coloradowaterplan.com
cowaterplan@state.co.us
Direct: 303-866-3441

Appendix D

IBCC Conceptual Framework

The IBCC will review a new version of the Conceptual Framework on July 13, 2015.

COLORADO
Colorado Water Conservation Board
Department of Natural Resources

1313 Sherman Street
Denver, CO 80203

P (303) 866-3441
F (303) 866-4474

John Hickenlooper, Governor

Mike King, DNR Executive Director

James Eklund, CWCB Director

TO: Colorado Water Conservation Board Members

FROM: Jacob Bornstein, IBCC and Basin Roundtable Program Manager, Water Supply Planning Section

DATE: July 16, 2014

AGENDA ITEM: 13 - IBCC Conceptual Agreement

Staff recommendation: This is an informational item only. No Board action is required.

Background

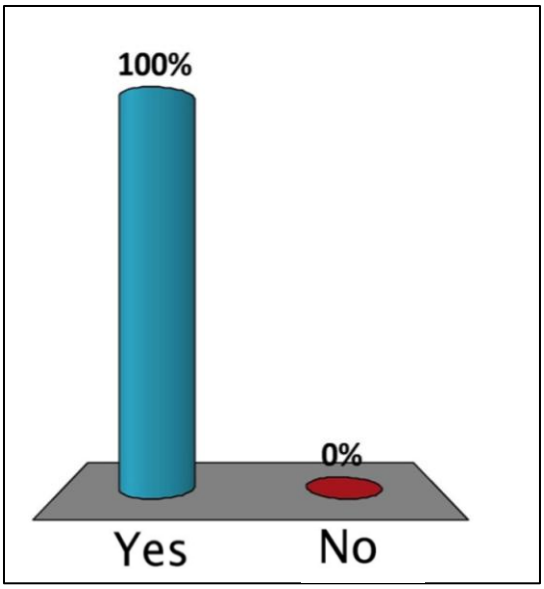
The Interbasin Compact Committee (IBCC) completed initial discussion of the Draft Conceptual Agreement on June 24th, 2014 and agreed to submit it to the CWCB Board for inclusion in the first draft of Colorado's Water Plan. The attached document incorporates the IBCC's requested changes from their the June meeting.

To demonstrate their level of agreement, the IBCC polled on the following question:
I agree that the Draft Conceptual Agreement is ready to go to the Board for consideration while we continue to get feedback from our roundtables, our constituencies, and the public.

All members of the IBCC polled "yes" to this question (see figure).

The IBCC anticipates additional revisions to the Draft Conceptual Agreement based on feedback from the Board, the Basin Roundtables, other water community stakeholders, and the public. IBCC members will work with staff to discuss and receive feedback on the Draft Conceptual Agreement with the Basin Roundtables. Individuals with suggestions for improvement to the Draft Conceptual Agreement should share them with a member of the IBCC or sumbit comments using the coloradowaterplan.com website. IBCC membership is available here.

There are still several topics the IBCC would like to further discuss. This work may begin as early as this fall.



All members of the IBCC polled "yes" to the following statement: *I agree that the draft Conceptual agreement is ready to go to the Board for consideration while we continue to get feedback from our roundtables, our constituencies, and the public.*

Discussion

The Director of Compact Negotiations, several board members that were in attendance, and staff will provide an update on the IBCC discussion and progress to this point.

Interbasin Compact Committee

DRAFT Conceptual Agreement

The *IBCC Conceptual Agreement* sets the framework for future detailed negotiations on a potential new transmountain diversion (TMD). It reflects major statewide areas of concern that should be discussed and negotiated between project proponent(s) and affected communities. The *IBCC Conceptual Agreement* was generated by the diverse stakeholders that make up the IBCC and represents a thorough exploration of the difficult issues that often surround a new TMD. As such, this framework may be helpful in accelerating future negotiations. However, the agreement is not meant to take the place of any specific negotiations and agreements that will surround any future transmountain project.

The IBCC acknowledges that overdevelopment of limited Colorado River System water is a serious risk that could result in a Compact deficit, and all planning has to recognize that risk. The purpose of this document is to provide an initial conceptual agreement about how a future increment of Colorado River water could be developed under the right circumstances.

IBCC Summary Points

1) The East Slope is not looking for firm yield from a new TMD project and would accept hydrologic risk for that project.
2) A new TMD project would be used conjunctively with East Slope interruptible supply agreements, Denver Basin Aquifer resources, carry-over storage, terminal storage, drought restriction savings, and other non-West Slope water sources.
3) In order to manage when a new TMD will be able to divert, triggers are needed.
4) An insurance policy that protects against involuntary curtailment is needed for existing uses and some reasonable increment of future development in the Colorado River system, but it will not cover a new TMD.
5) Future West Slope needs should be accommodated as part of a new TMD project.
6) Colorado will continue its commitment to improve conservation and reuse.
7) Environmental resiliency and recreational needs must be addressed both before and conjunctively with a new TMD.

1) The East Slope is not looking for firm yield from a new[1] TMD project and would accept hydrologic risk for that project.

See Section 5 for background information and concepts related to future West Slope needs.

2) A new TMD project would be used conjunctively with East Slope interruptible supply agreements, Denver Basin Aquifer resources, carry-over storage, terminal storage, drought restriction savings, and other non-West Slope water sources.

It is important for East Slope parties to demonstrate to the West Slope that agreements and frameworks are in place for East Slope backup water supplies during dry years. Interruptible supply agreements (ISAs), Denver Basin Aquifer resources, carry-over and terminal storage, and drought restriction savings are the key options for backup water supplies that can be drawn on by East Slope entities during years that water cannot be diverted from a TMD. The IBCC envisions that any entity interested in participating in a new TMD would prepare and share a detailed plan for firming the yield of a new TMD in dry years using some or all of these options. The firming plan should include steps to firm up not only the amount of water diverted in the project, but the full amount of water used to meet demands, including the additional yield generated through reuse. Each entity's firming plan should be tailored to the unique strengths and constraints of each system, with the tools listed below serving as options that could be employed in any plan but not requirements that must be incorporated into each plan.

Background: Both the 2010 IBCC "Letter to the Governors" and the East Slope Basin Roundtables White Paper discuss a "dual system," where transmountain water would be used conjunctively with storage and local basin supplies, such as groundwater and agricultural sources.

Alternative Transfer Methods (ATMs): Colorado is one of the leaders in the West when it comes to ATMs. The grant program of the Colorado Water Conservation Board (CWCB) has funded many pilot studies, including the Northeast Colorado Water Cooperative Project. In 2013, the Colorado Legislature passed H.B. 1248, which was signed by the Governor. This legislation further allows ATM pilots to move forward. The Super Ditch is an

Resources for Item 2:

- Alternative Agricultural Water Transfer Methods (ATM) Projects
- Previous ATM Grant Summary Reports
- Upper Black Squirrel Creek Study (December 2008)
- The Poudre Runs Through It: Northern Colorado's Water Future (Launched 2011)
- House Bill 13-1248
- Northeast Colorado Water Cooperative
- SB06-193 Underground Water Storage Study (March 2007)
- Aquifer Recharge of Ground Water in Colorado – A Statewide Assessment (2004)
- Regional Aquifer Supply Assessment (December 2008)
- South Metro Water Supply Authority Aquifer Recharge Pilot Study (Ongoing)
- South Metro Water Supply Authority Regional Water Master Plan (June 2007)
- Metro Roundtable Water Supply Paper (2012)
- Interbasin Compact Committee Letter to Governor Ritter and Governor-Elect Hickenlooper (2010)
- South Metro Water Supply Study (2003)

[1] A "new" TMD means a transmountain diversion project that is not considered an identified project or process in SWSI 2010.

example of an ATM project in the Arkansas Basin. During the February IBCC meeting, the IBCC reviewed language on the agricultural and nonconsumptive gap, which stated that "Agricultural water has a role to play with regard to adding flexibility and reliability to meet future water needs." In addition, the IBCC polled on language regarding multi-purpose projects, which stated: "In addition to meeting East Slope needs, a new supply project should have significant operational flexibility (such as the ability to be used conjunctively with alternative agricultural transfers and nontributary groundwater when water supply is not available) (October Polling Results: 86% agree /14% needs further discussion/0% disagree)."

For the purposes of this component, ISAs will be the primary ATM tool employed in conjunction with a TMD. Additionally, alternative agricultural transfers that are operated on a rotating annual basis regardless of whether it is a wet or dry year could be carried out with farmers willing to fallow a percentage of their land on a more permanent basis. This strategy could play an important role in establishing East Slope drought reserves. It is possible that that many farmers will be glad to fallow a percentage of their land on a more permanent basis in return for a reliable cash-flow.

Denver Basin Aquifer Resources: Through interviews with water providers in the South Metro region, SWSI 2010 determined that water providers were hoping to replace approximately 30,000 acre-feet (AF) of nonrenewable Denver Basin Aquifer water with renewable sources. A new TMD project will change the conversation about nontributary groundwater resources. If new water supplies are brought to the East Slope, it may be appropriate to get away from the 30,000 AF concept and to speak generally about the different possibilities of conjunctive use of Denver Basin Aquifer resources.

The Denver Basin Aquifer can be conceptualized in two ways: 1) as a savings account in which available water is stored during years with more than sufficient water and then utilized during years without sufficient water through aquifer storage and recharge (ASR), or 2) as an equity line of credit when the limited and original aquifer water resources are drawn upon. ASR could be used as carry-over storage of TMD water for use in dry periods. Colorado's State Legislature commissioned a study on Underground Water Storage completed in 2007, which examined both alluvial and bedrock aquifer storage potential. In addition, WSRA grants have funded ASR pilots in the Black Squirrel, Lost Creek, and Denver Basin aquifers. Centennial Water and Sanitation District has an active ASR program, and other entities, such as Castle Rock and the East Cherry Creek Valley Water and Sanitation District are conducting ASR pilot projects. The 2007 Underground Water Storage report states: "Currently, rules only exist for implementing underground water storage projects in the non-designated portions of the Denver Basin bedrock aquifers…. A dialogue on developing rules and regulations for underground water storage aquifers throughout the state" should be considered (5-4).

Important questions remain about the use of Denver Basin Aquifer resources, including how much water can be stored and withdrawn, the timing requirements for storage and withdrawal, costs, and conceptual designs.

Carry-Over and Terminal Storage: Utilizing carry-over storage between wet and dry cycles is an important component of maximizing and timing the delivery of water supplies on the East Slope. Additionally, terminal storage can be used at the point of diversion as well as downstream to optimize the timing of conveying the water resources. Carry-over storage facilities and terminal storage facilities can be the same or different structures, depending on the design.

Drought restriction savings and drought reserves: Drought restrictions reduce demand and put less pressure on other East Slope water resources. Most communities have methods for handling a water-short year. However, a balance must be struck between how much the Front Range can commit to in terms of conservation measures and the variability of a TMD without firm yield. If a commitment to conservation measures is too great, flexibility for managing drought is reduced.

Drought reserves are utilized by several water providers. These reserves would store East Slope water, such as ATM water, for use during times of drought.

Hypothetical Table: How TMD water in wet years is used conjunctively with water saved through drought restrictions, carry-over storage, ISA water, Denver Basin Aquifer resources, and reuse supplies is difficult to envision. Below is a hypothetical example developed for discussion to understand the interplay between the differing systems. This hypothetical example uses the "Winner Rule," where an average one AF diversion is illustrative:

	20 yr. period	Year Type	Potential TMD Withdrawals (AF)	TMD Use	Drought Restrictions / Reserve*	Stored TMD Water (ASR & Other)	Interruptible Supply Agreement Water	Denver Basin Aquifer Water	Reuse	Total Yield
Wet Period	1	Water Available	1.75	1.00	-	-	-	-	0.60	1.60
	2	Some Water Available	1.00	1.00	-	-	-	-	0.60	1.60
	3	Some Water Available	1.00	1.00	-	-	-	-	0.60	1.60
	4	No Water Available	-	-	0.24	0.40	0.15	0.30	0.51	1.60
	5	Water Available	1.75	1.00	-	-	-	-	0.60	1.60
	6	Water Available	1.75	1.00	-	-	-	-	0.60	1.60
	7	Some Water Available	1.00	1.00	-	-	-	-	0.60	1.60
	8	Water Available	1.75	1.00	-	-	-	-	0.60	1.60
	9	Some Water Available	1.00	1.00	-	-	-	-	0.60	1.60
	10	Water Available	1.75	1.00	-	-	-	-	0.60	1.60
Dry Period	11	No Water Available	-	-	0.24	0.40	0.15	0.30	0.51	1.60
	12	No Water Available	-	-	0.24	0.40	0.15	0.30	0.51	1.60
	13	No Water Available	-	-	0.24	0.40	0.15	0.30	0.51	1.60
	14	Some Water Available	1.00	0.75	0.24		0.05	0.05	0.51	1.60
	15	No Water Available	-	-	0.24	0.40	0.15	0.30	0.51	1.60
	16	No Water Available	-	-	0.30	0.30	0.21	0.30	0.49	1.60
	17	Some Water Available	1.00	0.75	0.24	-	-	0.10	0.51	1.60
	18	Water Available	1.75	1.00	-	-	-	-	0.60	1.60
	19	No Water Available	-	-	0.32	0.20	0.30	0.30	0.48	1.60
	20	No Water Available	-	-	0.32	0.20	0.30	0.30	0.48	1.60
Average Annual Yield (AF)			**0.83**	**0.58**	**0.13**	**0.14**	**0.08**	**0.13**	**0.55**	**1.60**
Total 20 Year Use (AF)			**16.50**	**11.50**	**2.62**	**2.70**	**1.61**	**2.55**	**11.02**	**32.00**
Average Annual TMD Water Usage						**0.71**				
Net Stored TMD Water Still Available (AF)						**2.30**				

* Drought Reserves may include water from alternative agricultural transfers that are operated on a rotating annual basis.

