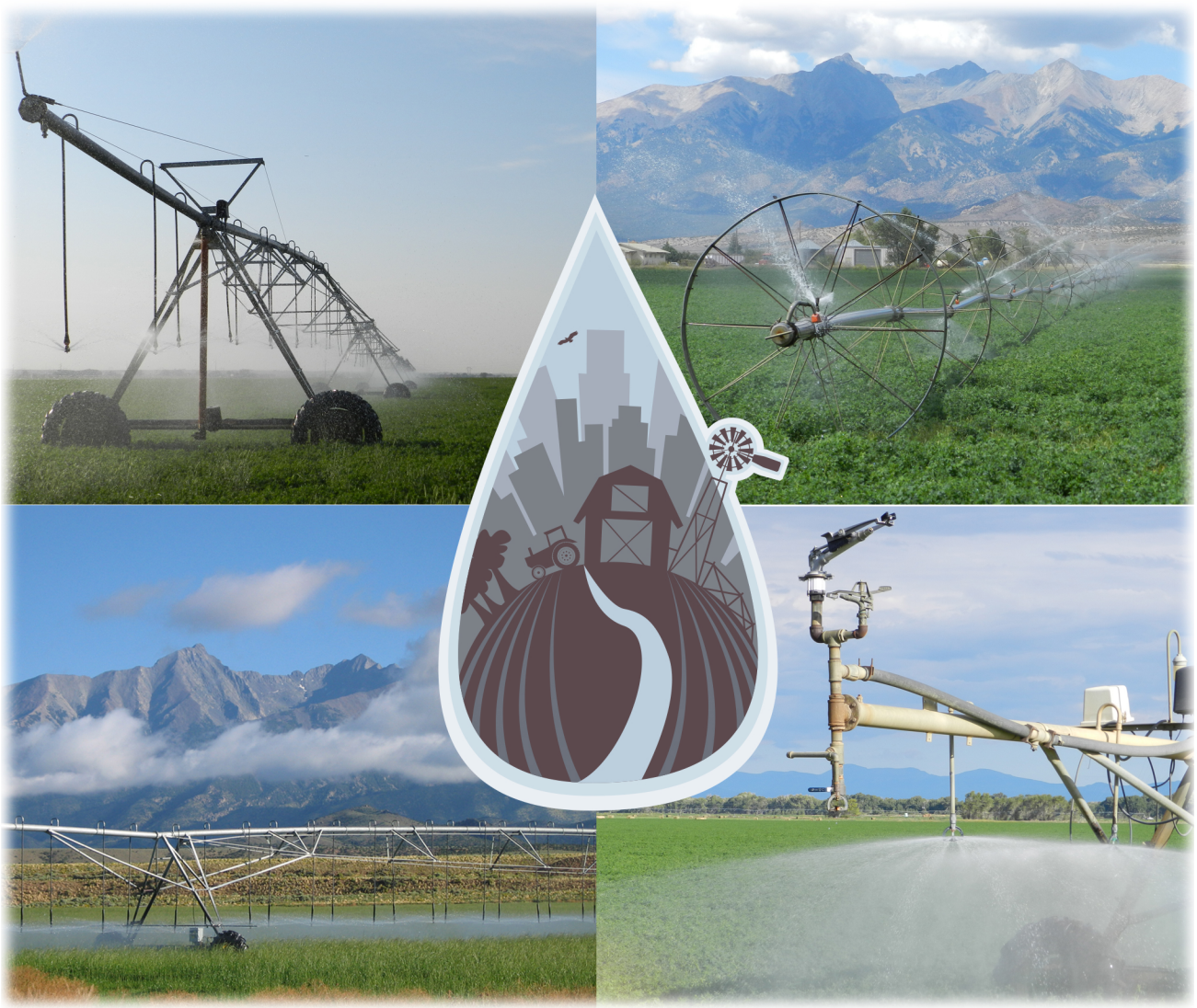
Prepared for the Colorado Water Conservation Board

Agricultural Economics and Water Resources: Methods, Metrics and Models – A Specialty Workshop

February 18, 2014



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Section 1

Introduction

The purpose of this project was to convene a Specialty Workshop, gathering experts on the subject of Agricultural Economics and Water Resources. Particular attention was paid to the presentation of methods, metrics, and models for economic valuation of agriculture and its relationship to water supplies, both consumptive and non-consumptive.

The Specialty Workshop was formal in nature. The Colorado Water Institute identified prominent experts in the field of Agricultural and Resource Economics and invited them to participate. These experts represented the top of their professions and eagerly accepted our invitations to join the event. These notable experts were invited on the basis of their interest and potential contribution to an "informed dialogue" on the manner by which agriculture can be assessed in terms of its value within a basin-wide, regional, or state economy.

The two basic groups of questions considered at the workshop were:

1. How do we talk about the economics of agriculture? Is there a conventional dialogue that can be used to maintain an informed discussion on this subject? What are the available metrics and methods that exist in the body of research on this topic?
2. How do we translate metrics and methods into a model that relates agriculture's value to larger statewide economy? How do these metrics and methods help us understand the economic relationship between agriculture and water resources?

The Specialty Workshop was moderated by faculty at the Colorado State University Department of Agricultural and Resource Economics, Prof. James Pritchett and Prof. Chris Goemans, along with Dick Brown, President of Sand Dollar Research. A moderated "long-panel" format was for the workshop, designed to maximize interaction with the panelists on this highly nuanced topic.

1.1 Event Support and Funding

The conference received support from the Water Supply Reserve Account (WSRA) via the CWCB and the Arkansas Basin Roundtable ($9,746) and additional support from sponsors and stakeholders ($5,000). A registration fee of $50 was charged for early registrants, $75 for late registrants and $100 for those registering on the day of the event. Registration fees ($6,900) garnered additional support from 156 total attendees (including speakers). Public Education, Participation and Outreach (PEPO) funding ($2,000) yielded support from the Arkansas and South Platte Basins. Significant in-kind support was provided by the Colorado Water Institute, CSU Extension, Colorado Department of Agriculture and Sand Dollar Research, along with the time and contribution of CAWA members.

1.2 Esteemed Speakers

From left to right. Harry Seely (WestWater Research), Frank Ward (NMSU), Bonnie Colby (Univ. Arizona), Tom Binnings (Summit Economics), Dan Keppen (Family Farm Alliance) and Michael Hanemann (ASU and UC-Berkeley).

Dr. W. Michael Hanemann

Title: Chancellor's Professor, Agricultural and Resource Economics & The Goldman School of Public Policy at the University of California-Berkeley.

Background: Dr. Hanemann's research interests include non-market valuation, environmental economics and policy, water pricing and management, demand modeling for market research and policy design, the economics of irreversibility and adaptive management, and welfare economics. Dr. Hanemann's research in economics has focused largely on aspects of modeling individual choice behavior, with applications to demand forecasting, inducing conservation, environmental regulation and economic valuation. He is a leading authority on the methodology of non-market valuation using techniques of both revealed and stated preference. His book chapter on "*The economic conception of water" in Water Crisis: myth or reality?*" edited by P.P. Rogers, M.R. Llamas and L. Martinez-Cortina is critical reading material for students of resource economics.

