Decree, “In the Matter of the Supplemental Adjudication of the Priority of Appropriation of Water for All Beneficial Purposes in Water District No. 38 in the State of Colorado; Robert L. Bridges, Executor of the Estate of Tucker McClure, Deceased, and M. Stanley Pings, Petitioners” (Jun. 28, 1958).

⁹⁰ Dist. Court, Garfield Co., Civil Action No. 4613, Transcript of Testimony, Vol. II, Testimony of Philip P. Smith, 488-492 (Oct. 7, 1957). Colorado River Storage Project Act, P.L. 84-485, 70 Stat. 105 (Apr. 11, 1956).

⁹¹ Dist. Court, Garfield Co., Civil Action No. 4613, Decree, (Jun. 28, 1958). See also Dist. Court, Garfield Co., Civil Action No. 4613, Petition to Reopen Decree (Jul. 7, 1958).

⁹² *Id.*

⁹³ *Id.*

⁹⁴ Dist. Court, Garfield Co., Civil Action No. 4613, Order (Jul. 16, 1958).

⁹⁵ Dist. Court, Garfield Co., Civil Action No. 4613, Petition (Jul. 16, 1958).

⁹⁶ Dist. Court, Garfield Co., Civil Action No. 4613, Supplemental Decree, 16 (Aug. 3, 1959).

⁹⁷ *Id.*

⁹⁸ *Id.*

⁹⁹ *Id.*

¹⁰⁰ *Id.* at 17-18. Note that the Operating Principles also restricted project diversions from Lime Creek to May and June of each year. See House Doc. No. 130, 87th Cong., 1st Sess., ¶ 8 (Mar. 15, 1961)

¹⁰¹ *Id.*

¹⁰² Regarding the current use of the Basalt Project water rights for augmentation purposes, see Roaring Fork Watershed Plan, “The State of the Roaring Fork Watershed Report,” ch. 2, p. 2-3 (Nov. 2008).

¹⁰³ Busk-Ivanhoe, Inc., “Application for Change of Water Rights in Pitkin County,” Dist. Court, Water Div. 5, Exhibit C (Dec. 2009).

¹⁰⁴ Colo. Water Conserv. Bd., *supra* n. 51 at 2-32.

¹⁰⁵ John N. Winchester, “A Historical View: Transmountain Diversion Development in Colorado,” 11-12 (2001).

¹⁰⁶ See Dist. Court, Water Div. 5, Case No. 90CW340, “Findings and Decree,” (Nov. 15, 1993).

¹⁰⁷ J. Winchester, *supra* n. 105 at 12.

¹⁰⁸ *Id.*

¹⁰⁹ See Chris Woodka, “Pueblo water storage reaches record high,” *Pueblo Chieftain* (May 11, 2010).

¹¹⁰ See Dist. Court, Water Div. 5, Case No. 90CW340, “Findings and Decree,” (Nov. 15, 1993).

¹¹¹ *Id.*

¹¹² *Id.*

¹¹³ *Id.*

¹¹⁴ Chris Woodka, “Aurora files for change of Busk-Ivanhoe rights,” *Pueblo Chieftain* (Jan. 8, 2010).

¹¹⁵ *Id.*

¹¹⁶ Dist. Court, Water Div. 5, Case No. 09CW186 (case pending). See also Dist. Court, Water Division No. 5, “December 2009 Resume,” p. 5-9 (Dec. 2009).

¹¹⁷ Dist. Court, Water Div. 5, Case No. 09CW186 (case pending) (statements of opposition included in case file).

¹¹⁸ J. Winchester, *supra* n. 105 at 9.

¹¹⁹ Dist. Court, Water Div. 5, Case No. 90CW340, “Findings and Decree,” (Nov. 15, 1993). The change decree in Case No. 90CW340 imposed the following seasonal and volumetric limitations on the Columbine Ditch: operations are limited from April 28 to October 21 of each year; diversions may not exceed 80,220 acre-feet in any 60-year period; diversions may not exceed 36,400 acre-feet in any 20-year period; and diversions may not exceed 3,148 acre-feet in any one year.

¹²⁰ Dist. Court, Water Div. 5, Case No.’s 09CW187 and 09CW188 (cases pending). See also Dist. Court, Water Div. No. 5, “December 2009 Resume,” 9-16 (Dec. 2009).

¹²¹ See Dist. Court, Water Div. No. 5, “December 2009 Resume,” 16 (stating that “The purpose of this appropriation is to divert water that is in excess of the 20 year and 60 year volumetric limits to which the original Columbine Ditch appropriation is subject”).