3) In order to manage when a new TMD will be able to divert, triggers are needed.

Triggers in the context of this component refer to when East Slope backup supplies will be needed to supplement a TMD. They do not refer to a mechanism to protect existing users (e.g., a West Slope water bank). It will be up to a project proponent to line up East Slope backup supplies and to demonstrate what they are.

Continuing conversations and negotiations between Colorado, other Colorado River Basin States, and the federal government regarding the continuation of the 2007 Interim Guidelines, 1944 Mexican Water Treaty and related Minutes, and similar basin-wide operations are sensitive. Colorado does not want to pre-judge the outcome of these discussions, and these conversations should occur at the appropriate level.

The triggers contemplated in this current IBCC effort only pertain to operations of a TMD within Colorado, distinct from those in the Interim Guidelines or the Treaty and its Minutes, which are applied to the Colorado River Basin as a whole. Any triggers to be discussed at the IBCC level cannot presuppose the outcome of these conversations, nor negatively impact Colorado's position in such conversations.

For the purposes of Colorado's Water Plan, it should be sufficient to: 1) include language indicating that the IBCC encourages the Upper Basin states to continue discussion on this subject, and that triggers should be finalized after the Interim Guidelines are renegotiated in 2026, but no later than 2030, and 2) draft a brief memo outlining components and variables of triggers that could be used for managing a new TMD (e.g., 10-year rolling averages, Colorado River Storage Project (CRSP) reservoir levels, hydrologic variability, climate change).

Triggers to manage when a TMD can divert will rely on contractual agreements between parties and not on changes to the Colorado Constitution. It is the hope and expectation that the IBCC-recommended process for further development of Colorado River supplies will be more attractive to project proponents than the status quo.

Resources for Item 3:

- Colorado River Basin Water Supply and Demand Study & continued work
- IBCC Scenario Development
- Colorado River Compact
- Upper Colorado River Basin Compact
- Minute 319
- 2007 Interim Guidelines
- Endangered fish PBOs
- Colorado River Water Availability Study
- Gunnison Basin Risk Assessment Scenario for Portfolio Tool Document
- IBCC Report to the Governors
- WISE Partnership
- Colorado River Cooperative Agreement

Background: The trigger concept has been utilized or proposed in several disparate situations. The Interim Guidelines, which expire in 2026, provide triggers for coordinating operations of Lakes Powell and Mead. Further, Minute 319 to the Mexican Water Treaty identifies triggers for increasing and decreasing release of Colorado River water for use in Mexico. While these and other work related to triggers/signposts in the Colorado River Basin Supply and Demand Study and through the IBCC scenarios are not intended to be applied to a new transmountain project, they serve as examples of triggers established in legal agreements for specific, interim operations in the Colorado River Basin.

There is also some precedent for linking project operations to hydrological triggers through contractual agreements within Colorado, such as is the case with the Water, Infrastructure, and Supply Efficiency (WISE) partnership and the Shoshone relaxation described in the Colorado River Cooperative Agreement (CRCA). In addition, the programmatic biological opinions (PBOs) on the Yampa, Green, and Colorado Rivers provide specific flow targets for endangered fish species that may be helpful to further examine as examples. Finally, the Gunnison Basin's "Risk Assessment Scenario for Portfolio Tool" document, primarily authored by Bill Trampe, discusses two hypothetical examples of potential trigger use. Lastly, the IBCC 2010 "Letter to the Governors" laid out the need to examine triggers to prevent a Compact curtailment and explored some ways to do this.

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4) An insurance policy that protects against involuntary curtailment is needed for existing uses and some reasonable increment of future development in the Colorado River system, but it will not cover a new transmountain diversion.

Resources for Item 4:

- Basin Implementation Plans
- Identified Projects and Processes (IPPs)
- Colorado BRT white paper
- East Slope white paper
- Yampa/White/Green White Paper
- Western Slope Water Banking
- Risk Management Strategies for the Upper Colorado River Basin (Kuhn, 2012)

Defining "Insurance Policy": The insurance policy refers to proactive protection against involuntary curtailment of Colorado River water uses in Colorado. The seven Colorado River Basin States' contingency planning has the potential to be the model for an insurance policy, and the insurance policy must be inextricably linked to and coordinated with contingency planning. Contingency planning is described in more detail below, but it can most simply be described as an operational strategy to minimize or avoid the risk of Lake Powell dropping below the minimum levels required to generate power ("minimum power pool"). It is therefore protective against the possibility of Compact compliance issues arising. The insurance policy will apply to existing uses, "agreed-to" projects, and some additional increment of future development on the West Slope. A new TMD will not be included in the insurance policy; it will be considered junior and "self-insured" through backup supplies such as alternative transfer method (ATM) water, Denver Basin Aquifer resources, and other water supplies described in Item 2.

Ongoing conversations between Colorado, other Basin States, and the federal government concerning current and future operation of the Colorado River Basin are sensitive. Colorado does not want to pre-judge the outcome of these discussions, and these conversations should occur at the appropriate level. While significant technical work could be done that combines consideration of the endangered fish protection, levels in Lake Powell, and the status of the Upper Basin's rolling 10-year non-depletion obligation under the Colorado River Compact with physical and legal water availability, this is work that must be done among the Upper Basin states as part of contingency planning for the Colorado River Basin. For the purposes of Colorado's Water Plan, it should be sufficient to include the language indicating that the IBCC encourages the Upper Basin states to continue discussion on this subject, and that triggers associated with contingency planning could be finalized to inform, or as part of the discussions for, renegotiating the Interim Guidelines. In addition, Colorado should continue existing work on the Water Bank Feasibility Study, Aspinall Water Bank Study, scenario planning and adaptive management.

In addition to encouraging the Upper Basin to continue contingency planning and compliance work, the IBCC also encourages the Upper Basin to clarify the amount of water contingency planning could cover through demand management. It is assumed that the volume should at least cover existing users, but it is not yet clear how much additional insurance, if any, demand management can provide for future diversions. Once the amount of potential demand management is determined, additional consideration of how much future development of Colorado River water can be covered by the insurance plan can be considered. The State of Colorado will bring information from the Basin Implementation Plans (BIPs) to contingency planning discussions to inform their examination of how much water can be covered through the insurance policy and will confer with the basin roundtables and other stakeholders throughout the negotiations.

The IBCC believes that the insurance policy as described above is critical for Colorado's water future and recommends that it be included in other sections of Colorado's Water Plan as appropriate, as it will be needed with or without a new TMD.

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Background: The Basin States are evaluating possible contingency plans for operating the Colorado River system to meet minimum power pool in Lake Powell under extreme dry conditions. These plans are not directly related to Compact compliance issues. However, developing contingency plans to forestall the identified concerns would also help ensure that no Compact compliance issues would arise.

The Upper Basin representatives are currently evaluating options that could be deployed in the near term to address Lake Powell elevations, and have concluded at the proof of concept level that the Upper Basin can respond to a contingency condition on the River by taking three actions:

1) **Augmentation**: Continuing augmentation operations like cloud seeding;
2) **Extending CRSP Operations**: Extend operations of CRSP reservoirs to release increased amounts of water on an as needed basis to shore up storage levels at Lake Powell; and
3) **Demand Management:** Demand management is the term used to describe the process for compensating existing users across the Upper Basin to voluntarily reduce demand and thereby bolster reservoir storage. The Upper Basin states are exploring demand management with the understanding that any water generated as a result would be "system water" and would be carefully managed so that critical storage levels are maintained without triggering greater releases to the Lower Basin. These conversations are sensitive, and they are occurring among the sovereign states. Because of the structural deficit in the Lower Basin, demand management through conservation and other measures is also critical.

The contingency planning evaluations are still in their nascent form but are expected to progress through current and future water years. Several Colorado stakeholders serve as advisors to the State and there will be opportunity for broader stakeholder feedback in the future.

Colorado is also continuing its work through two water bank grants, which could inform demand management as it relates to contingency planning. The first is examining how the Aspinall reservoirs could be used in a water bank, and the second is a broader look at the feasibility of a water bank on the West Slope. Water banks, especially if developed and used across the whole Upper Basin, could support both existing users of West Slope water (both in-basin and out-of-basin users), and potentially some additional increment of "agreed to" projects.

Item 1 through Item 3 in the *IBCC Conceptual Agreement* also provide protection to existing users, as a new TMD would be curtailed in advance of a Compact compliance issue arising. A junior water right paired with Item1 through Item 3 would make a new TMD designed to "do no harm" to existing uses. These points are not intended to make existing uses better off than before a new TMD is developed. Contingency planning would make existing users better off but is not the new TMD project proponent's responsibility.

Future consumptive use on the Colorado River is difficult to predict. However, between identified projects and processes (IPPs) and development of additional supplies by West Slope entities, it is expected that at a minimum 100,000 acre-feet of consumptive use will be needed for municipal and industrial (M&I) needs.

In addition to traditional M&I needs, the needs of energy, agriculture, the environment, and recreation could also be taken into consideration. Pairing all of these projects and needs with an insurance policy may not be realistic. For instance, since a water bank would heavily rely on agricultural water to meet critical needs, it may not be appropriate for the insurance policy to cover new agricultural water uses. Instead, such increased use could be part of an insurance policy for meeting critical needs. By doing so, infrastructure costs could potentially be shared between

the agricultural users and those with critical needs who would want to buy into an insurance policy.

5) Future West Slope needs should be accommodated as part of a new TMD project.

A new TMD will need to provide benefits to the West Slope. The focus should be on pairing the new TMD described above with one or more of the following:

- Compensatory projects and methods (meeting both consumptive and nonconsumptive needs),
- A socio-economic compensation fund (as described in the 2010 IBCC "Letter to the Governors"), and
- Other requirements of conservation and conservancy districts.

Resources for Item 5:

- Basin Implementation Plans
- Identified Projects and Processes
- Colorado River Basin Water Supply and Demand Study
- Colorado River Compact Water Development Projection
- Water Supplies of the Colorado River
- Development Potential in Yampa River Basin
- The Yampa Doctrine
- Reconnaissance Level Cost Estimates for Strategy Concepts

The new TMD project and compensatory West Slope project(s) need to move together conjunctively in order to ensure that both the funding and hydrology are available. Such an arrangement would provide the necessary mutual assurance that the new TMD described above and compensatory project(s) move forward as a package of projects that benefit both East and West Slopes.

Some portion of future West Slope needs will be met through the increment of additional development discussed in Item 4. The purpose of Item 5 is to indicate that a new TMD should include West Slope consumptive or nonconsumptive projects and methods that require East Slope support in the form of either financial or infrastructure resources. Discussion of future West Slope needs in relation to a new TMD is not meant to imply that West Slope entities should not move forward with additional projects and methods in the absence of a TMD.

Background: In 2009, each West Slope roundtable was asked what types of in-basin benefits would need to be on the table for them to consider an additional TMD project. This is summarized in the *Reconnaissance Level Cost Estimates for Strategy Concepts - Water-Related Benefits for West Slope Subbasins,* which is an appendix in SWSI and is included in the annotated bibliography below. These types of considerations are important when considering how future West Slope needs will be accommodated. These range from compensatory projects to other considerations that would benefit the West Slope.

In recent years, several projects have demonstrated the ability to meet the needs of both sides of the Divide, while also taking into account environmental needs. For example, the Windy Gap Firming Project included improvements to the Colorado River, providing water to West Slope water providers, and longer-term commitments to Grand Lake. In 2012, Grand County approved a 1041 permit for this project, based on the many benefits afforded West Slope local entities, through negotiation of the parties.

The CRCA also serves as an example of East and West Slope interests working together to achieve mutually beneficial outcomes. Under the terms of this agreement, Denver Water entered into a partnership with 42 West Slope entities, making steps toward the implementation of the Moffat Project while agreeing to many beneficial obligations on the West Slope. While firming supply for Denver, the agreement also provides many environmental protections for Colorado headwater communities and streams. This process is also notable for the creation of the "Learning by Doing"

process, which establishes a stakeholder group and process for environmental improvements, utilizing funding from Denver Water and others.

The IBCC and roundtable process outlined in HB 1177 also provides several provisions by which these institutions may participate in voluntary negotiations. As delineated in the bill, the roundtables and IBCC would be a natural venue for working together for mutual benefits, under the terms of an interbasin compact charter.

6) Colorado will continue its commitment to improve conservation and reuse.

Part A. Municipal & Industrial Conservation and Reuse

Conservation actions defined in the No and Low Regrets Action Plan should be substantively completed prior to implementation of a new TMD project. Such actions include development of conservation standards for communities planning to use agricultural transfers or new supplies for future water needs, focusing as much as possible on incentives, legislative options and support for indoor water use, and legislative options and support for outdoor water efficiency standards.

Reuse actions defined in the No and Low Regrets Action Plan should also be substantively completed prior to the implementation of a new TMD project. Such actions include improved tracking and quantification, development of a statewide reuse goal, development of new incentives for reuse, and education and outreach efforts.

All proponents of new M&I water projects should meet high conservation standards. Water providers participating in a new TMD project should have active conservation plans and activities approved by the CWCB in place prior to implementation of the project. Additionally, water providers participating in a new TMD project who utilize other fully consumable water supplies should have a reuse program to recycle as much water as is technically and economically possible.