Harry Seely

Title: Principal, WestWater Research

Background: Mr. Seely has fifteen years of experience in applied mathematical programming and econometric analysis techniques to estimate the value of water. His work develops and utilizes market information, simulation models, and econometric techniques to estimate the market value of water for federal and state agencies, nonprofits, and private industry in support of water project development and reallocation activities. He has conducted market and financial analyses of proposed private water development projects and numerous water right appraisals in support of water acquisitions for urban and instream flow purposes. The 2010 report entitled "*The Economic Value of Water for Agricultural, Domestic and Industrial Uses: A Global Compilation of Economic Studies and Market Prices*" prepared for the UNFAO, co-authored with Bruce Aylward, Ray Hartwell and Jeff Dengel is a comprehensive review of methods for the economic valuation of water with case examples from California, Colorado and Nevada.

Mr. Tom Binnings

Title: Senior Partner at Summit Economics

Background. After working in the field of applied economics for 33 years, Mr. Binnings formed Summit Economcis with four leading economists. As a researcher, Mr. Binnings authored numerous studies on a wide range of topics in most industries. His primary expertise is in applied economics, with significant work developing business plans for start-ups and turnarounds in pipeline, construction, real estate, agriculture, education, recreation/tourist and utility industries. His work began with community, urban and regional economics and has expanded to include real estate and organizational economic analysis for strategic and tactical planning as well as process improvement. In recent years more of his work centers on public policy and impact analyses. He teaches at Regis University and Webster University as an adjunct professor for graduate and undergraduate students in the areas of economics and strategic planning. The Summit Economics report on "*Water and the Colorado Economy*" commissioned by the Front Range Water Council is an economic analysis of the value of water use within Colorado designed to provide data for collaborative decision-making, which can be utilized in assessing the future use and allocation of water resources..

Mr. Dan Keppen

Title: Executive Director, Family Farm Alliance

Background: Dan Keppen has 24 years of experience in water resources engineering, planning, policy and advocacy in the Western United States. For the past eight years, he has served as Executive Director of the Family Farm Alliance, a nonprofit organization that advocates for agricultural water users in 17 Western states, including Colorado. Mr. Keppen is a Registered Professional Civil Engineer in California and a past Civil Engineer and Certified Water Rights Examiner in Oregon. He has testified before Congressional environmental and water committees 14 times on water resources, environmental and climate change matters.

The Family Farm Alliance report on "*The Economic Importance of Western Irrigated Agriculture: Water Values, Analysis Methods and Resource Management Decisions*" commissioned by the Family Farm Alliance focuses on the economic contribution to irrigated agriculture contribution in the U.S., current capabilities and methods to analyze this contribution, and steps necessary to improve the significance of water in policy decision-making.

Dr. Bonnie Colby

Title: Professor of Agricultural and Resource Economics at the University of Arizona

Background: Dr. Colby's research is in natural resource and environmental economics and in public policy, and in particular, water resource economics. Some of her current projects involve nonmarket valuation of natural amenities, analyzing transactions costs generated by regulatory policies, evaluating the reallocation of water resources among economic sectors, economic tools to resolve environmental conflicts, and identifying strategies to promote efficient allocation of risk associated with variability in water supply and water quality. She is the recipient of numerous awards and recognitions. Classes that she teaches include the Economics of Water Management and Policy and the Economic Evaluation of Water and Environmental Policy. Some of her seminal works include "Risk and Resilience: The Economics Of Climate-Water-Energy Challenges In The Arid Southwest" (2010) with George Frisvold published by Resources for the Future Press and "Negotiating Tribal Water Rights: Fulfilling Promises in the Arid West" (2005) with John E. Thorson and Sarah Britton published by the University of Arizona Press. Her 2005 paper entitled "Visitor Values and Local Economic Impacts of Riparian Habitat Preservation: California's Kern River Preserve" appearing in the Journal of the American Water Resources Association is among her substantive works regarding contingent valuation and willingness-to-pay techniques.

Dr. Frank Ward

Title: Professor of Water Policy, Department of Agricultural Economics and Agricultural Business at New Mexico State University

Background: Dr. Ward's expertise is water policy. His recent work has focused on promoting conservation and economically efficient use of water in irrigated agriculture. It also includes policy planning, program formulation for water resources development, analysis of water resource systems, and institutional strengthening. He is the author of numerous journal articles, research reports, and book chapters. He has written two books: Valuing Nature with Travel Cost Models (2000) with D.J. Beal published by Edward Elgar (UK) and Environmental and Natural Resource Economics (2005) published by Prentice-Hall. Prof. Ward teaches Water Resource Economics and Natural Resource Economics at New Mexico State University. His 2002 paper entitled "The economic value of water in agriculture: Concepts and policy applications" in the academic journal *Water Policy* is a good read for students of agricultural water policy. Since 2007, he has published several papers in academic journals on the economic value of water in irrigation with applications to ongoing policy debates in Afghanistan, Jordan, Egypt, Central Asia, and, of course, the southwestern USA.

Invited Speaker - Justice Rebecca Love Kourlis

Title: Executive Director, Institute for the Advancement of the American Legal System. Stanford University B.A. English, 1973. English. Stanford University Law School J.D. 1976.

Justice Rebecca Love Kourlis served Colorado's judiciary for nearly two decades, first as a trial court judge and then as a Justice of the Colorado Supreme Court. She resigned from the Supreme Court in January 2006 to establish IAALS, where she serves as Executive Director. Justice Kourlis began her career with the law firm of Davis, Graham and Stubbs. She then started a small practice in Northwest Colorado where she developed an expertise in natural resources, water, public lands, oil and gas and mineral law. In 1987, she was appointed as a trial court judge with a general jurisdiction docket. She served as Water Judge and later as Chief Judge of the District. In 1994, Kourlis returned to Denver and worked as an arbitrator and mediator for the Judicial Arbiter Group. She was appointed to the Colorado Supreme Court in 1995. Justice Kourlis accepted the 2007 Legal Reform Organization of the Year honor from the U.S. Chamber of Commerce. She has also received numerous individual honors, including the American Bar Association (ABA) Justice Center's 2012 John Marshall Award, the ABA Judicial Division's 2009 Robert B. Yegge Award For Outstanding Contribution In The Field Of Judicial Administration and the 2008 Regis College Civis Princeps citizenship award. Kourlis and her husband Tom have been named the 2010 Citizens of the West by the National Western Stock Show. She is a Colorado native and daughter of former Governor John A. Love.

