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## Ages of Limits in Colorado, and How do we Recognize Them in Developing a State Water Plan?

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various fifty-year models in the Basin Study, the projected flows at Lee's Ferry declined. The median result of the models projected Lee's Ferry flows would drop nine percent by 2060, with climate change as one of the contributing factors.

Udall then addressed allocation, overuse, and reservoir problems. According to the models he presented, on average, by 2060, there would be a four percent annual increase in demand on reservoirs in the Colorado River Basin due to climate change. Notably, these models did not include the increase in energy demand resulting from population growth in the Basin. Lake Mead, which stores water to be provided to the Lower Basin, currently has a net deficit of 1.4 million acre-feet per year. Currently, the Lower Basin covers this deficit with unused Upper Basin flows. The Lower Basin will be forced to address this deficit as water demands in the Upper Basin increase and those unused flows are used. Udall noted as demand in the Upper Basin increases, there will likely be Compact calls and additional shortages.

Finally, Udall addressed the level of uncertainty involved in science and climate change policy. Udall contended a lack of certainty does not provide grounds for taking no action. Scientists can only calibrate global climate models somewhat imprecisely because the time horizon on these models is usually one hundred years into the future. Udall emphasized, possible futures exist outside the models and there is no rational way to rank the myriad of models in use. Udall, however, still argued for taking action to combat climate change. He also stressed the high level of uncertainty involved when scientists reduce a global climate model to a specific region. Ultimately, Udall stated he hopes to better integrate the efforts of the scientists producing the models with the decision-makers using them, because the models, though imprecise, provide a good starting point for discourse in the climate change forum.

*Gerard Deffenbaugh*

#### AGE OF LIMITS IN COLORADO, AND HOW DO WE RECOGNIZE THEM IN DEVELOPING A STATE WATER PLAN?

John Stulp, Special Policy Advisor to the Governor on Water and Chairman of Colorado's Inter-basin Compact Committee, moderated a panel on the limits of Colorado's water supply and how future water supply projects and legislation may manage those limits. Panelists shared Western Slope and Front Range perspectives on Colorado's water supplies and the need to balance the development of new supply projects with flows for environmental and recreational purposes. The panel also examined the viability of agricultural water transfers to meet growing municipal water demands. The panel consisted of Eric Kuhn of the Colorado River Water Conservation District; Marc Waage of Denver Water; David Taussig of White & Jankowski, LLP; and Peter Nichols of Berg, Hill, Greenleaf, & Ruscitti, LLP.

Eric Kuhn was the first to deliver his presentation on "Augmenting Supply in Colorado: How Much Water Is Left to Develop in Colorado?" Mr. Kuhn discussed the uncertainty in new water projects regarding the future supply and demand of water in the Colorado River Basin. Kuhn identified three primary sources of uncertainty: (i) future hydrology; (ii) future demands; and (iii) exist-

ing compacts, such as the Colorado River Compact of 1922 and Upper Colorado River Basin Compact of 1948, which impose uncertain legal constraints. Mr. Kuhn also identified three strategies to reduce risks and uncertainties for future water projects, which he recognized are both politically and practically difficult to implement: (i) limit new consumptive use to times when the system storage is full; (ii) use water banks; and (iii) implement improvements to current and future storage.

Next, Marc Waage responded to Kuhn's presentation. Waage started with the principle that there is no unused water in the state that the people of Colorado can use without consequences. Mr. Waage then outlined the conservation measures Denver Water currently employs to make the most of its water resources. Waage noted Denver is reaching the limits of what behavior-oriented conservation mechanisms can achieve in terms of producing additional water supply for the Front Range. Waage completed his presentation with the argument that small projects are very important for the future viability of the state's water delivery systems. He then listed four key things that will promote the effectiveness of these small projects: (i) giving water utilities support for conservation measures; (ii) flexibility in water laws to allow for increased sharing of water resources; (iii) streamlining water project approvals; and (iv) enabling future development of Colorado water.