The active water conservation plans of providers participating in a new TMD should demonstrate a commitment to working toward enhanced conservation goals. These goals should have measurable outcomes. The IBCC discussed, but did not resolve, whether entities using water from a new TMD project should be held to a higher conservation standard than other water entities in the state. This topic requires further IBCC discussion, including refinement of the terms “high” or “higher” related to this issue, including how to measure and track progress. The resolution of this issue should recognize that opportunities for conservation may vary from one community to another.

Examples of measurable conservation goals include establishing target indoor/outdoor water use ratios, target gallons per capita per day, and best management practices (BMP) targets. Developing implementation targets for BMPs may be the simplest approach to a measurable outcome in the short term, as per capita targets and indoor/outdoor water use ratios may be more challenging or controversial in some communities than others and there is currently insufficient baseline data. However, new data on per capita use data is emerging through HB 1051 in June 2014 and could provide a baseline for a future per capita or indoor/outdoor ratio target. Additionally, the BIPs are due in July 2014 and are expected to include plans for implementation of BMPs. The BIPs could provide helpful insight into how many BMPs are likely to be implemented and by how many providers. This information should inform a future IBCC discussion about what the right BMP implementation targets are and what progression of desired implementation would push providers to do more over time without overwhelming them.

Land use practices that help reduce water consumption should be supported and encouraged, focusing as much as possible on incentives. Land use is an important component in water conservation; however, further work is needed to determine strategies and partners to tackle this issue. Additional discussions on this issue should be initiated by the IBCC and should include municipalities, counties, local planning agencies, and elected officials at all levels.

Background: The Arkansas, Metro, and South Platte Basins have put significant efforts into conservation, reuse, and cooperative infrastructure. Some water providers, like Aurora, have reduced their per capita water use by 30% since 2002. Many other areas in the state have also seen declines in per capita water use.

M&I Conservation: SWSI 2010 takes what are essentially current water usage numbers and determines low, medium, and high conservation levels. The No and Low Regrets Action Plan determined that a minimum of 165,000 acre-feet of active conservation would need to be applied to meet future demands. This is equivalent to 100% of low conservation levels or 50% of medium conservation levels being applied to the gap. In addition, about 150,000 acre feet of passive conservation is factored into the overall demands. Passive savings are those realized by the natural replacement of more efficient fixtures and appliances in homes and businesses. There has been some concern that the replacement rates and starting points in SWSI 2010 may not reflect the latest data. SWSI 2016 will reexamine passive conservation. Recently the Fixtures Bill (SB14-103) passed through the Colorado Legislature and is awaiting the Governor's signature. This bill will help yield passive conservation savings from shower heads, toilets, faucets, and other fixtures.

The Metro Basin Roundtable Conservation White Paper determined that achieving somewhere between low and medium conservation was reasonable under current conditions, but any additional levels would need statewide action. The East Slope White Paper in general agreed that enhanced levels of conservation are needed, and the Colorado Basin Roundtable White Paper, several other West Slope basin roundtable portfolios, and the *Filling the Gap* report indicated that Colorado should strive for high levels of conservation. More recently, the Southwest Basin Roundtable has put together a conservation goal and measurable outcome that links the percentage of outdoor conservation use to indoor conservation use, with new transmountain (and agricultural dry-up) diverters needing to use less outdoor irrigation.

Resources for Item 6:

- Colorado Basin Roundtable White Paper
- Filling the East Slope Municipal Water Supply Gap
- Metro Roundtable Selection of a Reuse Factor for the Portfolio Tool Planning Exercise
- Metro Roundtable Updated Conservation Strategy
- Metro Roundtable Water Supply Paper (2012)
- Basin Implementation Plans
- Southwest Basin Roundtable Municipal Water Conservation Goal and Measurable Outcome
- Guidebook of Best Practices for Municipal Water Conservation in Colorado
- Statewide Water Supply Initiative
- SWSI M&I Water Conservation Strategies
- Fixtures Legislation
- Filling the Gap Report Series
- Currier Memo on SWSI 2010
- CWCB Response to Currier Memo
- IBCC Letter to the Governors
- No and Low Regrets
- Green River Studies in Wyoming
- Senate Bill 23
- Colorado Demonstration Zero Liquid Discharge Processes
- Rotary Sprinkler Nozzle Retrofit
- Colorado Review: Water Management and Land Use Planning Integration
- Calculating Per Capita Water Demand Savings from Density Increases to Residential Housing for Portfolio and Trade-off Tool
- Colorado River Cooperative Agreement
- Windy Gap Firming – Reuse
- CAWA
- WISE

The IBCC's No and Low Regrets Action Plan lists several possible options for how to move forward with enhanced levels of conservation. These items and other concepts were organized into four conceptual bullets related to demand management for the IBCC's polling exercise in October 2013 in order to explore the intersection of conservation, reuse, and land use with TMDs.

Reuse: Colorado water law defines what water supplies can be reused, and to the extent each source can be reused. Currently there are a limited number of sources that can legally be reused in Colorado:

- **Nonnative water:** Water imported into a basin through a transbasin diversion can be reused to extinction. Transbasin diversions account for a substantial quantity of the total reusable supply in Colorado.
- **Agricultural-Municipal Water Transfers:** Agricultural transfers are generally available for reuse; however, reuse is limited to the historic consumptive use of the original agricultural water right decree. Reuse is applicable for water from traditional purchase of agricultural water rights and ATMs.
- **Nontributary groundwater:** Reuse of nontributary groundwater is allowable.
- **Other Diverted Water:** Any water right with a decreed reuse right may be reused to the extent described in the decreed reuse right.

There are two ways in which these different source types can be reclaimed for reuse:

1. **Direct Reuse:** This is the process in which the return flows from the various supplies are physically reclaimed either for potable or nonpotable uses. An example of this can be found in Aurora's Sand Creek Water Reuse Facility for potable water or Colorado Springs Utility's non-potable water system.
2. **Indirect Reuse:** This process entails the exchange or substitution of the return flows from a reusable source. The most common form of Indirect Reuse is through river exchanges, where a utility lets the reusable water flow downstream, and diverts an equal amount of water from an upstream source.

In addition, municipal wastewater is usually used by agricultural producers downstream. In some cases, this water is directly leased to agricultural producers. In other cases, the water becomes part of the stream flow and used downstream.

Further reuse recommendations and descriptions can be found in the No and Low Regrets Action Plan, Metro Reuse White Paper, and the East Slope White Paper. The CRCA and Windy Gap firming agreements specifically deal with reuse. West Slope basin roundtables have expressed concern that current and planned reuse on the East Slope does not sufficiently utilize fully consumable waters.

Other Demand Management Strategies: In addition to conservation and reuse, the IBCC recommends regional and cooperative strategies and land use measures as important factors in the efforts of Colorado's various regions to "up their games."

Regional cooperative projects, like WISE and the Chatfield Reallocation Project, are becoming more common. According to the Metro Reuse Paper, reuse by exchange has nearly been exhausted, and more and more direct reuse (both potable and nonpotable) is being planned. Grand Junction, Ute Water, Clifton, and Palisade have interconnected their systems to provide reliability in the face of drought and emergencies. The No and Low Regrets Action Plan makes the following recommendation:

> **Encourage cooperative projects through BIPs:** CWCB should encourage Basin Roundtables to work with water providers and communities that anticipate having a water supply gap in the future (or that have one now) to partner with neighboring providers and communities to find creative solutions to

their water needs. In particular, water-short communities should work with their surrounding communities to examine whether they can be integrated into current systems or upcoming IPPs. Expanding the number of water users served by IPPs that are already planned or underway can help limit or delay the need for new supply or agricultural transfer projects.

Urban land use has also been a major discussion point. Both the 2009 Land Use and Water conference and associated report and the memo on water demand savings from density described several options, as did the No and Low Regrets Action Plan:

Support and encourage land use practices that help reduce water consumption, focusing as much as possible on incentives: In 2010, CWCB produced a report titled Colorado Review: Water Management and Land Use Planning Integration. Several local actions that could be used more broadly stemmed out of that report. These include:

Expedited permitting: Permitting for buildings and developments could be expedited if the project incorporates certain water efficiency measures or high levels of density.

Tax incentives: There could be tax breaks if the project incorporates certain water efficiency measures or high levels density.

Structure impact (tap) fees: Use impact fees to promote water-wise developments and in-fill. These fees could be structured to penalize water inefficient or sprawling developments and/or to reward sustainable/dense developments.

Regional collaborative planning: Localized solutions are often not effective, since water demand may be transferred from one jurisdiction to one or many others. Therefore, regional solutions are critical and should be further explored. Some opportunities exist, such as engaging Council of Governments in water/land use discussions, identification of related regional planning efforts that are underway and including water issues, and the use of intergovernmental agreements.

Integration: Many other efforts are currently underway that could reduce regional water demand, but are not specifically aimed at achieving that purpose. There are many opportunities for developing partnerships with other water conservation efforts, sustainable/walkable neighborhood developments, energy conservation and CO2 reduction programs, water quality programs, food security programs, transportation projects, market drivers, comprehensive plans, and many others.

Part B. Agricultural Conservation

When considering agricultural conservation strategies, it will be important to take a site-specific perspective and to consider the potentially negative consequences of altering the timing and amount of return flows. While some locations lend themselves well to agricultural conservation practices, others do not, and a clear understanding of the affected systems is necessary.

Current Agricultural Uses: Many of the BIPs are looking to find the explicit interconnections between agricultural and nonconsumptive uses. In addition, several are looking to decrease agricultural shortages. As part of this work, each basin should seek to reduce consumptive non-beneficial use by following the guidelines laid out in the Colorado Agricultural Water Alliance (CAWA) 2008 Agricultural Conservation Paper (e.g., reducing soil moisture loss where practical through drip irrigation or mulching). Lining of high-priority ditches is another important tool in reducing seepage losses in appropriate areas. Phreatophyte control presents one of the largest opportunities for reducing non-beneficial consumptive use and should be pursued aggressively, although balancing this with nonconsumptive needs can be challenging. Additional incentives should be developed to assist basins in implementing, where appropriate, agricultural efficiency and conservation practices, supporting the ecosystem services agriculture can provide, and changing crop types to lower water use crops.

Future Agricultural Uses: New irrigated agricultural lands (currently identified in the North Platte and Yampa basins) should be designed to either use best practices with regard to

agricultural conservation and efficiency, or, alternatively, be measurably and explicitly multi-purpose by meeting identified nonconsumptive needs.

Background: Communities around Colorado are working to improve the efficiency of water use in agricultural settings. Recent work in the Grand Valley serves as an excellent example of this. Many headgates have been modified, and orchards are now on drip irrigation. CWCB and others have supported many agricultural producers across the State who have put significant funds into decreasing ditch loss, diversion structures, and improving irrigation efficiencies. The Rio Grande and Republican River basins are working to maintain a sustainable agricultural community in the face of an imbalance between available water supplies and current levels of water use. The South Platte is still grappling with a Supreme Court decision that led to the shutdown of many agricultural producers who relied on wells. It is also important to take into consideration legal constraints such as the Arkansas River Compact or the decree in the North Platte Basin, under which greater efficiency measures can have complicated consequences for agricultural producers.

In addition, some irrigation practices, such as flood irrigation, often support riparian and wetland areas critical for migratory birds and other environmentally important species. Irrigation practices can also retime river flows, so that late summer and early fall flows are often better than they were under natural conditions. For instance, in high mountain meadows, high levels of irrigation early in the season benefit agricultural return flows and nonconsumptive values later in the year.

Agricultural conservation is aimed at reducing consumptive use and needs to be distinguished from agricultural efficiency. In some instances and for some crops, practices such as drip irrigation and mulching can reduce consumptive use. Agricultural efficiency measures, such as pivot sprinklers, may retime water, divert less, or otherwise modify operations to maximize the water delivery to the crop, but it is not aimed at reducing consumptive use. In fact, agricultural efficiencies often lead to increased consumptive use since most areas in the state already do not provide as much water as the crops could use under ideal conditions. When water is applied more efficiently to a crop, then it can more easily use and consume that water.

7) Environmental resiliency and recreational needs must be addressed both before and conjunctively with a new TMD.

Agriculture and Nonconsumptive Partnerships: Agricultural water has a role to play with regard to adding flexibility and reliability to meet future water needs. Agricultural partnerships with environmental, recreational, and municipal groups should be supported to help sustain Colorado's economic future and healthy environment. In addition, development of all new water projects should consider important agricultural and nonconsumptive gaps identified by the basin roundtables.

Environmental Resiliency: Colorado's Water Plan, BIPs, and stakeholder groups across the state should identify, secure funding for, and implement projects that help recover imperiled species and enhance ecological resiliency whether or not a new TMD is built. This could create conditions under which future projects may be possible but would not be the responsibility of a new TMD project proponent since these issues were not

Resources for Item 7:

- CWCB Instream Flow Program
- Nonconsumptive Toolbox
- Programmatic Biological Opinions
- Colorado River Basin Water Supply and Demand Study
- Streamflow Evaluations for Whitewater Boating
- Watershed Flow Evaluation Tool: Yampa/White and Colorado Basins
- Colorado Parks and Wildlife Planning
- Wildlife Mitigation Agreements
- NEPA Documentation on Ongoing Processes
- Arkansas Voluntary Flow Management Program

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caused by the new project proponent. These existing environmental and recreational gaps should be meaningfully addressed in the near term and in any new TMD-affected areas before a new TMD is built. Sources of funding will likely include federal, state, foundation, corporate, and private money. However, additional sources will likely be needed as well.