1.3 Event Program

The event program was assembled over many months

7:30A – 8:00A (Promenade Level)	Registration
8:00A – 8:15A *(Colorado I)*	*Welcome, opening remarks and discussion of format* **Charlie Bartlett**, Colorado Ag Water Alliance **Reeves Brown,** 3R Ranch and Arkansas Basin Roundtable
8:15A – 9:15A *(Colorado I)*	*In-depth Interview: On the economic concepts used to value agricultural water* **Dr. Michael Hanemann**, University of California at Berkley **Harry Seely**, Principal, WestWater Research Moderated by **Dr. James Pritchett**, Colorado State University
9:15A – 10:15A *(Colorado I)*	*In-depth Interview:* O*n the application of economics to agricultural water* **Tom Binnings**, Senior Partner, Summit Economics **Dan Keppen**, Executive Director, Family Farm Alliance Moderated by **Dr. Chris Goemans**, Colorado State University
10:15A – 10:30A	Break - food and beverages will be provided
10:30A – 12:00P *(Colorado I)*	*In-depth Interview:* O*n using economics to inform agricultural water policy* **Dr. Bonnie Colby**, University of Arizona **Dr. Frank Ward**, New Mexico State University Moderated by **Dick Brown**, Principal, Sand Dollar Research
12:00P – 1:30P *(Colorado II & III)*	*Luncheon and Distinguished Speaker* **Justice Rebecca Kourlis**, Institute for the Advancement of the American Legal System Welcoming by: **Commissioner John Salazar**, Colorado Dept. of Agriculture
1:30P – 1:45P	Break and Transition into Breakout Rooms

Breakout Session 1: Agriculture is as much an endeavor as it is a land use. This Breakout Session focused on the long-term goals for Colorado agriculture and the connection to water.

1:45P – 2:45P	**1A** (White River I) **Hanemann and Ward** Moderated by **John Stulp**	**1B** (White River II) **Seely and Binnings** Moderated by **John Salazar**	**1C** (EPR Amphitheater) **Colby and Keppen** Moderated by **Robert Sakata**
2:45P – 3:00P	Break and Transition		

(continued on next page)

Breakout Session 2: Policy measures and public engagement can take various forms that influence the management of water resources. This Breakout Session focused on the nexus of policy a water.

3:00P – 4:00P	**2A** (White River I) **Keppen and Seely** Moderated by **Jeff Tranel**	**2B** (White River II) **Hanemann and Colby** Moderated by **Mark Smith**	**2C** (EPR Amphitheater) **Binnings and Ward** Moderated by **Mark Sponsler**
4:00P – 4:15P	Break and Transition		
4:15P – 5:15P *(Colorado I)*	*Plenary Discussion and Closing Remarks. The end of the day will convene a discussion on the concept and understanding of an agricultural water "gap"* Moderated by **Gary Barber,** Regional Director, WestWater Research		
5:15P	Adjournment		

1.4 Breakout Sessions

The breakout sessions focused on the following questions:

- What are the future scenarios for agriculture in Colorado, in particular irrigated farming?
- By what metrics should we measure the agricultural and economic sustainability in Colorado? (Participants were asked for some examples of measurable outcomes by which this sustainability can be measured)
- How will the full irrigation requirements for Colorado agriculture change?

- By what justification or rationale should policy measures have a role in the free-market transfer of water rights?
- What central message needs to be conveyed regarding the value of ag water?
- Who should convey this message, and to whom?
- This message should be conveyed with what specific goals in mind?

Section 2

Outputs

2.1 Live Video Recording

One of the primary deliverables from the conference is the video recording of the morning sessions, available through Colorado Ag Water Alliance (http://coagwater.colostate.edu/) or directly through Barn Media (http://www.ihigh.com/barnmedia/), where they can be found under "Archived Broadcasts." These videos have been viewed 128, 30 and 39 times, for the Morning Interviews and the afternoon wrap-up session.

2.2 Event Commentary

The event participants addressed the majority of questions provided to them during the breakout sessions. During Breakout Session 1 (1:45 -2:45 PM), most of the focus was given to the question dealing with the "the future scenarios for agriculture in Colorado, in particular irrigated farming?"

- *Higher-Value Crops*. Many of the participants asked whether so-called "cash crops" and "niche-markets" would become popular in the future. Producers at the event cautioned against an foregone conclusion that these crops would be beneficial, citing the fact that they also require greater risk at higher costs of production.
- *Marginal Lands*. A number of references were made to the idea that so-called "marginal" lands (i.e., areas that receive irrigation, but yield at lower rates) might be taken out of production and the water right user be compensated appropriately for the transfer.
- *Irrigation Technology*. It was expected that more reliance on technologies for optimizing water and land use (irrigation, GPS/GIS) will occur. A strong desire existed to ensure that these improvements would not be met with regulatory resistance, citing the example of the Arkansas River Irrigation Improvement Rules, which have created disincentives to use improved irrigation tools. Technological adaptations are not easy solutions, given regional differences and water rights questions surrounding the adoption of newer irrigation practices.
- *Seed Mixes and Genetics*. Genetically-modified crops are expected to play a greater role in the future, providing higher yields. It should be recognized, therefore, that certain sectors of agriculture will need ample water to keep pace with the capabilities of new advances in biotechnology.
- *Food Outsourcing*. While not wildly popular at the event, it was acknowledged that food supplies will undergo greater outsourcing in certain sectors. and reduced farming of

"marginal lands." Outsourcing of food was predictably undesirable, for reasons of food safety and food security.

- *Land Use Planning*. By far, the most commonly cited scenario that the even participants cited was the idea that land-use planning and water-availability planning be linked somehow. This goal was mentioned in every breakout session, and echoed by the various experts that attended the event. Because so much land use planning is done at the local level, it is complicated to incorporate the statewide perspective.

During Breakout Session 1 (1:45 -2:45 PM), additional focus was given to the question dealing with the "metrics by which should we measure the agricultural and economic sustainability in Colorado?" This question is still being evaluated, but generally the responses included:

- The number of operators that might still be in the farm census,
- The number of acres that might have some perpetual preservation to it.
- If you want to keep water and agriculture, make agriculture profitable, so farmer family income is critical.
- The number of, or the percentage of, the next generation that returns to the farm.
- Some sort of "index" that would be transparent.

During Breakout Session 2 (3:00 -4:00 PM), additional focus was given to the question dealing with the "central message [that] needs to be conveyed regarding the value of ag water? participants found agreement. There was consensus that agricultural water users must understand coalitions with recreational and environmental uses. The "lumped approach" of including spillover effects, additional benefits, ecosystem services and non-market values ("way of life") was offered as a viable means of understanding agricultural water use within its larger context. It was suggested that agricultural water users should play a more proactive advisory role to agencies and governmental organizations, and state, county and municipal policy-makers. Agricultural water users were encouraged to enact a statewide "campaign" to educate the public. Lastly, the overall sentiment was that message clarity is crucial and there are lessons to be learned from environmental groups, but there is existing public support for agriculture.

2.3 Post-Workshop Survey

After the workshop was completed, participants were asked to complete a short online survey that was sent to all attendees who had provided their e-mail addresses. Overall, the attendees felt that the event was a beneficial use of their time. However, some attendees felt that the discussion was incomplete. Some participants responded to the survey by indicating a demand for more discussion on specific tactics and approaches that could be used to change the trend by which agriculture is considered the "default source" of water for municipal and industrial uses. Responses to the primary survey questions on the quality of the program are provided in the following figures.

Based on the information presented, do you feel that the importance of agricultural water is recognized in Colorado?