¹²² Dist. Court, Water Div. No. 5, “December 2009 Resume,” 7 (Dec. 2009).

¹²³ *Id.*

¹²⁴ Dist. Court, Water Div. No. 5, “December 2009 Resume,” 7 (Dec. 2009).

¹²⁵ Dist. Court, Water Div. No. 5, “December 2009 Resume,” 7-8 (Dec. 2009).

¹²⁶ See Chris Woodka, “Going underground,” *Pueblo Chieftain* (Apr. 2, 2010).

¹²⁷ *Id.*

¹²⁸ Joseph Stibrich, executive director, Water Resources Department, Aurora Water, email to author (Apr. 2, 2010).

¹²⁹ See also Chris Woodka, “Priming the Well,” *Pueblo Chieftain* (Aug. 1, 2007). Currently, Aurora’s water department provides water to 20 other private service distributors. Aurora Water estimates that annual water demand within its service area will grow from the current level of 45,364 acre-feet of treated water per year to approximately 64,221 acre-feet by 2020, and 73,090 acre-feet by 2030. See Aurora Water, “Water Supply Fact Book – 2010-2011,” 6 (available at <http://www.auroragov.org/AuroraGov/Departments/AuroraWater/InformationEducation/Information/index.htm?ssSourceNo deId= 602&ssSourceSiteId=621>).

¹³⁰ J. Winchester, *supra* n. 105 at 11-12.

¹³¹ *Id.*

¹³² Dist. Court, Garfield Co., Civil Action No. 3082, “In the Matter of the General Adjudication of the Priority of Water Rights to the Use of Water in Water District No. 38; Busk-Ivanhoe Company, Petitioner,” Transcript of Testimony, Testimony of William A. McKenzie, 6 (Oct. 23, 1935).

¹³³ Colo. Water Conserv. Bd., *supra* n. 51 at 2-71.

¹³⁴ *Id.*

¹³⁵ *Id.*

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- ¹³⁷ *Id.*
- ¹³⁸ Roger L. "Bud" O'Hara, president, Busk-Ivanhoe Water System Authority, email to author (Jun. 7, 2010).
- ¹³⁹ *Id.*
- ¹⁴⁰ *Id.*
- ¹⁴¹ City of Aurora, "2005 Adopted Budget," G-150 (Jan. 31, 2005).
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- ¹⁴³ Dist. Court, Water Div. 5, Case No. 90CW340, "Findings and Decree," ¶ 8 (Nov. 15, 1993)
- ¹⁴⁴ Bur. of Reclamation, "Contract between the United States and the High Line Canal Company for Transportation and Storage of Water," Contract No. 14-06-700-6576, 1 (noting that the Ivanhoe Tunnel is "would require extensive rehabilitation and betterment work in order to provide service").
- ¹⁴⁵ Dist. Court, Garfield Co., Civil Action No. 4033, "In the Matter of the Adjudication of Priority Rights to the Use of Water for Irrigation Purposes in Water District No. 38 in the State of Colorado," Transcript of Testimony, Testimony of Harvey B. Cooper, 8 (1950).
- ¹⁴⁶ A 25 c.f.s. conditional right on the Pan Creek Ditch was cancelled in 1952. See Dist. Court, Garfield Co., Civil Action No. 4033, "In the Matter of the Adjudication of Priority Rights for the Use of Water for Irrigation and Non-Irrigation Purposes in Water District No. 38 in the State of Colorado; Emma Bradshaw, also known as Emma C. Bradshaw, Petitioner," Findings, 124 (Oct. 2, 1952).
- ¹⁴⁷ CDSS, Station ID 09073000, "TWITUNCO" (2009).
- ¹⁴⁸ Dist. Court, Garfield Co., Petition, "In the Matter of the Adjudication of Priorities of Right to the Use of Water, in Water District No. 39, of the State of Colorado, and in the Matter of the Twin Lakes Reservoir and Canal Company, a Corporation, for a Decree to the Independence Pass Transmountain Diversion System," 2 (May 7, 1935).
- ¹⁴⁹ Chris Woodka, "Twin Lakes: A Tunnel through Turbulent Times," *Pueblo Chieftain* (Apr. 5, 2009).
- ¹⁵⁰ Bur. of Reclamation, "Draft Water Resources Technical Report," 3-21 (Nov. 4, 2005).
- ¹⁵¹ Dist. Court, Water Div. 5, Case No. W-1901, Change Decree, (May 12, 1976); affirmed in *Twin Lakes Reservoir & Canal Co. v. City of Aspen*, 193 Colo. 478 (Colo. 1977).
- ¹⁵² *Id.* (Change Decree).
- ¹⁵³ CDSS, *supra* n. 147.
- ¹⁵⁴ *Id.*
- ¹⁵⁵ See Roaring Fork Watershed Plan, "The State of the Roaring Fork Watershed Report," *supra* n. 9 at ch. 2, p. 28 (Nov. 2008).
- ¹⁵⁶ K. Lusk, *supra* n. 7 (stating that in "extremely wet years" ... "there has been less need and/or capacity for the water and most of it is left in the river. Increasing demands and expanding facilities will only serve to bring diversions in these wet years more in line with long term average annual diversions").
- ¹⁵⁷ See Colo. Water Conserv. Bd., *supra* n. 26 at ch. 6, p. 4-5
- ¹⁵⁸ Dist. Court, Water Div. 5, "August 2007 Resume," 5 (Aug. 2007). See also Dist. Court, Water Div. 5, Case No. 07CW145, Ruling of the Referee and Decree of the Water Court, "Concerning the Application for Water Rights of the Twin Lakes Reservoir and Canal Company for Findings of Reasonable Diligence and to Make Absolute Portions of the Independence Pass Transmountain Diversion System in Pitkin County, Colorado."
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- ¹⁶² *Id.*
- ¹⁶³ *Id.*
- ¹⁶⁴ *Id.* at 4.
- ¹⁶⁵ Roaring Fork Conservancy, "Independence Pass Transmountain Diversion System," map (Oct. 7, 2005) (provided by the Twin Lakes Reservoir & Canal Co.) (available at [http://www.roaringfork.org/images/maps/Twin%20Lakes%20TWIN LAKES SYSTEM%20Map%20TLC&TC.jpg](http://www.roaringfork.org/images/maps/Twin%20Lakes%20TWIN%20LAKES%20SYSTEM%20Map%20TLC&TC.jpg)).
- ¹⁶⁶ *Id.*
- ¹⁶⁷ *Id.*