Environmental and recreational needs in relation to a new TMD: In addition, a new, multipurpose TMD could potentially fill remaining environmental and recreational gaps as part of a package of compensatory projects. Any new project should also include benefits and/or mitigation for environmental and recreational values. Environmental and recreational needs should be addressed proactively and voluntarily up-front in the project design, and proponents should include nonconsumptive partners to help the package of projects associated with the new TMD be truly multipurpose. Environmental impacts associated with a new TMD should be avoided, minimized or mitigated, and environmental restoration and enhancement opportunities should be provided. Project proponents will be responsible for mitigating impacts that result from the new TMD project, even if those impacts occur outside of Colorado. The above statements are not intended to create any new regulatory or permit requirements beyond those currently found in federal, state or local law.

Background: Since the 1970s, environmental and recreational needs have gained increasing recognition in Colorado's water law through instream flow and recreational in-channel diversion water rights. Colorado has become a destination state, with recreation-based tourism and activity contributing approximately $10 billion annually to the economy. Colorado's natural beauty and recreational opportunities are one reason why so many people move to and continue to live in Colorado.

The IBCC and basin roundtables have continued to acknowledge the importance of environmental and recreational needs. The Yampa/White and Colorado basin roundtables have conducted a flow analysis called the Watershed Flow Evaluation Tool, and many basins already have flow agreements or standards in place. For instance, the Arkansas Basin has the Arkansas Headwaters Recreation Area, the Gunnison Basin has flows through the Black Canyon, the Three States Agreement affects flows in the South Platte, and the Colorado, Yampa, and Green Rivers have PBOs that establish flows for the endangered species recovery program. In addition, all of the basin roundtables have identified where their important nonconsumptive values are located; these are called "focus areas." In 2009, CWCB conducted a survey to determine nonconsumptive IPPs, which have been put together with the focus areas in a nonconsumptive database. The BIPs will determine additional projects and methods to meet nonconsumptive needs. Additional efforts in Colorado include work by the Bureau of Reclamation as part of the ongoing efforts of the Colorado River Basin Supply & Demand Study, as well as other efforts by Colorado Parks and Wildlife, American Whitewater, The Nature Conservancy, Colorado Water Trust, and many other local, statewide, and national groups.

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Topics for Further IBCC Discussion Beginning in Fall 2014

- A discussion of quantifiable conservation targets, using HB 1051 reporting data and the BIPs to help inform the discussion
- A discussion of a socioeconomic compensation fund for a new TMD, above and beyond what is outlined in the IBCC 2010 "Letter to the Governors"
- Future use allocation (previously known as "equitable apportionment")
- Use of Denver Basin Aquifer resources (how much water can be stored and withdrawn, the timing requirements for storage and withdrawal, costs, and conceptual designs)
- How a new TMD could/should be structured (partnership structures, participants, financing, operational rules, proof of need, and project feasibility)
- Steps to preserve the option for a new TMD

Action Items

The following items are works in progress by CWCB staff and IBCC members. The IBCC believes that these steps will better inform the ongoing discussion of the seven points, while also keeping the roundtables up to date and informed about the IBCC process and key discussion items.

- **Basin Roundtable Outreach:** IBCC members will play a critical role in communicating about discussion items and updates contained in the *IBCC Conceptual Agreement* with their basin roundtables and constituents. IBCC members will also be responsible for bringing back feedback for discussion and integration into future drafts of the *IBCC Conceptual Agreement*.
- **Risk Management:** The concept of risk management is central to the discussion of this conceptual framework and in the ongoing conversations. Though not specifically designated as such, many elements proposed in the seven points will serve as risk management tools. As the documentation and dialogue continue, clarification should be made regarding which elements are advancing the concept of risk management. For example, the triggers concept in Item 3 and the "insurance policy" for existing uses of Item 4 are strategies by which the risk of Compact and other interstate related issues associated with a new TMD may be managed. This will also help reduce the risk that agriculture statewide will have to bear the full brunt of meeting a future water supply shortfall.
- **East Slope Incentives:** Incentives should be presented to East Slope entities in return for compliance with identified triggers. Further discussion is needed by the IBCC to determine what these incentives might include.
- **TMD Triggers Memo:** This action item will be an ongoing product of CWCB staff, as requested by the IBCC. The memo will address potential options available for triggers, as described in Item 3. These triggers only pertain to operation of a new TMD within the state of Colorado and are separate from any discussion of triggers at the interstate level.
- **Contingency Planning Updates:** A concern was raised by IBCC members regarding the ongoing contingency planning process occurring at the interstate level. This process, as described in Item 4, is obviously of great importance and concern to the entire state. IBCC members requested that updates on the process be provided or presented to basin roundtables to encourage greater understanding of the need and methods by which this planning is proceeding.
- **Review of Previous Streamflow Analyses:** The IBCC requested that a new study or review of previous analyses of streamflow in the Colorado River Basin be considered. Specifically, this work would utilize the Colorado Decision Support System or existing modeling under that

system to summarize estimates of natural flow, depletions, and pre-Compact depletions for each river in the Colorado River Basin. This work would conceivably better inform several different topics within the seven points.

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Appendix A. Annotated Bibliography

Item 2 References:

Alternative Agricultural Water Transfer Methods (ATM) Projects

Senate Bill 07-22 authorized the CWCB to develop a grant program to facilitate the development and implementation of ATMs in the state. Since its inception in 2007, the CWCB's Alternative Agricultural Water Transfer Methods Grant Program has awarded nearly $3 million to municipal water providers, ditch companies, conservancy and conservation districts, university research teams, nonprofit organizations, and other entities to pursue the goal of turning the conceptual idea of ATMs into a practical reality. At the request of the CWCB, the technical memorandum linked below was prepared to provide an update on the status of the ATM grant program and to summarize findings of the funded projects with regard to identifying solutions to the barriers to implementation. Section 1 identifies each of the ATM grant recipient projects and provides a series of targeted recommendations for moving forward with the ATM grant program and eventual implementation of ATMs as viable means to secure M&I water supplies in Colorado. Section 2 revisits the first round of grant recipients in more detail. Final reports for most of those projects were completed after the publication of the previous ATM grant program summary report, so this technical memorandum seeks to place the findings of those projects in context of the barriers to implementation. Section 3 summarizes the objectives of the projects receiving second round grant funding and also provides a status update on each project as of October 2012.

The Alternative Agricultural Water Transfer Methods Grant Program Summary and Status Update Technical Memorandum (November 2012) can be found here.

Previous ATM Grant Summary Reports

Colorado Water Conservation Board. 2011. Colorado's Water Supply Future – Alternative Agricultural Water Transfer Methods Grant Program Summary. Final Report. Prepared by CDM Smith.

Final (or most recent) deliverables for the first round of ATM Grant Program studies are as follows. *These documents are not presently available online*.

1. *Parker Water & Sanitation District and Colorado State University*
   Hansen, N., J. Pritchett, B. Lytle, T. Holtzer, J. Brummer, L. Garcia, J. Schneekloth, B. Bosley, and A. Helm. 2011. Final Report of The Lower South Platte Irrigation Research and Demonstration Project.
2. *Colorado Corn Growers Association*
   Colorado Corn Growers Association, Ducks Unlimited, Aurora Water, and Lower South Platte Water Cooperative. 2011. Completion Report: Development of Practical Alternative Agricultural Water Transfer Measures for Preservation of Colorado Irrigated Agriculture. Prepared by Brown and Caldwell, Colorado Water Resources Research Institute, Harvey Economics, and Lawrence Jones Custer Grasmick LLP.

3. *Lower Arkansas Valley Water Conservancy District Super Ditch Company*
   Lower Arkansas Valley Water Conservancy District. 2011. Development of Land Fallowing-Water Leasing in the Lower Arkansas Valley (2002 through mid-2011). Prepared by Trout, Raley, Montano, Witwer & Freeman, P.C.
4. *Farmers Reservoir & Irrigation Company*
   Farmers Reservoir and Irrigation Company. 2012. An Evaluation of Alternative Agricultural Water Transfer Methods in the South Platte Basin. Prepared by DiNatale Water Consultants, Inc. in association with CSU College of Agricultural Sciences, CSU Department of Agricultural and Resource Economics, and Ecological Resource Consultants, Inc.
5. *CSU Extension Office*
   Cabot, P., J. Valliant, J. Tranel, and M. Bartolo. 2012. 2012 Fall Annual Report to Colorado Water Conservation Board Alternative Agricultural Water Transfer Methods.

<u>Final (or most recent) deliverables for the second round of ATM Grant Program studies are as follows. *These documents are not presently available online*.</u>

1. The Nature Conservancy
   The Nature Conservancy and Trout Unlimited. 2014. Yampa Basin Alternative Agricultural Water Transfer Methods Study. Final Report. Prepared by CDM Smith.
2. *Colorado River Water Conservation District*
   MWH. 2012. Colorado River Water Bank Feasibility Study, Phase 1. Final Draft Report. Prepared for Colorado River Water Conservation District.
   MWH. 2013. Colorado River Water Bank Feasibility Study, Phase 2. Final Draft Report. Prepared for Colorado River Water Conservation District.
3. *Lower Arkansas Valley Water Conservancy District*
   Lower Arkansas Valley Water Conservancy District. 2012. Agricultural Water Lease Evaluation Tool (AgLET): Enhancements to Include Time and Uncertainties. Final Report. Prepared by Honey Creek Resources.
4. *Colorado Water Innovation Cluster*
   Colorado Water Innovation Cluster. 2013. Project Report: Lake Canal Alternative Agricultural Practices and In-Stream Flow Demonstration Project.
5. *East Cherry Creek Water & Sanitation District*
   East Cherry Creek Valley Water and Sanitation District. 2012. DRAFT Alternative Transfer Methods Status Report – October 2012. Submitted by DiNatale Water Consultants and N. Hansen, Troy Bauder, R. Flynn, and J. Deering (CSU).
6. *Parker Water & Sanitation District*
   Jaeger, F., B. Lytle, N. Hansen, J. Chavez, and L. Garcia. 2012. Lower South Platte Irrigation Research and Demonstration Project Status Report.
7. *Lower South Platte Water Conservancy District*
   Frank, J. M. Shimmin, J. Yahn, and Grant Review Committee. 2012. Memorandum – Lower South Platte Water Cooperative Interim Progress Report. Prepared by Matt Lindburg, Brown & Caldwell.
8. *Colorado Corn Growers Association*
   Sponsler, M, and the Flex Water Market Project Team. 2012. Memorandum – Flex Water Market Interim Project Report. Prepared by Matt Lindburg, Brown & Caldwell.
9. *Upper Arkansas Water Conservancy District*

Scanga, T. 2012. Memorandum – Building & Assessing Accounting and Administration Tools for Lease-Fallowing – Phases 1-3 Progress Report.
Walter, I. 2012. Memorandum – Update Lease Fallowing Accounting Tool (LFAT) Task Committee (TC).

10. *Colorado State University Agricultural Experiment Station*
    Reich, D. 2012. Alternative Agricultural Water Transfer Methods: Progress Report – 1st Year.

A third round of ATM grants awarded more than $800,000 to six recipients in 2013, several of which are continuations of projects initiated and ongoing under the first and/or second round of ATM grants.

Upper Black Squirrel Creek Study (December 2008)

This study integrates new field data with information from previous studies and cooperating partners to refine our knowledge of the hydrogeology of the alluvial aquifer system in the Upper Black Squirrel Creek basin for the purposes of identifying potential sites for aquifer recharge and storage implementation. The final deliverable is available here.

The Poudre Runs Through It: Northern Colorado's Water Future (Launched 2011)

The Poudre Runs Through It is a diverse group of regional leaders brought together and facilitated by CSU's Colorado Water Institute to better understand both the operational and ecological needs of the Poudre River. By sharing their knowledge and experience, this work group learned together about many aspects of the Poudre River to identify opportunities for cooperative action. This group is trying instead to find broadly acceptable ways to meet multiple objectives: to have both a working Poudre and a healthier Poudre. Through a series of meetings in 2012 and 2013, the group identified a variety of innovative opportunities for voluntary, collaborative solutions that may help protect habitat and water quality while respecting private property rights. According to the group's website, they will continue meeting through June 2014 to put in action the "Flows, Funding, Forum" initiatives identified in the July 2013 progress report. Also visit their website at:
http://www.cwi.colostate.edu/thepoudrerunsthroughit/index.shtml

House Bill 13-1248: Concerning an Authorization of Pilot Projects for the Leasing of Water for Municipal Use

This bill authorizes the Colorado Water Conservation Board (CWCB), after the State Engineer determines the issue of injury, to approve up to ten pilot projects to test fallowing-leasing, with each project lasting up to ten years and no more than three pilot projects to be located in any one of the major river basins, namely: The South Platte river basin; the Arkansas river basin; the Rio Grande river basin; and the Colorado river basin, except as further limited by board. The CWCB may provide financial, technical, or other assistance to a pilot project pursuant to the Board's other activities and programs. The purposes of the pilot programs are to demonstrate cooperation, evaluate feasibility, provide sufficient data, and demonstrate how to operate, administer and account for the prac tice of fallowing irrigated agricultural land for leasing water for temporary munciipla use without causing material injury to other vested water rights, decreed conditional water rights or contract rights to water. The bill can be found here.

Northeast Colorado Water Cooperative

Several years ago, a small group of water users and water professionals began discussing the possibility of organizing a water cooperative in the area of Water Districts 1 and 64 in the lower South Platte River. The water cooperative would create a mechanism for moving augmentation credits from plans with unused credits into plans that need additional credits.