	Response Percent	Response Count
I think that the State of Colorado does not have an appreciation of the value of agricultural water.	13.6%	3
I think that the State of Colorado recognizes the value of agricultural water but does not place enough emphasis on it.	**59.1%**	**13**
I think that the State of Colorado has a good appreciation of the value of agricultural water.	27.3%	6
I think that the State of Colorado has done all it can to value agricultural water and does not need to do more.	0.0%	0
	answered question	**22**

At the conclusion of the conference, do you feel as if you received information of importance that you did not have before the conference?

	Response Percent	Response Count
Yes, I learned a great deal more than I knew before the conference	27.3%	6
Yes, I learned information that strengthened what I already knew	**63.6%**	**14**
Yes, the information was useful but did not add significantly to what I already knew	4.5%	1
No, the information was not what I needed for my purposes	0.0%	0
No, I did not find the information useful	4.5%	1
	Other (please specify)	5
	answered question	**22**

Section 3

Summary

A vast quantity of information regarding the value of agricultural water was exchanged at this event. Among the more tangible deliverables are the video recordings of the various talks, the availability of this proceedings document, and the greater partnership developed among these Western universities and the stakeholders who attended the event.

One of the major goals of this event was to achieve greater understanding of the concept of water valuation as it is applied to the irrigation water used in agriculture. Given the feedback that was received verbally and through the survey, this goal was achieved to varying degrees, depending upon the level of economic knowledge that each attendee brought to the event.

Of the morning sessions and interviews provided the foundation for a thoughtful discussion between event participants and our invited speakers in the afternoon. Given the rapid pace of the afternoon breakout sessions, it was not possible for the attendees to address every question that was posed to them. However, thoughtful responses were given to the major themes. For example, the first breakout session encouraged participants to consider the "future scenarios" that lay ahead for agriculture in Colorado. Based on the recorded and transcribed notes from the sessions, it was clear that the attendees who represented municipal water uses benefited greatly from their counterparts in agriculture. In particular, a popular sentiment among many of the participants was that so-called "niche markets" or "high-value crops," in other words specialty crops like the vegetables, fruits and wineries should be a new and positive direction for Colorado agriculture. While this premise is grounded in a certain logic and undeniable appeal, agricultural producers and many of our invited speakers cautioned that specialty cropping requires a much higher tolerance for risk, ability to absorb variations in demand and more expensive inputs and training. in short, specialty crops will continue to play an important role in Colorado irrigated agriculture, but will not likely supplant the more dominant uses of agricultural water, such as alfalfa and corn.

Another thread of discussion that emerged popularly among all of the breakout sessions, in some form or another, was the desire for land-use planning and water availability to be more closely linked. A great deal of discussion centered around the fact that land-use planning generally occurs at the county level, whereas water availability studies and plans are being developed at the statewide level. The event attendees felt that it would be a necessary and positive advancement in terms of the protection of agriculture, to find ways to link the planning of both of these resources. Many of the discussion groups examined the importance of public policies that would not interfere with privately held water rights, despite the need to protect

agricultural from continual "buy and dry." Measures to accomplish these ends, that were widely supported or at the very least not opposed, included conservation easements to link water rights to agricultural land in perpetuity and alternative methods to agricultural transfers, such as rotational fallowing and interruptible supplies. Other groups discussed the viability of "transaction fees" that would be commensurate with the amount of water transferred, which could be collected into a larger fund that could be used to accomplish broad goals, such as the purchase of conservation easements or infrastructure improvements to protect agriculture.

The event also encouraged participants to discuss what "central message" needs to be conveyed regarding the importance of agriculture, and to whom this message should be delivered? Responses varied widely on the subject, but it was largely recognized that agriculture plays an important cultural role in Colorado, as well as having a role in food security and associated linkages with nonconsumptive uses. The most common audience suggested as a target for messaging the importance of agriculture was the "younger generations" who lack an understanding of food production. However, it was also recognized that a more immediate audience included policymakers, by and large County Commissioners, who play important roles in land-use planning. The central issue needs to be one that explains how long-term negative impacts can't outweigh the short-term gains found when water is transferred out of agriculture

Another one of the primary goals of the event was to examine various means of determining a "baseline" for agricultural water use. While this question wasn't raised specifically in the breakout sessions, the discussions trended towards this topic nonetheless. Another set of opinions emerged around the concept of using economic metrics as a baseline. Agriculture should be supported in terms of remaining profitable, providing opportunities for new and beginning farmers, supporting rural communities that depend by virtue of their geographic location on agriculture, and anchoring a reliable sector of Colorado's economy. Among many of the participants from the agricultural sector, it was not a foregone conclusion that water rights would ultimately be sold for municipal uses, simply because of their high values. Members of the agricultural community stated the importance that agriculture remained profitable, but many farmers are willing to tolerate the risk associated with farming, despite any short-term gains that may be realized through water sales. There are approximately 3.5 million acres of irrigated agricultural land in Colorado. Agricultural participants at the event are alarmed at the possibility of further dryup of this land, in order to supply water for municipal consumptive uses such as landscape irrigation.

In summary, an interesting juxtaposition between the concepts of "value" and "importance" as they pertain to agriculture. Clearly, not all aspects of agricultural water use can be assigned a direct and immediate value. However, agriculture is, without any disagreement, important to the character and underpinning of Colorado, particularly in the less populated regions.

Appendix A

Text from afternoon wrap-up session

Gary Barber: These roundtables started back really, technically in 2003. The Statewide Water Supply Initiative identified a municipal gap, and that was going to be followed by SWSI-2 and instead we get the Roundtables in 2005 the Water for the 21st Century Act and on the Arkansas Roundtable are chairman was Alan Hamel the great statesman of the basin and we spent a couple years in the know each other in several years and a little bit of money looking at adding to municipal transfers and in the implications of those and what that might mean but we were always talking about municipal supply gap. When they updated SWSI in 2010, they included an "ag gap" and that I gap was defined as the number of acres you could irrigate if you had unlimited water, how many acres you irrigate now, and that's the gap. Well – for us in the Arkansas, that's kind of meaningless. We went over – appropriated in 1890. So the theory of how many acres you could irrigate didn't have much meaning. When we got into this, our charge legislatively is a roundtable was to identify projects and methods that would meet the needs of our basin. And so Reeves Brown and some others started having a very serious conversation about, "how do we value agriculture, how do we preserve agriculture, and how do we make that an informed conversation?" So we went to the Colorado Water Conservation Board, at their November 2012 meeting and turned in a little report – "here's how we think we're been a meet our needs, and one of those was that we were going to start pursuing this "value of agriculture" and we did that with the Colorado Water Institute, Colorado State University and then someone in middle that the governor showed up and threw down this Executive Order – "you shall have a plan – a basin plan." So – it's given us an opportunity to take the results of this conference and move that forward and that – to us has been, in my opinion, a real benefit.