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- ¹⁶⁸ Dist. Court, Water Div. 5, Case No. W-1869, Application for Water Right, “In the Matter of the Application for Water Rights of the Twin Lakes Reservoir and Canal Company for the New York Collection Canal Supplement for the Independence Pass Transmountain Diversion System in Pitkin County,” (Apr. 30, 1973).
- ¹⁶⁹ Dist. Court, Water Div. 5, Case No. W-1869, Findings of Fact, Conclusions of Law, and Decree, 4 (Mar. 14, 1975).
- ¹⁷⁰ *Twin Lakes Reservoir & Canal Co. v. City of Aspen*, 192 Colo. 209, 211-212 (Colo. 1976),
- ¹⁷¹ Dist. Court, Water Div. 5, Case No. W-1869, Application for Water Right, 2 (Apr. 30, 1973).
- ¹⁷² Dist. Court, Water Div. 5, Case No. W-1869, Findings of Fact, Conclusions of Law, and Decree, 8 (Mar. 14, 1975).
- ¹⁷³ Dist. Court, Water Div. 5, Case No. W-1869, Findings of Fact, Conclusions of Law, and Decree, 5 (Oct. 2, 1979). *See also Twin Lakes Reservoir & Canal Co.*, 192 Colo. at 212 (1976).
- ¹⁷⁴ Dist. Court, Garfield Co., Civil Action No. 3082, Statement of Claim, “In the Matter of the Adjudication of Priorities of Right to the Use of Water, in Water District No. 38 of the State of Colorado, and in the Matter of the Twin Lakes Reservoir and Canal Company, a Corporation, for a Decree to the Independence Pass Transmountain Diversion System,” 4-5 (Apr. 27, 1935).
- ¹⁷⁵ Dist. Court, Water Div. 5, Case No. W-722, “Application for Biennial Finding of Reasonable Diligence and Determination that a Conditional Right has Become an Absolute Eater Right by Reason of the Completion of the Appropriation,” 7 (May 30, 1972). *See also* Dist. Court, Water Div. 5, Case No. W-1869, Application for Water Right, 2 (Apr. 30, 1973).
- ¹⁷⁶ Dist. Court, Water Div. 5, Case No. 86CW155, Application for Quadrennial Finding of Reasonable Diligence and to Make Absolute a Portion of a Conditional Right, 4 (Jun. 9, 1986).
- ¹⁷⁷ Dist. Court, Water Div. 5, “November 2000 Resume,” Case No. 00CW228, 4 (Nov. 2000).
- ¹⁷⁸ *Id.* at ¶ 3.5.
- ¹⁷⁹ Dist. Court, Water Div. 5, Case No. 07CW199, Referee’s Ruling and Decree of Water Court, “Concerning the Application for Water Rights of the Twin Lakes Reservoir and Canal Company in Pitkin County, Colorado,” ¶ 4.5 and 4.6 (2009).
- ¹⁸⁰ John Colson, “Pitkin County cost-cutting talk turns heated,” *Aspen Times* (Oct. 22, 2008).
- ¹⁸¹ *Id.* at 19.
- ¹⁸² For more information, *see* Roaring Fork Watershed Plan, “Phase II Guidance Document Released: Illuminating the Way Ahead,” Appendix III, xvii-xx (2010).
- ¹⁸³ *See* Colo. Rev. Stat. §§ 37-46-149 through -151 (LexisNexis 2009). (For example, the River District has helped develop and sustain both the West Divide and Basalt Projects, in conjunction with the corresponding water conservancy districts that the the River District helped organize with local interests.)