The steering committee applied for and was awarded two grants to research organizational and operational aspects of the water cooperative. Work under a grant through the Water Supply Reserve Account (WSRA) focuses primarily on research and development of an organizational structure for the Water Cooperative. An Alternative Transfer Methods grant was awarded to the Lower South Platte Water Conservancy District (the lead applicant) and numerous supporting augmentation plans, ditch companies and water organizations to research operational aspects of the cooperative.

The Cooperative is currently working towards implementation using funding from an additional ATM grant that was awarded in 2013. The Lower South Platte Water Conservancy District is the lead applicant for this grant, and it is being supported by numerous augmentation plans, ditch companies and other water organizations. The goal of the project is to implement the Cooperative in 2014. Implementation of the cooperative will be primarily in Districts 1 and 64. In the future, it is possible the cooperative could expand upstream of those two districts.

SB06-193 Underground Water Storage Study (March 2007)

Senate Bill 06-193 (SB06-193) directed the Colorado Water Conservation Board (CWCB) to conduct a study of potential underground water storage areas in the South Platte and Arkansas River Basins. In 2004 the Colorado Geological Survey (CGS) completed their report "Artificial Recharge of Ground Water in Colorado – A Statewide Assessment." In that study, large aquifer regions were identified statewide for recharge potential. This SB06-193 study uses the CGS study as a beginning point and goes a step further in the South Platte and Arkansas River Basins. More information on the study is available here.

Aquifer Recharge of Ground Water in Colorado – A Statewide Assessment (2004)

In 2003, the director of the Colorado Department of Natural Resources requested that the Colorado Geological Survey conduct a statewide assessment study of artificial recharge potential. This study assessed the opportunities for using artificial recharge to meet water storage needs statewide, focusing primarily on the hydrogeologic properties of aquifers and other underground storage options.

This study assesses the best aquifers in Colorado for their artificial recharge potential of ground water based primarily on their hydrogeological suitability. Implementation of an AR project must also consider several other factors, including (1) project objectives; (2) site-specific hydrogeologic conditions; (3) source water availability; (4) water law and water rights; (5) available land surface area and compatible land-use activities; (6) governing water-management districts or entities; (7) facility design criteria; (8) capital costs to construct; (9) operation and maintenance costs; and (10) general storage efficiency, recovery, and deliverability. An Executive Summary of the Study can be found here. Further information can be found here.

Regional Aquifer Supply Assessment (December 2008)

This study is an assessment of the regional data relevant to groundwater supply in the south Metro area undertaken with the support of a Water Supply Reserve Grant from the Colorado Water Conservation Board (CWCB). The purpose of this assessment is to compile recent regional aquifer data to support the South Metro Water Supply Authority (SMWSA) evaluation of aquifer storage and recovery (ASR) pilot test locations. As part of this regional aquifer supply assessment, a dataset of

aquifer characteristics, recent water levels, and well production was compiled and evaluated to gain a better understanding of the Denver Basin bedrock aquifers in the south Metro area. These aquifers are a key component of water supply for many of the SMWSA entities.

Based upon the findings of this assessment SMWSA would like to further explore the potential for implementing ASR in the south Metro area by conducting an ASR pilot study. This study would evaluate several long-term renewable water sources candidates for supplying ASR wells in the area, water quality compatibility, and the potential for regional integration of ASR operations to better manage the groundwater resources of the SMWSA entities. The Technical Report is available here.

South Metro Water Supply Authority Aquifer Recharge Pilot Study (Ongoing)

The SMWSA received a grant of $550,000 from the Colorado Water Conservation Board (CWCB) via a Water Supply Reserve Account (WSRA) Grant to implement an ASR Pilot Study. This study was originally scoped to identify two SMWSA member wells (Denver Basin wells) that could be retrofitted to implement ASR using water of similar water quality SMWSA members would receive from the WISE project.

A recent review of the financial feasibility of completing the South Metro Water Supply Authority (SMWSA) Aquifer Storage and Recovery (ASR) Pilot Project at an alternative site was completed and it was determined that the project, as currently defined, cannot be completed within the allocated grant funds. The primary reason for this is the ability to incorporate the cost of completing a monitoring well at a cost of $292,000, which was not part of the original scope. There are a few options for how the project can still proceed but will require coordination and input from SMWSA staff, SMWSA Groundwater Group and SMWSA members not represented in the groundwater group. The Scope of Work is available here.

South Metro Water Supply Authority Regional Water Master Plan (June 2007)

This Master Plan serves as a guidance document in developing renewable water supplies for the South Metro area. Development of the plan was based on the following approach:

- Identify goals for additional renewable water supply for each SMWSA provider in 2010 (interim), 2020 (mid-term), 2030 (long-term), and at buildout
- Develop alternatives and associated costs to convey, treat, and store renewable water from specific sources to the South Metro area
- Develop alternatives and associated costs to locally distribute renewable water supplies to SMWSA providers
- Develop an implementation plan that provides a general timeline and an outline of methodologies to follow when pursuing and evaluating renewable water supplies

The 2003 South Metro Water Supply Study recommended further investigation of a conjunctive use program, including use of imported water from the South Platte River and the Blue River in wet years, and exclusive reliance on local groundwater in drier years. Imported water would be stored locally, with an average of 19,000 to 26,000 acre-feet per year (AFY) of renewable water delivered to the South Metro area under the various conjunctive use scenarios studied.

Aquifer storage/recovery (ASR) is a potential alternative to surface water terminal storage. Depending on hydrogeologic conditions and other technical and institutional constraints, SMWSA providers could retrofit existing wells or install new wells for injection of surface water into the Denver Basin aquifer. Treated water in the potable distribution system exceeding demands would be directed to ASR, and withdrawals would be used to meet peak demands in excess of available Northern system supplies. The Regional Master Plan is available here.

Metro Roundtable Water Supply Paper (2012)

This paper describes how the Metro Roundtable conducted the Portfolio Tool planning exercise. The outcome of the exercise was the development of the Metro Roundtable's vision for meeting the projected future gap in municipal supply needs which is also described in this paper. The paper can be found here.

The Metro Roundtable prepared companion papers titled "Metro Roundtable Conservation Strategy" and "Selection of a Reuse Factor for the Portfolio Tool Planning Exercise." Together, these papers on filling the supply gap, conservation and reuse explain how the Roundtable performed its Portfolio Tool planning exercise.

Interbasin Compact Committee Letter to Governor Ritter and Governor-Elect Hickenlooper (2010)

This letter was presented to Governor Ritter and Governor-Elect Hickenlooper as a summary report related to the IBCC's discussion and accomplishments over the previous four years (2007-2010) and the proposed work plan for 2011. A "Comprehensive Framework to Meet Water Supply Gap" by the IBCC's New Supply Subcommittee (working document only, not consensus or decision document) is included starting on page 15 of the letter. It can be found here.

South Metro Water Supply Study (2003)

This study was undertaken by a number of partners to investigate water supply alternatives for the South Metro area through the year 2050. Of special interest was whether the Denver Basin Aquifer would meet the demands of the population in 2003, with the expected demands of population growth. Another issue addressed that of "conjunctive use", augmenting wet year flows from the South Platte and Blue River with groundwater. The study is available here.

Item 3 References:

Colorado River Basin Water Supply and Demand Study

This study, released in December of 2012, was a collaborative effort between the Bureau of Reclamation and the seven Colorado River Basin States. The study examined the Colorado River basin as a whole, along with peripheral areas reliant on Colorado River water, such as Denver and Los Angeles. The study evaluates reliability of the Colorado River system to meet increasing demands and outlines potential strategies for dealing with projected imbalances are outlined. The future demands of the system are analyzed under six hypothetical situations, which include varying factors that will affect the system over the next few decades, such as: population growth in the basin states, potential savings from conservation, and economic conditions in the watershed. Under these projected situations, the demand for consumptive uses in the Colorado River system is projected to range between 18.1 and 20.4 MAF by 2060. Four supply scenarios are utilized, taking into account historical hydrology and potential effects of climate change. The study team also reviewed 160 options for dealing with the potential imbalances, submitted by participants and stakeholders.

The study is available here. Actions identified as "Next Steps" in the study have begun with the formation of workgroups composed of experts and stakeholders. One Coordination Team and three Workgroups have been formed, on the matters of: Municipal and Industrial Conservation and Water Reuse; Agricultural Conservation and Water Transfers; and Healthy Flows. More information on the Moving Forward process can be found here.

IBCC Scenario Development

The Basin Roundtables and IBCC have chosen to utilize a scenario planning approach for addressing Colorado's water supply future. Based on the work of the roundtables, the IBCC identified five scenarios that represent a broad range of possible futures, taking into account drivers that will affect the direction of Colorado's water future. These scenarios will be utilized in SWSI 2016 to inform an adaptive management framework. The scenarios are described in greater detail in this draft chapter of Colorado's Water Plan: 5.1: Scenario Planning & Adaptive Water Strategy.

Colorado River Compact (1922)

This interstate compact is considered the cornerstone of the "Law of the River," which is the legal framework under which the Colorado River is operated. Key provisions of the Compact divide the river basin into the Upper and Lower Basins and Divisions and recognize the potential for right of use by Mexico. Of great import to the Upper Division States as it relates to work with the IBCC is Article III(d), which outlines the non-depletion obligation of 75 MAF over a ten-year rolling average. The full text of the Compact can be found here.

Upper Colorado River Basin Compact

The Upper Colorado Basin Compact was signed in 1948 by Arizona, Colorado, New Mexico, Utah, and Wyoming. Subject to the provisions of the 1922 Compact, the Upper Division states, which includes all the Upper Basin States but Arizona, are apportioned a percentage of consumptive use of the Upper Colorado River System. Colorado is apportioned 51.75% of the consumptive use available in the basin per year, less the 50,000 acre-feet (af) apportioned to Arizona. This Compact also establishes the Upper Colorado River Commission as the authority to, among other things, determine the quantity and timing of delivery by Upper Division states in a curtailment situation under the 1922 Compact. The full text of the 1948 Compact can be found here.

Minute 319

In November 2012, representatives from the Colorado River Basin states, the United States government, and the government of Mexico entered into Minute 319, which furthers the commitments of both countries to the 1944 Water Treaty between the U.S. and Mexico, while adapting to the increasing demands and drought conditions on the Colorado River. The Minute is a five-year agreement, under which Mexico committed to accept voluntary shortages when Lake Mead reaches certain levels, while gaining opportunities to receive increased releases under certain conditions. Also included is potential for a one-time environmental flow, which culminated recently in a pulse flow to the Mexican Delta, the opportunity for Mexico to delay delivery of Treaty allocation until subsequent years, and the opportunity for binational investment in Mexico infrastructure for mutual benefit of water users in the United States and Mexico. The full text of the Minute can be found here.

2007 Interim Guidelines

The Colorado River Interim Guidelines for Lower Basin Shortages and Coordinated Operations for Lake Powell and Lake Mead were signed in 2007, with affirmation and input from the seven Basin States' representatives. These guidelines, effective until 2026, are a collaborative effort to manage the risk of an increasingly variable water supply, while avoiding compact conflicts on the River. Under the guidelines, shortages are imposed upon the Lower Basin when certain elevations occur at Lake Mead, and guidelines for releases for Lake Powell are based on the elevations of the two lakes, as well as other specific criteria. The Guidelines also allow the Lower Basin states to store "Intentionally Created Surplus" and use that water under the terms of certain agreements and the guidelines. More information about the Guidelines, such as the full text and Basin States' affirming documents can be found here.

Endangered Fish PBOs

The programmatic biological opinions (PBOs) for sections of river within the Colorado River system provide specific flow targets for the endangered species of fish within those reaches. Under the Upper Colorado River Endangered Fish Recovery Program, these PBOs are a result of cooperation between federal agencies and other interested parties. More information about the Recovery Program is available here, and the PBOs are available here.

Colorado River Water Availability Study

The Colorado River Water Availability Study (CRWAS) was undertaken by CWCB to evaluate how much water from the Colorado River Basin System is available to meet Colorado's future water needs under alternate hydrologies. CRWAS utilizes many ongoing programs and processes directed by CWCB, in collaboration with other State, federal, and local agencies, as well as the IBCC and the BRTs. Phase I of the Study was released in March 2012, and Phase II is ongoing. More information about CRWAS, such as the final report from Phase I, Board meeting presentations, and the draft scope of work for Phase II can be found here.

Gunnison Basin Risk Assessment Scenario for Portfolio Tool Document (2013)

As quoted in the document, the Gunnison BRT is concerned with the following two points:

1. How do we manage development and use of Colorado River water to prevent a Compact curtailment, while allowing for full development of Colorado's entitlement?
2. If we fail, how do we deal with a Compact curtailment under full development of Colorado's Compact entitlement?

As part of this document the Gunnison BRT laid out two hypothetical examples of triggers, largely based on Colorado River Storage Project (CRSP) reservoir storage and hydrological predictions. These triggers could indicate when to use interruptible water supply agreements (IWSAs) on the East Slope and could reduce the reliance of East Slope water providers on West Slope water.

The document can be found here.

IBCC Report to Governor Ritter & Governor-Elect Hickenlooper (2010)

"Therefore, we are recommending a two-pronged approach. The first would be to put in place an "early warning" system that shuts down, curtails, or offsets new water development supply projects on the Colorado River in advance of a Compact curtailment. The early warning system would be based on hydrologic triggers." The complete IBCC Letter to the Governors can be found here.