What I'm to do with our panel here – a kind of summary conversation – is asked to questions:

1. ***If we preserved agriculture successfully, how would we know?***
2. ***What advice would you give us, from this day going forward? What plan of action should we take? What conversation should we try to have? How do we take today's experience, and turn it into something actionable, that's measurable, that we can include in our Basin Implementation Plan?***

Dr. Bonnie Colby: So the first question, "how would we know if we were successful in addressing the issue of preserving ag, one quick answer was that your meeting would suddenly turn to other topics and you wouldn't be devoting your attention, expert studies and so on to this issue. I mean that is the wonderful thing – when we solve one particular problem, we're not going to be unemployed right? There is only the next set of water management challenges and puzzles think about. So that would when this drops off the agenda, people are satisfied with the mechanisms that have been put in place. That would be one good signal.

We heard a lot of good ideas today about metrics during the breakout sessions, and somehow the issue of numbers employed in agriculture – either directly or indirectly with ag linked industries that sell

inputs, process and agricultural products. Others had standard of living in households and quality of life in rural areas. So basically, you would be free to turn your attention to other issues, and that would be a very good signal. And there will never be a lack of other issues. So the second question, I think that pushing forward with the alternatives to investigating "buying the dry" – you are so much in that momentum now, as a state and in keeping that momentum with investigating deficit irrigation, water banking, what additional technical information is not yet in hands that would make these other arrangements work well. What kind of changes to laws and policies are needed? So – keeping the momentum going that you already have, which is impressive and encouraging to those of us from other regions is important. And, for the agricultural sector and those who articulate on behalf of agriculture, I would say give more attention to the sort of the "public good" aspects of a vibrant agricultural sector, near areas where there's urban residents, or even areas where there's small towns – the open space value, the effect on wildlife, for agriculture located higher up in stream systems, the fact that water moves through the irrigation cycle, in some cases actually helps extenuate the season of good stream flows up high. So these kinds of benefits that are appealing to recreationists and urban dwellers around the state – it's definitely in your interest to continue to explore them, quantify them and make the most of them. And by the way – what was the name of the organization that sponsored our coffee? [Tri-State Generation] so – in Arizona we discovered somewhat painfully how closely our water and energy generation sectors are tied together. You have good research on that already in Colorado, so attending to the energy generation sector, even though power plant cooling doesn't consume a lot of water, it changes water temperature, brings it out of streams - bringing in the whole energy generation and energy use as well as what we consume to move water around the state. We didn't hear much about that today because we had a very focused subject matter here today, but that's one I've learned from working elsewhere that has sometimes been forgotten with consequences that are not positive.

Harry Seely: The first question – so how do we know if we preserved agriculture successfully? In economics is a lot of ways to try to measure that, but I think what I've heard today is that it's not all about the economics, it's about the community and about preserving that way of life, so one metric may be – looking at the age class of farmers that you have in your community, and trying to look back to see if you have a more diverse age class then maybe you're headed towards. The other thought I had was that sometimes it's useful to have farmers that both own and operate the land, as opposed to private investment that then rinse out the land, from a community perspective. So those are two things that I think are useful metrics that are little bit nontraditional in an economic sense, but may be worth considering. So how do you move forward with something actionable conference? I think it depends on the goals that you guys can coalesce around, and be able to create a unified message around their tools that those goals. But clearly, there are tools – you can look to other states to learn from. Colorado has been on the forefront of water markets – I think not by design – maybe more by demographic changes, but there are other states that have used water markets in a way that I think is more efficient and is not necessarily inconsistent with the goals of preserving farming in your community.

Dan Keppen: So – I guess that the way I define success is probably more of an anecdotal measure than anything else. My Board of Directors meets face-to-face wants a year because we spam the 17 Western states. We don't have a huge budget so that's usually the only time we can see each other face-to-face,

set our priorities, identify issues that are out there. Every year, we hear reports from every one of our board members about agriculture land disappearing in our communities, not just in Colorado but throughout the West, and when I stop hearing those reports at such a widespread scale, I'll know that some sort of progress is being made. I have to say though – compared… What I heard today was so heartening. Five years ago, I would say right before the recession kind of hit, our membership was definitely concerned about Las Vegas, and Southern California and some of the big cities, Phoenix, some of the bigger metropolitan areas in the Southwest in particular growing, doing amazing things from a Conservation standpoint – you know, ripping out turf and putting in arid landscaping and that sort of thing. But still the growth was so great – it wasn't making up for the savings of the conservation. Nevada, the Southern Nevada water Authority flat out is looking at extending huge pipeline into northern Nevada to get groundwater from ranchland. And so our concern was – wow here's another chunk of ranchland that is going to be gone. And frankly the urban interests and some conservation interests were rolling us. Nobody was listening to agriculture. And today – I'm blown away. People are getting it. We got a new one of those discussions this afternoon, and people get it – it's not just about the economics. There's rural communities that are at stake here. So – were making progress and I think Colorado is making more progress. I'm very confident of that – it's been very encouraging. So suggested action, I guess, as we move forward on all this. Again I think… It seems to me there's a consensus to shy away from permanently buying up water rights, and drying up farms. I think Colorado has learned its lesson. That's just my perception for most people I've talked to. Maybe they're just saying that because they know that that's what I want to hear, but that's what I've heard. So, however – water transfers are reality in the West. They can be done in a sustainable way. They can be done in an incentive – driven away. They can be done in a temporary way. And I hope that that will happen here in Colorado. It's already happening in California. It's already happening in the Klamath basin where I live. Albeit with a huge influx of federal money to make it happen, for environmental purposes. But – we need to continue to demand management, we need to continue conservation actions which is being done, but there is the potential to do more of that. But we also need to take a hard look at developing ways to enhance supplies. And we look back at the last 20 or 30 years in this country, infrastructure development has ground to a halt. And in my view it's because of the maze of regulations, primarily federal regulations that have made it very difficult. It's so daunting to move forward with the storage project right now, and most people just say "forget it, I'm not can it do it." And I know Northern is doing the yeoman's work, trying to advance that project there. I think they've made some good progress, but it's tough. When the regulatory flexibility to allow infrastructure, not just to allow storage. Again – the days of the huge dams are over, but there's opportunities to do off stream projects and conjunctive management and things like that will help the mix. The energy water nexus is hugely important. There's opportunities in Colorado and the upper basin to partner with petroleum industries, to find ways to make use of all that nasty ones being produced with coalbed methane generation – those sorts of things. Treat that water at least make it usable for agricultural purposes, maybe, and then take some of that ag water, and then maybe transfer it downstream to meet other needs. My boss Pat O'Toole a rancher in Wyoming is, like the cutting edge of coming up with ideas there. To do all this we need coalitions. I'm a huge fan of working with constructive conservation groups who share our vision that agriculture land needs to stay in production, because it's far preferable for habitat projects, and the potential for projects than condos

and new developments. And they are a very powerful ally to have, and it's been real fun to work with that some of them here in this basin. We have to respect water and property rights. Locally driven solutions are the best solutions. The state is local as far as I'm concerned. The Fed should back those efforts up anyway possible. And finally – just the messaging is so important. I think we in agriculture have a hard time getting a positive message out there. I'm amazed how well the environmental community has simple soundbites and they're so effective. We need to find those soundbites in the right spokesman. And, again my choices Peyton Manning. I think he'd be a great spokesperson, after seeing him in action yesterday. I can see why Broncos fans are so excited this year. But yes – the messaging is huge. We have a huge industry and it's amazing to me how little we put into marketing the good things that we do. And so that would help drive a lot of this.