- ¹⁸⁴ Front Range Water Council, “Water and the Colorado Economy” (Dec. 2009) (available at http://www.ncwcd.org/news_information/web_news/LatestNews/Water&TheColoEconomy.pdf).
- ¹⁸⁵ K. Lusk, *supra* n. 7 (stating that “the [Front Range Water Council’s] report was done in response to the ‘monetization’ of RICDs and environmental flows, i.e. the assertions that, for example ‘rafting brings X million dollars to the state’, etc. These seem like big numbers until set up against the money brought in by the day-to-day mundane business that occurs on the eastern slope relying on water diverted from the [W]est [S]lope”).
- ¹⁸⁶ Gary Harmon, “State’s two halves try to reconcile competing interests in Shoshone,” *Daily Sentinel* (May 24, 2010).
- ¹⁸⁷ John Colson, “Curry shows independent streak,” *Valley Journal* (Dec. 30, 2009).
- ¹⁸⁸ *See* Chris Woodka, “Conserve or cooperate,” *Pueblo Chieftain* (Jun. 7, 2010).
- ¹⁸⁹ *See* Interbasin Compact Comm., “Meeting Summary,” 6 (Aug. 30, 2010) (noting comments by IBCC members that “The Gunnison Basin would prefer not to be impacted by a new transbasin diversion. How can the Gunnison Basin contribute to statewide concerns about the gap?”).
- ¹⁹⁰ *Id.*
- ¹⁹¹ *See* Chris Woodka, “Blue Mesa storage could protect water imports,” *Pueblo Chieftain* (Aug. 15, 2010).
- ¹⁹² *Id.*
- ¹⁹³ *Id.*
- ¹⁹⁴ *See* Chris Woodka, “Roundtables want to move on Blue Mesa plan” *Pueblo Chieftain* (Oct. 14, 2010).
- ¹⁹⁵ *See* Dist. Court, Water Div. 5, Case No. 95CW32, Findings of Fact, Conclusions of Law, Judgment and Decree (Apr. 20, 2001). Specifically, the original right decree for the Twin Lakes Project imposes the restriction that the project cannot divert from the Colorado Basin if (1) the project has already stored 54,452 acre-feet of water in Twin Lakes Reservoir in a given year, and (2) 756 c.f.s. of water is available for diversion by the Colorado Canal.
- ¹⁹⁶ *Id.* at ¶ 14.4.
- ¹⁹⁷ *Id.*
- ¹⁹⁸ *Id.*

¹⁹⁹ *Id.*

²⁰⁰ *Id.*

²⁰¹ K. Lusk, *supra* n. 7 (stating that “The River Districts 1/3 of the water produced under the 1995 right would be dedicated to the east slope to pay for releases of water from Homestake Reservoir for the benefit of the west slope. Ultimately, the east slope will keep most if not all of the water diverted under the 1995 right”).

²⁰² Dist. Court, Water Div. 5, Case No. 95CW32, Findings of Fact, Conclusions of Law, Judgment and Decree, ¶ 14.7 (Apr. 20, 2001). *See also* Grand River Consulting, “Streamflow Assessment of the Roaring Fork River Upstream of Aspen, Colorado” (Nov. 2007). *See also* Roaring Fork Watershed Plan, “State of the Watershed Report,” Executive Summary, 14 (2008).

²⁰³ K. Lusk, *supra* n. 7 (stating that “This is the kind of project that meets the basin’s needs through actions within the basin, and would likely be supported by east slope entities.”)