WISE Partnership

The WISE (Water Infrastructure Supply Efficiency) Partnership is a regional water supply project between Aurora Water, Denver Water, and the South Metro Water Supply Authority, which seeks to create a sustainable water supply for the South Metro area. This supply will be provided by combining the unused capacity of Aurora's Prairie Waters project with unused water supply from Aurora and Denver. More information on the WISE Partnership is available here and here.

Colorado River Cooperative Agreement

The Colorado River Cooperative Agreement (CRCA) gained signatures of all 18 partners in the fall of 2013. The agreement is the culmination of years of negotiations between Denver Water and West Slope entities, aimed at protection of Colorado River watersheds, while allowing Denver Water to

develop future water supplies. More information about the agreement, parties, and specific provisions is available here.

Item 4 References:

Basin Implementation Plans

Every roundtable is currently engaged in the process of formulating Basin Implementation Plans (BIPs). These Plans, spearheaded by the Basin Roundtables, will establish goals and measurable outcomes for that Basin. Then, with guidance from roundtable members, basin stakeholders, and interested parties, the Plans will set forth projects and methods to meet their water needs. The BIPs are a way for basins to plan their way forward through 2050, with an eye to development and potential future uses. More information about the BIP process and the basin roundtables can be found here.

Identified Projects and Processes (IPPs)

Iterations of SWSI have updated lists of identified projects and processes (IPPs) for each basin, and it is expected that the BIP process will update and inform the IPPs for SWSI 2016. For a definition of a project that meets the requirements of an IPP, click this link. These projects and processes are the basins' means to meet the future needs established and outlined in SWSI and in the BIPs. For more information about IPPs and SWSI, click here.

Colorado Basin Roundtable White Paper

To inform the BIP process, the Colorado Basin Roundtable formulated a white paper to explain and delve into the issue of "Providing for Colorado's statewide and West Slope water needs." This document explains the background of water use in that particular basin, especially with regard to transmountain diversions, and the history of such diversions. The white paper sets forth the Roundtable's vision for the future of the basin with regard to water usage and future needs. Also, the white paper adopts a series of principles, focused on the Executive Order regarding Colorado's Water Plan. The Colorado Basin white paper in available in its entirety here.

Filling the East Slope Municipal Water Supply Gap

Similar to the Colorado River Basin Roundtable, the East Slope roundtables coordinated on a white paper to address a vision for the water supply future of their representative portion of Colorado. "Filling the East Slope Municipal Water Supply Gap" was released in draft form in July of 2013, intended to inform the BIPs of the East Slope roundtables. This paper addresses the various gaps in the basins and also provided a vision for filling the municipal supply gap. This paper provided recommendations for Colorado's Water Plan, addressing conservation, reuse, IPPs, and other ways to address the water supply future of the East Slope. The draft white paper is available here.

Yampa/White/Green Basin Roundtable Paper

The Yampa/White/Green Basin also authored a white paper to explain the issues facing their basin, and propose management solutions that would protect the basin's potential future uses. This white paper was approved by the roundtable in March of 2014 and explains the basin's view on future depletions in the Colorado River basin. The white paper is available here.

West Slope Water Banking

Efforts are ongoing amongst West Slope entities and interested parties regarding the potential for a water banking effort. The concept is spearheaded by the Colorado River Water Conservation District and involves utilizing pre-Compact water rights to meet post-Compact needs in a situation in which curtailment of rights is necessary. The goal of the proposal is to increase certainty for Upper Basin usage and reduce the increasing impacts of drought on existing uses. Outreach meetings are ongoing,

engaging with agricultural users to gage interest in participation, and potential costs and compensation for involvement in the bank. A report entitled "Colorado River Water Bank Feasibility Study" was released in March 2012, and is available here. In May 2013, a grant was approved for further study of the concept; references are here and here.

Risk Management Strategies for the Upper Colorado River Basin (Eric Kuhn, 2012)

Eric Kuhn authored this paper in 2012, explaining the challenges facing the Upper Basin and explains the history of the Colorado River Compact and the Upper Colorado River Basin Compact. The risk of a curtailment is examined, associated with three factors: the non-depletion obligation at Lee Ferry, the level of water use among Upper Basin states, and hydrology. The paper also examines potential Upper Basin strategies to minimize the risk of a curtailment. The paper is available in its entirety here.

Item 5 References:

Basin Implementation Plans

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Colorado River Basin Water Supply and Demand Study

This study, released in December of 2012, was a collaborative effort between the Bureau of Reclamation and the seven Colorado River basin states. The study examined the Colorado River basin as a whole, along with peripheral areas reliant on Colorado River water, such as Denver and Los Angeles. The reliability of the Colorado River system to meet increasing demands is evaluated, and potential strategies for dealing with projected imbalances are outlined. The future demands of the system are analyzed under six hypothetical situations, which include varying factors that will affect the system over the next few decades, such as: population growth in the basin states, potential savings from conservation, and economic conditions in the watershed.
Under these projected situations, the demand for consumptive uses in the Colorado River system is projected to range between 18.1 and 20.4 MAF by 2060. Four supply scenarios are utilized, taking into account historical hydrology and potential effects of climate change. The study team also reviewed 160 options for dealing with the potential imbalances, submitted by participants and stakeholders.

The study is available here. Actions identified as "Next Steps" in the study have begun with the formation of workgroups composed of experts and stakeholders. One Coordination Team and three Workgroups have been formed, on the matters of: Municipal and Industrial Conservation and Water Reuse; Agricultural Conservation and Water Transfers; and Healthy Flows. More information on the Moving Forward process can be found here.

Colorado River Compact Water Development Projection

This report was a product of the "Endangered Fish Flow and Colorado River Compact Water Development Workgroup." The Workgroup was convened by the CWCB in 1995 to estimate and formulate a way to protect the future uses of Colorado's Compact apportionment in the Colorado River Basin. The purpose for this task was to estimate how much water could be appropriated for endangered fish recovery instream flow purposes, without impairing the state's ability to fully develop apportioned water under the Compact. The final report of the Workgroup is available here. The CWCB planned an instream flow appropriation to meet these needs, which was later withdrawn. More information is available here.

Water Supplies of the Colorado River

This report was written in 1965 as a product of the Upper Colorado River Commission. The purpose of the report was to assess the supplies available from the Colorado River for use in the Lower Basin and the sufficiency of those supplies to meet the needs of the Lower Basin under Supreme Court decisions. This report is one of several examples that provide an examination of hydrology and usage in 1965 and determines that the river will not support the usage at that time. The report is available here.

Development Potential in Yampa River Basin

This 1993 memo contemplates the Upper Colorado River Basin Compact and provides points of consideration for development of water in the Yampa River Basin. Included are minutes and engineering reports from the 1948 Compact negotiations, as well as a consideration of proportional distribution of the development of Colorado's Compact entitlement among subbasins. The memo and associated references are available here.

The Yampa Doctrine

The Yampa Doctrine asserts that if the Yampa River is meeting the obligation of 5 million AF over 10 years under Article XIII of the Upper Colorado River Basin Compact, water uses in the Yampa Basin are not subject to curtailment under the Colorado River Compact of 1922. There has been much discussion of this Article at the Yampa/White/Green Basin Roundtable level. A CRWCD memo from 2010 discussing the Yampa Doctrine, with a memo from Tom Sharp outlining the Doctrine itself is available here.

Reconnaissance Level Cost Estimates for Strategy Concepts – Water Related Benefits for West Slope Subbasins

This appendix from SWSI 2010 examines some suggested water-related benefits that could be realized in West Slope basins as a result of a transmountain diversion. These suggestions include additional infrastructure, financial support for ongoing projects, and potential cooperative agreements. The document is available here.

Item 6 References:

Colorado Basin Roundtable White Paper

To inform the BIP process, the Colorado Basin Roundtable formulated a white paper to explain and delve into the issue of "Providing for Colorado's Statewide and West Slope water needs." This document explains the background of water use in that particular basin, especially with regard to transmountain diversions, and the history of such diversions. The white paper sets forth the Roundtable's vision for the future of the basin, with regard to water usage and future needs. Also, the white paper adopts a series of Principles, focused on the Executive Order regarding Colorado's Water Plan. The Colorado Basin white paper in available in its entirety here.

Filling the East Slope Municipal Water Supply Gap

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Metro Roundtable Selection of a Reuse Factor for the Portfolio Tool Planning Exercise

This paper provides background information on municipal water reuse, examples of water reuse by Metro Roundtable member utilities, and describes how the Metro Roundtable's reuse factor was selected for the Portfolio Tool planning exercise. This paper can be found here.

Metro Roundtable Updated Conservation Strategy

The purpose of this memo is to present an estimation of potential future water demand reductions that the Metro Basin Roundtable can reasonably expect by 2050 based on current and future water conservation programs and improved water use efficiencies. In keeping with the Statewide Water Supply Initiative (SWSI) and other state water conservation policy efforts, estimated demand reductions relate to three basic processes or influences on water use:

- Passive saving reductions related to the natural replacement of customer water using fixtures and appliances;
- Other changes in water use behaviors (e.g., state legislation, changes in land use, drought impacts, etc.); and
- Active water conservation program impacts related to implementation of water conservation programs sponsored by water utilities and special districts.

Noteworthy is that current water demand is trending downward due to a combination of these three influences. Similarly, future demand reductions will require that water utilities, nongovernmental organizations (NGOs), water customers, and state and local officials work together to support and ensure that meaningful, permanent water conservation programs are developed and implemented. This shared responsibility for future water conservation does not dismiss the important role of water utilities to act as good stewards of the state's water resources. But the work of managing water in Colorado is not solely the responsibility of our water utilities. It requires the cooperation and collaboration between all members of the water community.

Metro Roundtable Water Supply Paper (2012)

This paper describes how the Metro Roundtable conducted the Portfolio Tool planning exercise. The outcome of the exercise was the development of the Metro Roundtable's vision for meeting the projected future gap in municipal supply needs, which is also described in this paper. The paper can be found here.

The Metro Roundtable prepared companion papers titled "Metro Roundtable Conservation Strategy" and "Selection of a Reuse Factor for the Portfolio Tool Planning Exercise." Together, these papers on filling the supply gap, conservation, and reuse explain how the Roundtable performed its Portfolio Tool planning exercise.

Basin Implementation Plans

Basin Implementation Plans (BIPs) are being prepared in order to support Colorado's Water Plan and will be a fundamental component to its development. Each BIP will focus on strategies to meet roundtables' consumptive and nonconsumptive water supply needs. The Colorado Water for 21st

Century Act established the Basin Roundtables and tasked them to develop a water supply needs assessment, conduct a water supply analysis and propose projects and methods to meet those needs. BIPs will provide a more detailed analysis and be geared towards implementing projects to meet those needs to address the gap in a meaningful way. The BIP effort will be a foundational component of the update to SWSI and provide critical inputs into the Colorado Water Plan. Additional information on BIPs and Colorado's Water Plan can be found here. Draft BIPs will be available in July 2014.

Southwest Basin Roundtable Municipal Water Conservation Goal and Measurable Outcome

In support of the Basin Implementation Planning process the Southwest Basin Roundtable has developed draft municipal water conservation goals and measurable outcomes. A document detailing these goals is available here, and a summary is provided as follows:

- The SWBRT first conservation goal is to change the ratio of in-house to outside treated water use for municipal and domestic water systems (referred to as water providers herein) from the current ratio of 50/50 to 60/40 for southwest Colorado and the entire State by 2030.
- The water providers in the state that are using dry up of agricultural land (defined as requiring a water court change case) and/or pursuing a new Transmountain Diversion (TMD) (as defined by IBCC to be a new west slope to east slope diversion project) shall have a higher standard of conservation. The goal for these water providers is a ratio of 70/30.
- Water providers proposing a new TMD shall achieve a 60/40 ratio by 2020 and 70/30 by 2030 (high conservation) as a prerequisite for the SWBRT to consider support of a new TMD.

Guidebook of Best Practices for Municipal Water Conservation in Colorado (Colorado WaterWise and Aquacraft, Inc., 2010)

From the Introduction

The Colorado WaterWise *Guidebook of Best Practices for Municipal Water Conservation in Colorado* (*Best Practices Guidebook* for short) is a planning tool prepared for the purpose of improving and enhancing water efficiency in Colorado. The *Best Practices Guidebook* offers a detailed description of specific water conservation measures, program elements, regulations, policies, and procedures that can be implemented by Colorado water providers to help ensure reliable and sustainable water supplies for future generations.

Colorado WaterWise envisions that the *Best Practices Guidebook* will be used by water professionals including water providers, local governments, consultants, building managers, design engineers, irrigation professionals, and others throughout the state to help select the most sensible and cost effective water conservation measures and programs. Utilities can use the *Best Practices Guidebook* to help select water conservation programs to include in their conservation plans to be submitted to the Colorado Water Conservation Board (CWCB). Building trade professionals may use the *Best Practices Guidebook* to determine the most sensible water efficiency practices to implement in new construction projects and existing buildings. Others may find the *Best Practices Guidebook* a useful tool to increase water efficiency in their local community.

The *Guidebook of Best Practices for Municipal Water Conservation in Colorado* is an essential companion to the water conservation planning resources developed by the CWCB[1] and can be used by water providers large and small to help select appropriate, cost effective water conservation program measures.

A copy of the *Guidebook* can be found here.