David Taussig then presented on "Challenges and Opportunities in Protecting Non-Consumptive Uses in an Ecologically Limited River System Like the Colorado River and its Tributaries in Grand County." Mr. Taussig listed numerous challenges to protecting the water resource of Grand County. Specifically, he mentioned the need to improve the water clarity of Grand Lake; reduce sedimentation in Grand Lake and the Colorado River; and ensure water flows are adequate to keep water temperatures at or below standard levels. Mr. Taussig also identified the following opportunities to protect the water resources of Grand County: (i) increase limits on future diversions from the Colorado and Fraser Rivers; (ii) require Grand County's and the Colorado River District's approval for all future projects; (iii) adhere to the 2008 Colorado Water Quality Control Commission's narrative standard on water quality; and (iv) require flushing flows of up to 1,200 cfs below Windy Gap. Mr. Taussig was confident that implementing the initiatives he listed would help alleviate current challenges and protect the Colorado River and its tributaries in Grand County.

Last, Peter Nichols presented "The Future of Transfer From Agricultural to Municipal Use: Changing Colorado Legislation to Allow for More Flexible Water Leases." Mr. Nichols outlined six pieces of existing and future Colorado legislation allowing for temporary transfers of water rights from agricultural uses to municipal uses. The various pieces of legislation Mr. Nichols discussed would limit the majority of transfers to periods of three to ten years, contingent on the requirement that no injury would result to existing water rights holders, and also subject to the State Engineer's approval. Mr. Nichols completed his presentation by asserting water leases are an essential element of state water policy, and we need to devote more attention to whether they will be effective tools for alleviating future water shortages.

Mr. Kuhn, Mr. Waage, Mr. Taussig, and Mr. Nichols therefore presented on a variety of issues, challenges, and opportunities to be drawn from the inherent limits on Colorado's water supply, and which should be addressed in the development of a state water plan. All panelists were optimistic that a well-conceived state water plan could ensure a water supply for Colorado's future generations.

*Christopher H. Butler*

SECURING THE MOFFAT SUPPLY SYSTEM: WEIGHING THE COSTS AND  
BENEFITS OF THE GROSS RESERVOIR EXPANSION, AND PROJECT  
ALTERNATIVES

Rebecca Mitchell of the Colorado Water Conservation Board moderated a panel discussion titled "Securing the Moffat Supply System: Weighing the Costs and Benefits of the Gross Reservoir Expansion, and Project Alternatives." Panelists shared Western Slope and Front Range perspectives on Denver Water's Moffat Collection System project and the accompanying expansion of the Gross Reservoir. The panel consisted of Charles Howe, Professor Emeritus in Economics at the University of Colorado; Barbara Green of Sullivan, Green, and Seavy, LLC; Amelia Whiting of Trout Unlimited; and Travis Bray of Denver Water.

The panel discussion began with an overview of Denver Water's Moffat Collection System. The existing Moffat supply system diverts water from the Fraser River through the Moffat Tunnel to South Boulder Creek. South Boulder Creek then flows into Gross Reservoir and the Gross Reservoir Dam releases water into the South Boulder Creek. The South Boulder Diversion Canal then diverts water from the South Boulder Creek to the Ralston Reservoir. The Ralston Reservoir ultimately provides water to Denver Water's Moffat Treatment Plant. Denver Water estimates an 18,000 acre-foot shortage of water in the coming decades. To meet this demand, Denver Water proposed expanding Gross Reservoir to hold an additional 76,000 acre-feet of water. This project would increase the dam's height from 340 feet to 465 feet. Notably, the Moffat system would not divert the additional water in dry years.

Charles Howe was the first to present on "The Economics of High Volume Interbasin Water Transfers." Professor Howe detailed the history of large interbasin transfers in Colorado. He explained the secondary economic and social impacts of interbasin transfers are important considerations and large water transfers out of depressed regions can result in severe regional economic and social disadvantages. He emphasized large transfers out of depressed regions require compensation for those regions but, even in light of these facts, legislation should not outright prohibit interbasin transfers.

Barbara Green next presented "Colorado River Cooperative Agreement and the Gross Reservoir Expansion—Western Slope Non-Opposition to Gross Reservoir Expansion." Ms. Green began by providing background information on the historical tensions between water interests on the Western Slope and the Front Range of Colorado. She then outlined the evolution of Article IV, Paragraph J of the newly minted Colorado River Cooperative Agreement. Article IV, Paragraph J prevents West Slope signatories, other than Grand