Dr. Michael Hanemann: I agree with what Bonnie and the others have said. This tension between the objectives of private property, and protecting private property rights – but also the fact that water is a public resource – I'm saying that not because that's my personal opinion – it's a widespread view, it's a view enshrined in the law to some extent. And so one must necessarily balance those two interests. From that perspective, it matters greatly not only what happens to agricultural water use, but what happens to urban water use. I live in Phoenix – it was a nicer area 20 or 30 years ago. There's lots of sprawl. You kind of – you have to pinch yourself every so often to know where you are – because everything is sort of … looks alike. The land is available, but – this is my personal judgment – it's not a great style of urban living – spreading out endlessly, and low-density, and you know it's worked for the last 30 or 40 years, but if we keep doing that, 50 years from now, it's really not going to be a terrific place to live. In other words we have land – we shouldn't use it profligately. We should be thoughtful, and conserving and how we use it because the land-use sticks around. We're not going to unbilled this, and so we put together a city, shape, a path of urban water use that may be fine for now but isn't sustainable over the next 50 or 100 years. So we have to pay attention now. We also have to pay attention to how much water we use and what is our urban water footprint in the cities. I'm saying this because the same applies to agriculture. We have to look to agriculture as to cities and form a vision or goals for land-use as well as water use. And so I think part of what is needed, now thinking of agriculture, is for the basin, and through the basin, the state of Colorado, to have sort of a vision or a goal for water and land-use in the basin. And the two important objectives and doing that – one is flexibility. Water supply is variable. It has been throughout the history of the European settlement. They're going to be dry years there going to be wet years, and we want a pattern of water use and distribution for farms and for cities that is sustainable through those variations. We know that there's going to be climate change, which is likely to increase the fluctuations, make the more extreme. We want a pattern of water use on the farms and in the cities that will be sustainable over the next 50 or 100 years through climate change. So we need institutions and patterns of use that permit flexibility. And, that's one of the reasons for things like deficit irrigation, water banking, dry your water markets. Because they will give us more flexibility. The other objective I think is – in a sense – a diversified portfolio. We want to get the biggest bang for that we can for the resources that we have. But that means multiple uses. So as it's been pointed out, agriculture also serves the goal of open space, habitat, riparian habitat, and we want to get those benefits as well as the agricultural benefits. In Agro ecology

there's been a push against the trend towards monoculture. And there's been the observation, that if you have more of a diversified crop Max, then you are more robust. I think that applies on a larger scale to the way water is used in agriculture, so we want to have a diversified portfolio. So we want to diversify crops, the emergence of locavores, the spread of farmers markets, the interests the willingness to pay more money for high quality food produced locally – not the sort of square tomatoes that are transported hundreds or thousands of miles. So you want in agriculture that supplies these locally grown high-value crops, as well as other crops that are sold on world markets. So I think what one wants is first of all a vision or goal for land-use in rural areas both for farming for open space and for habitat. And – a vision of an institution for water management and water allocation that permits and supports those goals. And as I said earlier, I think there's parallel objectives for the urban use of water. And this needs to be done at a state level, at a basin level, but also at a state level. Because so much land-use is controlled locally, the county, or below the county. And the interest of counties in maximizing tax revenues, I think fights against some of the other public interest in the pattern of land-use, and the pattern of water use. And so I see the basin plan or the state water plan as the sort of "pushback" because purely local narrow self interested land-use decisions. I think I think with a basin and statewide vision of the land-use objectives for water, that becomes a pathway to implementing this – through the water plan and other legislative policies relating to land use. So the first step is the vision and I think this sort of process is really remarkable in its breadth and thoughtfulness as a mechanism for generating the vision. And then I think that the other institutions – the water plan and so on – can take that vision and move forward and implement it.

Dr. Frank Ward: having gone to school here a number of years ago, I was quite relieved to go to New Mexico where I was quite sure that the water problems would be less complicated, and quite saddened to find out that they are not really less complicated – many of them are quite similar. I guess I'm going to try to avoid repeating what's already been said, but the question again, if I have my notes correctly is "if we preserve agricultural land successfully, how would we know that?" I'm part of a group of people who build empirical models, computer models, optimization models actually in New Mexico, looking at that kind of question actually and one of the big debates we have is – what is the least cost way to be able to meet our interstate compact delivery requirements, and we have I think six or seven of them. Colorado you have about the same, probably more. And so, for example, when we have to make water deliveries at the Texas and New Mexico line, we very commonly asked the question "what is the cheapest way to get that water to Texas in a reliable sort of way, in terms of New Mexico water consumption displaced – that is the opportunity cost realized in some way or another?" And so we've been building as models for some time, and very often times we conclude that irrigated ag is the least cost way, by transfers to cities to get that water to Texas. But in a little bit more deep reflection on that, we thought well why don't we take a look at some of the things that we saw in Southern California – a former student of Michael's who did some work on multitiered pricing for the Metropolitan Water District in the late 80s (I believe), and it turns out that when cities price their water at average costs – then in drought periods, when the price stays the same, there is not much of a price elevation on what you might call discretionary type uses to encourage urban folks to conserve water. So maybe – in some of our modeling work, we are finding that pricing urban use at marginal costs, or at least maybe a two-