Statewide Water Supply Initiative (SWSI)

The Statewide Water Supply Initiative (SWSI) provides a comprehensive picture of Colorado's water needs, now and in the future. It incorporates and summarizes previously published work by CWCB and the Basin Roundtables. SWSI 2010 was adopted by the Board at its January 2011 meeting and includes the following:

- An analysis of nonconsumptive needs and nonconsumptive projects and methods
- An analysis of consumptive needs, including municipal, industrial, and agricultural water needs –*includes an analysis of passive conservation for municipal and industrial uses.*
- An analysis of water availability in each river basin
- An analysis of municipal and industrial identified projects and processes and a municipal and industrial gap analysis, and
- Strategies to fill the gap. – *includes an analysis of projected future conservation levels*.

Each of these sections is based on previous work which received significant input from the basin roundtables and the public. The SWSI 2010 website can be found here. Previous SWSI reports (i.e. SWSI 1 and SWSI 2) can found here. Information specifically related to municipal and industrial water conservation strategies can in Appendix L and is further described below.

SWSI 2010 Municipal and Industrial Water Conservation Strategies (Appendix L) – CWCB 2011

Municipal water conservation is an important component of Colorado's strategy to provide a safe, secure, and sustainable water supply for future generations. This document represents the latest effort by the Colorado Water Conservation Board (CWCB) to integrate water conservation into overall water supply planning and to estimate the statewide water conservation potential up to the year 2050.

The CWCB defines water conservation as those measures and programs that provide for measurable and verifiable permanent water savings (CWCB 2010b). This is separate and in addition to the temporary savings that may result from short-term drought restrictions and related programs. In support of SWSI, the Interbasin Compact Committee (IBCC), and other water conservation efforts throughout the State, the CWCB has developed several work products that provide technical detail related to water conservation planning. The purpose of this report is to:

- Incorporate recent water conservation-related efforts into the SWSI 2010 update,
- Update the range of potential future water conservation savings, and
- Provide water conservation strategies that may contribute toward meeting the projected 2050 municipal and industrial (M&I) water supply gap and help address Colorado's future M&I water needs.

Water conservation is assumed to be one of several water supply strategies that Colorado will need to rely on to meet future M&I water demands. Meeting Colorado's future water supply needs will require a mix of successful identified plans and processes (IPPs), agricultural transfers, reuse, and new water supply projects. The conservation savings forecasts presented here are intended for statewide planning purposes and are not intended to replace water conservation and water resources planning and projections prepared by local entities. This report estimates potential future water conservation for three distinct strategies, but has not determined the portion of those savings that could potentially be utilized toward meeting a future water supply gap. This reports can be found here.

Fixtures Legislation – SB 14-103 (originally SB14-0677)

The bill concerns the phase-out of the sale of certain low-efficiency plumbing fixture. A copy of the bill can be found here.

As specified in this bill, effective September 1, 2016, a person shall not sell a new low-efficiency plumbing fixture in Colorado.

As defined in the bill,

(1) "Low-efficiency plumbing fixture" means any of the following plumbing fixtures that is not a WaterSense-listed plumbing fixture:
   a. A lavatory faucet;
   b. A shower head;
   c. A flushing urinal; or
   d. A tank-type toilet or tank-type water closet.

(2) "WaterSense-listed plumbing fixture" means a plumbing fixture or plumbing fixture fitting that has been:
   a. Tested by an accredited third-party certifying body or laboratory in accordance with the federal Environmental Protection Agency's WaterSense Program or an analogous successor program;
   b. Certified by the body of laboratory as meeting the performance and efficiency requirements of the program; and
   c. Authorized by the program to use its label.

Filling the Gap Report Series

From Western Resource Advocates website.

Most of the population growth for the next 40 years in Colorado is expected to occur in the South Platte Basin and in the urban counties of the Arkansas Basin. The population in these areas is projected to grow by 70 percent from 2010 to 2050, and this growth will be the main driver for the increase of Colorado's water demand during the next four decades. The State of Colorado has projected that 85 percent of the population of the state (7.7 million Coloradans) will be living in these areas by 2050; and that an additional total water supply of 453,000 acre-feet per year (AFY) (147.6 billion gallons) will be required to meet the water demands of the residents and industries of the South Platte Basin and the urban counties of the Arkansas Basin by 2050.

Western Resource Advocates, Trout Unlimited, and the Colorado Environmental Coalition recognize the importance of preparing for our water future. However, we are concerned that many traditional water supply strategies have resulted in adverse impacts to rivers and streams and their associated environmental, recreational, and economic values. Rather than continuing old patterns, 21st century water development must account for instream flow needs, minimize the adverse environmental impacts of water supply strategies, and even improve stream flows or other environmental conditions on streams that are already depleted. These new challenges require new ways of thinking and new tools.

The Filling the Gap Series provides a proactive approach to meeting the future water needs of Colorado while protecting the state's economy, environment, and exceptional quality of life. Below you may find additional information on the reports of the Filling the Gap Series, including snapshots of their respective water management portfolios, which would more than fill the projected needs for the communities of the South Platte Basin and the urban counties of the Arkansas Basin.

Filling the Gap: Joint Executive Summary
   South Platte and Arkansas Basin Reports (2012)

Filling the Gap (I):
   Commonsense Solutions for Meeting Front Range Water Needs (2011)

Filling the Gap (II):
   Meeting Future Water Needs in the Arkansas Basin (2012)

Currier Memo on SWSI 2010

This memo is authored by John Currier, Chief Engineer at the Colorado River District, and was published in January 2014. The memo details observations made by Mr. Currier related to the most recent Statewide Water Supply Initiative (SWSI 2010). Specifically, Mr. Currier's memo observes that agricultural acreage loss was not calculated properly, conservative assumptions were made in determining the projected 2050 M&I gap, and that assumed reductions in per capita consumption in the South Platte Basin should be reconsidered so as to match those assumed in the Metro Basin. The memo concludes that these three factors, if revised per the memo's recommendations, would show that the need for a new, large transmountain diversion is nonexistent, or at best, remote. This memo can be found here. The CWCB prepared a response to Mr. Currier's memo, which can be found here and is described below.

Response to John Currier's Draft Memorandum Concerning SWSI 2010

This memo was prepared by CWCB in response to the concerns raised by Mr. Currier in his memo, SWSI 2010 Reality Check. The memo details the purpose and intent of SWSI 2010 being a reconnaissance level planning effort. Additionally, the memo goes into technical detail related to Mr. Currier's memo's three main points related to agricultural acreage loss, conservative assumptions made in determining the projected 2050 M&I gap, and the South Platte Basin's per capita consumption assumptions. Ultimately, the memo concludes that Mr. Currier's assumption on historical consumptive use from urbanized irrigated lands is incorrect and this water is not available to reduce the M&I gap. Also, Mr. Currier's reduction of the South Platte Basin per capita use to that of the Metro Basin cannot be assumed due to the differences in water use in the basins. The response memo also reminds the reader that while the success percentage of IPPs is critical to meeting the M&I gap, the outcome of many IPPs is still unknown. As SWSI 2016 and the Basin Implementation Plans (BIPs) are prepared, more information will be revealed on IPPs, and no and low regret strategies including conservation. The M&I gap will be adjusted appropriately. CWCB's intention is to continue in a transparent fashion using and developing the best data available and to partner with the basin roundtables and other stakeholder groups to update SWSI and other technical work as we move forward. Furthermore, CWCB expects and requests timely comment on its technical work and hopes that this memo will serve as an opportunity and reminder that CWCB will work with the Colorado River Water Conservation District to help Colorado be prepared for the future. This memo is available here.

Interbasin Compact Committee Letter to Governor Ritter and Governor-Elect Hickenlooper (2010)

This letter was presented to Governor Ritter and Governor-Elect Hickenlooper as a summary report related to the IBCC's discussion and accomplishments over the previous 4 years (2007-2010) and the proposed work plan for 2011. This letter contains many references to water conservation and reuse with a report from the IBCC's Water Conservation Sub-committee included starting on page 20 of the letter. It can be found here.

Draft No and Low Regrets: Agenda Item 24, September 24-25, 2013 Board Meeting

Based on the dialogue and direction from November 2012, March 2013, and June 2013 IBCC meetings, as well as numerous subcommittee meetings, a draft No and Low Regrets Action Plan has been developed. The No/Low Regrets Action Plan is based on the foundation of the Scenario Planning and Portfolio work conducted by the IBCC and the Basin Roundtables. This work indicates that the many strategies are necessary in preparation for any future scenario. Specifically, for conservation, the IBCC identified the following strategy:

Conservation: Implement strategies to achieve medium levels of conservation and apply half of that to meet the M&I gap.

Adaptive Capacities: Track the reliability of these conservation savings in meeting the gap. If conservation does not prove to be reliable, additional emphasis on other portfolio elements will be required.

The Draft No and Low Regrets can be found here.

Green River Studies in Wyoming

Based on conversation with Pat Tyrrell, Wyoming State Engineer, the following studies are being conducted in the Green River Basin of Wyoming:

- There is a study by Trout Unlimited (TU) and the Natural Resources Conservation Service (NRCS) on the Henry's Fork tributary within the basin on return flows and its impact on salinity control.
- There is a University of Wyoming study in the upper reaches of the Green River attempting to determine the economic benefits of irrigation return flows.
- Jeff Fassett, former State Engineer, is evaluating current statutes, regulations, and policies to determine if they can support demand management activities such as fallowing or deficit irrigation. If not, what additional authorities are needed? This is part of the Upper Colorado River Compact Commission's current discussions on demand management to increase inflow to Lake Powell.

Senate Bill 14-023 Transfer Water Efficiency Savings to Instream Use (SCHWARTZ—BECKER)

Concerning an authorization of the voluntary transfer of water efficiency savings to the CWCB for instream use purposes in water divisions that include lands west of the Continental Divide. This bill was vetoed by the Governor. A copy of the bill can be found here.

From the Bill Summary:

Section 1 of the bill defines "water efficiency savings" as that portion of a water right used solely for agricultural irrigation or stock watering purposes in water division 4, 5, 6, or 7 that is nonconsumptive under existing practices and that results from efficiency measures, determined as the difference between:

1. The lesser of the decreed diversion amount and the maximum amount that had been historically diverted using the existing facilities for a beneficial use under reasonably efficient practices to accomplish without waste the purpose for which the appropriation was lawfully made; and
2. The diverted amount needed to meet the decreed beneficial use after increased efficiency in the means of diversion, conveyance, storage, application, or use.

Section 2 allows water efficiency savings to be changed or loaned, pursuant to existing water court and water loan statutes, only to the CWCB, only for instream use, and only if:

1. The application was filed within 2 years after the diversions were decreased due to efficiency measures;
2. The change or loan will not materially injure decreed water rights; and
3. The change or loan will not adversely affect Colorado's interstate compact entitlements or obligations.

The change decree or loan approval must identify the amount of water efficiency savings and the stream reaches within which water efficiency savings, as changed or loaned, will be used. Water efficiency savings that have been changed or loaned are not subject to abandonment. The parties who enter into a change or loan of water efficiency savings may provide conditions by which the original decreed diversion rate may be preserved for a future use by the water right owner who implements the efficiency measures if use of the efficiency measures is discontinued.

Colorado Demonstration Zero Liquid Discharge Processes for Drinking Water Systems (Colorado State Grant No. C150456)

Study funded in part by CWCB Water Supply Reserve Account (WSRA) grants through the Arkansas and Metro Basin Roundtables and also interested utilities. In progress, anticipated to be published in June 2014.

From the Final Report Abstract:

Utilities within Colorado and throughout the western United States have been reluctant to build reverse osmosis plants due to the uncertainty surrounding the disposal of membrane concentrate (brine). Concentrate minimization and zero liquid discharge (ZLD) technologies can provide a means to solve the concentrate management problem. The purpose of this project was to pilot test concentrate minimization and ZLD techniques suitable for use in Colorado.

A new technology, Zero Discharge Desalination (ZDD), was selected for pilot testing. The ZDD technology is an integrated system combining electrodialysis metathesis with nanofiltration. The ZDD technology was pilot tested at two drinking water membrane plants in Colorado. The first pilot test obtained 96 percent recovery when treating brackish groundwater to levels suitable for human consumption. The second pilot test simulated increasing the recovery an existing membrane plant to 98 percent by treating its concentrate stream.

The ZDD technology did not obtain zero discharge as the name implies, but it demonstrated the ability to produce excellent water quality and obtain high recovery. The ZDD technology shows great potential, but further development of the technology to reduce cost, increase reliability, and simplify its operation is needed before the process is suitable for use in Colorado.

Rotary Sprinkler Nozzle Retrofit – Douglas County Water Resources Authority (WSRA Grant Completed Dec. 2013)

Retrofit of existing spray heads with rotary sprinkler nozzles could reduce water used in the project area by 15 percent, or approximately 6,305 AFY. High school students will be hired to perform the actual 1,000 retrofits as part of a summer jobs program in the Memorial Day to Labor Day timeframe over the summer of 2011. Not only will the rotary sprinkler nozzles be retrofitted, but they will also be aimed to avoid over-spraying and watering sidewalks. Irrigation controllers will be reset to reflect the proper application rates of the rotary sprinkler nozzles. WSRA funding will be used to purchase rotary sprinkler nozzles, pay high school students to perform retrofits, pay adults to schedule the retrofits and supervise the work of the high school students, collection of impact metrics, administrative oversight of the program, and public outreach to create excitement throughout the region for the retrofit program, and encourage widespread adoption over time of rotary sprinkler nozzles in the project area. A copy of the report can be found here.