tiered pricing – I think Tucson was the only city that experimented with true marginal cost pricing, and they suffered politically quite a bit for that – but to have urban water priced at its true marginal cost, at least for the discretionary uses would be one way to avoid shortages or to meet downstream delivery requirements without having to take it out of agriculture. But even that is not 100% satisfying, at least not to me. So when I got a call about a year and a half ago from some Israeli friends who asked me to come over there and talk to them about the Israeli water scene, and I asked them if they might have a little bit of money for an airline ticket for my lovely wife, and they said "well alright" and we went over there and we got given a lot of tours. And they said – well we have a similar problem here in Israel, and we're trying to figure out how to preserve irrigated agriculture and we had a very strong irrigation lobby here in Israel. And so for years we've been transferring water, taking it out of the Jordan River – and transferring it to cities and and not much environmental uses, but especially cities - the growers don't want us to take it from them. And so they have been fighting tooth and nail to not have water transferred out of irrigated ag, and I said to my Israeli friends, "well tell me the punchline, pray tell what will you do? Where will you get this water?" It turns out that about 15 years ago the Israelis government initially under subsidy began to subsidize what we in this country referred to as a "backstop" technology. And a backstop technology is any production from a renewable resource that can last forever or you know arbitrarily long, and not have to use your depletable resources. And I thought, "well what can a backstop technology do you folks have?" And it turns out that they've been investing heavily in desalinization. A high cost source, but renewable nevertheless. And, they have cut the price of desalinization down to about $.50 per cubic meter, starting at about $2.00 per cubic meter short time ago. And so now, what they're doing to get sustainability – preserving water in ag – as well as trying to restore the Dead Sea, the Sea of Galilee, and the Jordan River flows - is they are trying to meet that gap – in overall water not just in ag water – through desalinization. And like any backstop technology, if you can lower the cost of the cell sufficiently enough, then there will be plenty enough for everybody using this backstop renewable – I'm talking about seawater desalinization of course – from the Mediterranean. And, so how would that apply for New Mexico? Well – you know in New Mexico we get the same question – how can we avoid taking water out of irrigated ag? Well one possibility – look at underground/groundwater desalinization for which there are billions of gallons in New Mexico. It's very expensive, but if you could learn to find that water in a cheaper way. Maybe state subsidies of irrigation? Maybe state subsidies of reverse osmosis? But – you know – something that's not agriculture. Now you might ask, "why would you want to do that? Why would you want to get water from a more expensive source than agriculture? – When in fact agriculture is the ultimate reservoir?" I think maybe the answer to that we've heard over and over today is that that reservoir is indeed true –irrigated ag is something other reservoir – but the market price of water paid for transfers from farm to city don't always reflect the true cost of water lost in irrigated ag, for all the reasons we've heard so far. So there is a good likelihood that under a market system, market transfers from ag to cities are grossly underpriced because they're not including all the cost of agriculture. Now is there any institutional mechanism to include that cost? Sort of estimating all those values – that the huge research problem, but maybe simply subsidizing or looking into the cost of reducing backstop technologies, such as – in the case of New Mexico – those are very saline, but very abundant water sources that could be the salted. And I don't know what the backstop technology alternatives are in Colorado, but for example – when we have

serious drought and we don't want anyone to lose their water, very often times someone will drill a well at some hydrologic distance from a river – and voila there is water at least for a while – that will last forever of course. So I would say that preserving irrigated ag land might look at finding the real cost of water taken from agriculture, and you might find it quite a bit higher – opportunity costs – then you would guess. Then look at alternatives for finding sustainable supplies from sources that look really quite expensive right now, but may be renewable and if heavily subsidized and developed in terms of engineering technology might in the long term be quite a bit cheaper than taking it out of irrigated agriculture. Point number two, what advice would you give? It might be a bit presumptuous for me to give too much advice, but certainly in terms of a research agenda – going out and trying to measure those economic, especially marginal, economic values of water in agriculture would be a very productive thing. Marginal values, not just generic – overall values, but values by crop, values by location, values by timeperiod -and then seeing how those values shift around. That would give you some information on the opportunity cost of water taken from ag. And then I think Michael mentioned flexibility of institutions. Maybe finding institution, designing institutions, thinking out of the box – that would avoid taking water out of high valued irrigated agriculture, and doing whatever you can to make sure that it will valued water that you take out of agriculture. I think Bonnie's comments on maybe cutting back on alfalfa cuttings from 5 to 4 to 3 could be a fairly low cost way to take water out of irrigated ag.

So – measuring marginal values by crop by, by use, by location, by timeperiod.

And – finding institutions that seek out and discover those low opportunity cost values.

Tom Binnings: Well – I have to say that in addition to Dr. Colby was left in east for their gentlemen here, I'm incredibly humbled by my lack of knowledge in this arena. I'm much more of a generalist looking at how some of these things apply in different sectors, or what might be borrowed from other sectors. And – so I'm not going to – I think all of the recommendations or comments made here are some invalid. "How do you know if you've successfully preserved agriculture?" I'm going to take a different approach and say – how do you know if you're not successful? To create a juxtaposition there, and as I look out at this – and again I'm not an ag economist – but my greater concern, because I seen it happen in other industries, is not the last of water in the short term, because I think that can be a longer-term phenomenon – my greater concern is by far the demographic shift that you guys mentioned, because that's going to have indefinitely over the next 20 or 30 years. And so I think that's the more compelling issue facing the family farm. And, if not successful at that what you really lose is a knowledge base. So when you lose a knowledge base, a very specialized knowledge base – and my very limited experience in agriculture one thing – it's the riskiest business I've ever seen – and so this is an incredibly specific knowledge base, knowing how to manage that risk, how to finance those – and if you lose that, "what happens when that is lost at the family farm level? Or the small business level, is that there are only two alternatives: the first one is to import, and the second one is to incorporate – to make a major movement towards corporate farming. So – I see that is the more compelling risk in the short term. I think – again – and I was fairly optimistic this morning, and so my approach – I think we need to change the mental model that we use in evaluating water in the state of Colorado, rather than looking at it as a competing interest – looking at it as "how do we collaborate and defend and promote water conservation and growth within the state?" What action should be taken? – You are kind of borrowing

from strategic planning and thinking along those lines. Metrics need to follow the goals. And so – what do you measure is really – what is the goal? If the goal is to protect the family farm, and to maintain family farming, then your goals should center around that. If the overriding goal is to promote long-term food security, then that becomes more important in terms of the metrics that you try to pursue. I do think that – one of the things that has always puzzled me, because I've done a fair amount of work in rural areas over the years – to me, it's such a great quality of life, and a very different level. It's hard work. Different pace, and in many cases it requires multiple sources of income, which is why go back to this notion of leasing. But when we look at the merger or the movement of current technology, I'm always puzzled by – why don't people who are raised in rural areas – I can understand them going to the big city are going to CSU for an education or wherever – but it always surprises me is, "why aren't they returning?" And even if they can't totally support themselves off of ag – or like me the last thing I ever wanted to do was to work hand-in-hand, shoulder to shoulder with my – – so even if that's the issue, you can still go back to that sort of a lifestyle because it seems to have an inherent appeal to me. So I see a broader range of community economic development that doesn't just focus on ag. So for instance high-speed Internet access to rural areas becomes paramount, to where someone can go to work in Lamar and be connected to their family – maybe one day take over the family farm if they choose to do that and Dad is out of the way. And so I think there have to be some new approaches thought in the rural areas and how to preserve the rural lifestyle, and not just agriculture. Other general thoughts I had here – I've already mentioned moving away from a competitive win/loss to a collaborative paradigm – I think that's a very important shift that has to be made. And there's a lot of legitimacy to the environmental story, so I don't want to diminish that at all, but the environmentalists have figured it out. And they are getting their way pretty well in most arenas, and it's not necessarily through politics as much as through the courts in my estimation. So I think that there is a natural joining of efforts between ag and urban, in dealing with that situation – not to eliminate it – but to at least address it and look for greater equitable solutions. The notion of infrastructure development – urban areas needing water and can amortize a high infrastructure development cost or conservation technology costs over a lot of people and in the same process create incentive to conserve urban water, especially for greening lawns. So I think that's an important element. The notion – and I certainly won't like what Dr. Hanemann said – whatever is done has to maintain a high degree of flexibility. And, I also like the notion – and I think this is another trend that we see developing – and my philosophy, because in dealing with problem solving and coming from an economic point of view and moving it into a strategic point of view, my philosophy on these things is – look for point of leverage. So – if you have to create everything, and you change everybody's mind, that's a very difficult thing to do. So you look for point of leverage where you already are in agreement to a large part. So another area where I think the agriculture community is in strong agreement with much of the urban community is in land-use planning and going with denser land-use rather than continuing a sprawl paradigm. Moving into – periurban agriculture – bringing agriculture closer to the urban areas. So whereas the old paradigm – the urban area with sprawl and expand and developers would buy the land and the water rights that went with that – if that becomes, from a land-use policy point of view – looking at that as a periurban ag situation, I think they're a great complements. I've got a tell you, when I look at – these are the kind of things where my wife has lived here her entire life wants to move into more of an Aggie environment – a periurban environment – I

know a handful of young people today who are doing the similar thing and going and working a local farm and they get a share of the produce. So I see these kinds of trends really gaining momentum and can serve as a great leverage point for the ag community.