Colorado Review: Water Management and Land Use Planning Integration – CWCB 2010

Adequate supplies of fresh water will be the number one resource scarcity issue of the 21st Century, globally and here at "home" in the western United States. To meet our consumptive and nonconsumptive water needs, both demand side and supply side strategies will be needed (CWCB 2009b). The integration of land use planning and water supply planning is, therefore, a key component of managing our society's future demand for water.

Colorado and the West have integrated land use and water supply in many areas and arenas. This is especially the case with ensuring adequate water supplies for new developments. The focus of this report, however, is on the water demand management components of land use planning and practices. Demand management is a broad strategy for meeting the water requirements of Colorado's growing population by reducing the water needed to sustain each household and person. Ways to reduce future

demand include building denser communities, infilling existing urban environments, following low impact development standards, and using water wisely. Many of these demand management strategies have a land use component that will be explored herein.

Understanding what has already been accomplished, where we might go, and how we can continue to move forward is the purpose of the report. The report does not set the course but rather sets the stage for communities, planners, and policymakers to move forward armed with information about policies, statutes, and strategies that exist in Colorado and the West. A copy of the report can be found here.

Calculating Per Capita Water Demand Savings from Density Increases to Residential Housing for Portfolio and Trade-off Tool – 2010 CWCB, CDM Smith

Increases in population density are inversely correlated with water use in gallons per capita per day (gpcd). Assuming that for single family homes 50 percent of the water is used indoors and 50 percent outdoors, water savings can be estimated with each increment of density increase. The general rule implies that a 20 percent increase in density would yield a 10 percent per capita water savings. Although significant savings can result from changes in density, these changes are usually outside of the control of water providers. CWCB proposes calculating water savings from available density data. This methodology was applied to the Denver Metro Area based off the Denver Regional Council of Government's (DRCOG) Metro Vision 2035, which predicts a 10 percent increase in density by 2035. The above methodology then indicates that a total savings of approximately 5 percent would result for current and existing uses. Applying this level of savings solely to the new population results in a savings off new demand of just over 10 percent for the Metro area. The portfolio tool now has the capacity to incorporate density data as available on a county by county basis, using this methodology. A copy of this report can be found here.

Colorado River Cooperative Agreement

The Colorado River Cooperative Agreement (CRCA) is the product of 5 years of mediated negotiations. The negotiations were triggered by several events. In 2003, Denver Water initiated the National Environmental Policy Act (NEPA) process with the U.S. Army Corps of Engineers to enlarge Gross Reservoir. In 2006, Denver Water filed a diligence application in federal court regarding some of its water rights under the Blue River Decree. These filings created the potential for significant litigation and political dispute between Colorado's East and West Slopes. In 2006, several West Slope entities met with then-Mayor Hickenlooper, who suggested that resolution of longstanding disputes over water would require the services of a mediator. John Bickerman began serving as the mediator for the negotiations in February 2007. The proposed agreement goes well beyond these triggering events, however. Its geographic scope is from the Front Range, across the Continental Divide, to the western state line. It directly involves 43 parties that are either signing the agreement or receiving benefits. The CRCA can found here.

The proposed agreement begins a long-term partnership between Denver Water and the West Slope. The agreement outlines many benefits and provisions; however, only those related specifically to conservations are presented below and were reproduced here from the CRCA 6-page summary.

Benefits to Colorado

- Reinforces the priority and increases the amount of conservation and reuse within Denver Water's service area.

Summary of Provisions

- Denver Water will complete construction of its 17,500 AFY recycled treatment plant and 30,000 acre-feet (AF) of gravel pit storage and will maximize exchanges. Denver Water will implement its existing water conservation plan to achieve 29,000 AF of savings.

- Denver Water will develop an additional 10,000 AFY of water supply through conservation or reuse.

Mutual Commitments

- The parties commit to promote best management practices for water conservation.

Windy Gap Firming Project – Reuse

Windy Gap Firming Project: Purpose and Need Report. Prepared for U.S. Bureau of Reclamation (September 2005).
A copy of this report can be found here.

From Section 6.0 Sources of Supply:

Under Colorado water law, transbasin imports such as Windy Gap water can be used to extinction, thus allowing this water to be captured and reused multiple times. Many of the Windy Gap Firming Project participants reuse or are planning to reuse available water supplies to minimize the acquisition of new supplies.

Water reuse may include either the capture and treatment of effluent for direct reuse or the use of an effluent supply to meet return flow obligations or augmentation requirements. Direct reuse typically involves diversion from the wastewater treatment plant and conveyance to storage or distribution as nonpotable reuse for irrigation of parks, golf courses, and landscaping. Water reuse allows a portion of outdoor water uses to be met without using raw water treated to drinking water standards (potable water). Several Project Participants, including Broomfield, Louisville, and Superior, have developed water reuse treatment facilities, including conveyance and storage. The Platte River Power Authority relies on reuse water to meet the cooling needs of the Rawhide Energy Station. Because consumptive use is less in the winter, reusable water is often captured and stored for summer irrigation. None of the Project Participants reclaim water for potable uses. For some Participants, effluent is reused to meet downstream augmentation or return flow obligations. Reuse for these purposes does not directly affect nonpotable demands identified for a Participant, but it helps meet other legal or contractual needs for the Participant.

Colorado Ag Water Alliance

Meeting Colorado's Future Water Supply Needs: Opportunities and Challenges Associated with Potential Agricultural Water Conservation Measures (September 2008).
A copy of the report can be found here.

From the Executive Summary:

The Colorado Agricultural Water Alliance is an association of agricultural organizations committed to the preservation of irrigated agriculture through the wise use of Colorado's water resources. Agriculture in Colorado currently owns and manages the majority of the state's water rights, putting this water to beneficial use for the production of the state's food, feed, fiber, and bioenergy crops. There is a public perception that agricultural water conservation measures such as canal lining and conversion to sprinklers can easily provide additional water supplies to meet growing demands for urban, industrial, recreation, and environmental water needs in Colorado. To address these perceptions, an analysis of the current scientific literature and the administrative precedents in Colorado was undertaken to identify the opportunities and challenges associated with irrigation water conservation.

Specifically, this document attempts to address the following questions:

- Can "agricultural water conservation" result in transferable yield for new uses?
- Does increasing irrigation efficiency result in transferable yield for new uses?
- Does increasing irrigation efficiency and other conservation practices benefit existing uses?

This document is not a legal brief; it is intended to help foster dialog and a greater understanding of the challenges facing irrigated agriculture in Colorado.

Water Infrastructure Supply Efficiency

The Water Infrastructure Supply Efficiency (WISE) Partnership is one of the first of its kind in the country and will bolster water supplies to the South Metro area while maximizing the use of existing water assets belonging to Aurora and Denver Water. Through WISE, Aurora Water and Denver Water will provide fully treated water to South Metro for distribution to participating members on a permanent basis (initial phase – 7,000 AFY). WISE will also provide a new back-up drought supply for Denver and offset costs and stabilize water rates for Aurora. Additional information on WISE can be found here.

Item 7 References

CWCB Instream Flow Program

Per Colorado water law, the CWCB is the sole entity that can hold instream flow water rights. These rights are nonconsumptive, in-channel or in-lake uses of water for minimum flows between specific points on a stream or levels in natural lakes. These rights are administered within the state's water right priority system to preserve or improve the natural environment to a reasonable degree. For more information about the state's Instream Flow Program, and for current and completed appropriations, click here.

Nonconsumptive Toolbox

The Nonconsumptive Toolbox was created by the CWCB to support efforts of the basin roundtables and other stakeholders to develop projects and methods to meet nonconsumptive needs, via two objectives. First, to serve as a guide for BRTs as they develop their BIPs. Also, the toolbox serves as a clearinghouse for data and information generated in Phases I and II of the nonconsumptive needs assessment process, by compiling the work of the roundtables in one place. The Nonconsumptive Needs Toolbox, with appendices, is available here.

Programmatic Biological Opinions

The programmatic biological opinions (PBOs) for sections of river within the Colorado River system provide specific flow targets for the endangered species of fish within those reaches. Under the Upper Colorado River Endangered Fish Recovery Program, these PBOs are a result of cooperation between federal agencies and other interested parties. More information about the Recovery Program is available here, and the PBOs are available here.

Colorado River Basin Water Supply and Demand Study

This study, released in December of 2012, was a collaborative effort between the Bureau of Reclamation and the seven Colorado River basin states. The study examined the Colorado River basin as a whole, along with peripheral areas reliant on Colorado River water, such as Denver and Los Angeles. The reliability of the Colorado River system to meet increasing demands is evaluated and potential strategies for dealing with projected imbalances are outlined. As a metric in the Basin Study, boating flows were used as a recreational indicator to assess the potential vulnerabilities of recreational attributes under different scenarios. The study is available here.

Stream-flow Evaluations for Whitewater Boating

In October 2013, American Whitewater released this report, summarizing the results of a Gunnison River Flow Survey conducted the previous summer. The survey asked respondents to identify

"minimum, acceptable, and optimal" flows for boating and to identify the difficulty of reaches. The report seeks to define the range of flow needs on seventeen sections of the river. The Gunnison Basin will be incorporating some data from this study into their Basin Implementation Plan. The full report is available here.

Watershed Flow Evaluation Tool: Yampa/White and Colorado Basins

The WFET is a newly developed approach that is being tested and evaluated. It is a desktop tool that uses existing information to provide a regional framework for examining the risk of ecological change related to stream flow alteration at a watershed or regional level. The WFET helps basin stakeholders assess the vulnerability of nonconsumptive attributes by associating the risk of ecological response with potential flow regime changes. The three major steps in the development of the WFET are: 1) use existing data and expert opinion to develop flow-ecology relationships by stream type, 2) develop a hydrologic foundation of daily natural and altered flows, and 3) combine flow-ecology relationships and the hydrologic foundation to assign risk status for specific attributes across entire watersheds at a reach or subbasin scale. Thus far, the Colorado and Yampa/White Basin Roundtables have developed the WFET. The Colorado WFET is available here, and the Yampa here.

Colorado Parks and Wildlife Planning

Colorado's Wildlife Action Plan and the Colorado Recovery and Conservation Plans are designed to take a strategic habitat conservation approach using an adaptive resource management framework composed of five key elements: biological planning, conservation design, conservation delivery, decision-based monitoring, and assumption-driven research. This approach establishes specific, measurable objectives and uses models relating populations to limiting factors to target management and assess its impacts. A "taxonomy of actions" was developed for species and for habitats to summarize this information in a consistent format. Conservation actions for species and key habitats were prioritized on a scale of high, medium, or low, based on expert input, existing recovery/ management plans, and staff experience/expertise (CWCS 2006). The process is designed to be iterative and focused on developing and refining a conservation strategy, making efficient management decisions, and using research and monitoring to assess accomplishments and inform future iterations of the conservation strategy. The Action Plan is not an Endangered Species Recovery Plan, nor is it a type of regulatory or "decision" document. Its purpose is to identify the state's wildlife conservation needs in order to foster greater consistency in conservation efforts among all members of Colorado's wildlife conservation community and others with a stake in Colorado wildlife conservation.

The CPW's Conservation and Recovery Plans target specific species and includes an extensive list of amphibians, birds, fish, and mammals. One example, the Greenback Cutthroat Trout Recovery Plan, established two central measurable outcomes. The first was to simply maintain existing populations of greenback trout populations. The second was more quantitative, setting out to restore the greenback cutthroat trout to non-threatened status within its native range and delist the species by the year 2000. These goals can be accomplished by maintaining at least 20 stable greenback populations occupying at least 50 hectares (124 acres) of lakes and ponds and 50 kilometers (31 miles) of streams. These measurable outcomes exemplify the quantitative targets that guide restoration and planning practices in the Conservation and Recovery Plans.

The Range-wide Conservation Agreement and Strategy is a collaborative effort across multiple states signed in 2006 to maintain roundtail chub (Gila robusta), bluehead sucker (Catostomus discobolus), and flannelmouth sucker (Catostomus latipinnis) populations to a degree sufficient to ensure persistence of each species within their ranges. The process established measurable criteria to evaluate the number of populations and individuals within each population required to maintain the three species throughout their respective ranges. These approaches or others can be used by

stakeholders to set goals for meeting nonconsumptive needs and to build long-term implementation plans that identify projects at the local scale while maintaining and integrating those projects into basinwide and statewide objectives.

Wildlife Mitigation Agreements

Colorado Parks and Wildlife worked with several energy companies to form wildlife mitigation agreements, which will protect over 354,000 acres on Colorado's Western Slope. Under these agreements, the companies will consult with CPW on how to prevent or mitigate impacts from resource extraction. This close relationship will protect wildlife habitat while allowing the companies a more assured planning process. More information about the Wildlife Mitigation Agreements is available here.

NEPA Documentation on Ongoing Processes

NEPA documentation is available on several processes throughout the state, assessing the impact that they may have on the environment. More information on the Moffat Collection System Project, including the Mitigation and Enhancement Coordination Plan, is available here. EIS documentation and other permits and supporting documentation on the Windy Gap Firming Project are available here. More information on the Chatfield Reservoir Storage Reallocation Study, including EIS documentation, is available here. Further information about the Arkansas Valley Conduit is available here.

Arkansas Voluntary Flow Management Program

The Upper Arkansas River benefits from a Voluntary Flow Management Program, a unique arrangement between state and federal agencies, non-profits, water management organizations, and rafting organizations. This voluntary program provides for increased recreational flow on the river, as well as serving as beneficial flow for wildlife. More information about the VFM is available here on a local rafting organization's homepage, and more information about the Upper Arkansas Headwaters area is available here on CPW's website.

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