Gary Barber: last thoughts over here [Dr. Colby and Harry Seely] – reactions to what you heard?

Harry Seely: yes – just a reaction to Tom there. I think one of the points you made sparked a memory that I have about what generates these water markets, what creates competition, what influences water values in particular - water rights? Something to keep in mind in the back in Colorado, most of the cities push the responsibility to acquire water rights to support new development to the developers. And so you have a very broad group of potential buyers out there competing for the same water or other water rights that they can use to support their projects. We seem that model shifts to where the developers - sure they pay their share of the impact fees, but there is a community or a group of municipalities that band together – it sometimes creates a different incentive in the market. So that – you don't see this big run-up in water prices. You don't see it respond to housing prices, like you saw in Nevada, like we saw on the Colorado-Big Thompson market. It provides a little bit more control and opportunities for agriculture to communicate with urban interests and environmental interests to create those sort coalitions to manage water supplies in non-price ways.

Dan Keppen: I was just going to agree with something that Dr. Hanemann said - you know sitting down with a plan at the county level. I know in Oregon, we have - at one point anyways it was considered to be pretty innovative land-use planning, and everything – and then every county has a comprehensive plan – it is a land-use plan that the community has been involved in putting together. So – that mechanism is there, I don't know what it's like in Colorado or some other Western states but that potential is there. And then you know, honestly – we've been skirting around this all day – I mentioned it a little bit in my comments this morning about the Bureau of Reclamation and the assumptions they use in their modeling – they assume that urban needs are going to be met, they assume that environmental needs are going to be met, they assume that power needs or water needs are going to be met, and then they run the model out and it cranks out how many acres and are taken out of production. How come we can do the same thing, and figure out how many people shouldn't be moving to Colorado? Nobody's talking about that.

Gary Barber: [joking] we tried stopping them at the border, but you know – that Kansas thing – it's so open out there.

Dr. Michael Hanemann: Let me come back to the notion of equitable apportionment. Here is a big picture, if you like – or a high level – the way I see things at a very high level. There's only so much water, but there are many different sources of water. Frank talked about the backstop, and at the end you have desalinization, and you have some sort of reuse. So there are – it's not actually that there is a limited source – there is a whole series of possible sources. They're not unlimited, but most importantly, there are different costs. There are cheap sources, and then out there – there are some possibly very expensive sources. But so, you can think of equitable apportionment. You have users, you have the people who own rights. I developed the water rights for Los Angeles 20 years ago, and this is really how I thought of it: the city of Los Angeles owns various water sources - some cheap, local, imported,

Colorado River, there's desalinization. And so the question is, "who is entitled to how much of each source?" So people in old parts of town would say, "we should get the cheap water because 50 years ago, that was the main source – we lived here. If the folks in the San Fernando valley who came after World War II – they should be paying for the expensive water, not us." So these are equity decisions. These are judgments. They're not a matter of technical economic analysis. They're judgments that the community needs to make. And my own view is you allocate the various sources of water among the various groups of users. And then – if somebody wants to use more than that, he or she can but he pays for the expensive new sources that are not online. And so you have an allotment of water from existing sources, and you pay the cost of that. And you can use more, but then you pay for the new sources which are expensive. And on a larger scale that's sort of what happens within a community including within a state. You have property rights, you have restrictions, you have obligations – the state pays for a lot of the infrastructure which governs the streamflow from which you have property rights. So there's some shaping. And then the market takes over. If you want to use the water that you've been allotted, fine. If you want to use more water, fine – you can buy it. And the important thing is the thoughtfulness and the fairness of the sort of allotment. And I would say – times change, societies change – and the notion of a sort of once and for all allotment that just goes on for centuries – to me personally seems wrong. You need some way of revisiting this - with advance notice, and slowly over time. But in that sense there's a community – it has a set of resources and the ultimate issue is apportioning those resources in a thoughtful and fair manner.

Dr. Frank Ward: I was going to say something about a well adjudicated water rights system is what's needed to ensure this kind of flexibility and irrigated agriculture and Michael took the words right out of my mouth. Because, when you have a well adjudicated water right system, you have a set of rules for sharing shortages. You know – "who have to give up how much water under various conditions?" And of course that doctrine has been the doctrine of prior appropriation in the Western US, and has been for many years. I ask my Iraqi friends, "how do they set up adjudicated water rights? Who is first in time, to the first in right in Baghdad?" And they said will we have been doing it for 6000 years and we have no such thing as water rights in Iraq. And so – what it really gets down to – is an impressive decree booklet with priority dates – somewhat dodges the question, because as Michael just said – you almost need a collectively agreed-upon set of principles for defining the water right in the first place, and principles that can change with the times. And, I'm not sure that I've actually found that set of principles yet, and certainly in New Mexico when you have some unadjudicated basins – whenever you have a serious drought, everyone will stand first in line and they will say, "Well look – I have senior water righted acreage, and you can't take my water first – you take somebody else's water." But, when the adjudication is not complete, when the decree booklet is not done, there's no way to falsify anyone's claim of a senior right – they all claim they have a senior right. So I would say adjudication – a stream system adjudication – combined with some mechanism to allow property right principles, if you will, to change with the times. I don't exactly know what that principle should be, since Colorado is probably the leader in the country in defending the prior appropriation system, and may continue to be for some time.

Gary Barber: I would predict that. So, let me just say – Dan that question of the "the equation solved for lost acreage" – was the driver for this conference. And I credit Reeves Brown over there for continuing to bring it up at darn near every Roundtable meeting we've ever had.

Appendix B.1

Text from Breakout Session 1A – Dr. Hanemann and Dr. Ward

What are the future scenarios for agriculture in Colorado, in particular irrigated farming?

Participant. We came up with EPA. My thinking on that is that some of the people that [have been] with the EPA have never been on a farm. They don't know squat about it, but they went to college and got a degree so they're authorities. And then we have new crops. Different crop rotation for the water that you have. Advances in technology – that's ever-changing. Marketing. But that is some of the things we come up with I think that they pretty well all go hand-in-hand. They are all important.

Jim Pokrandt. A future scenario matter what is going to be efficiency. Efficiency has to become part of it. It will both create supply and help improve water quality and deal with things like erosion. All of that will come in at increased capital costs. Then we talked about land preservation as a way to sustain and keep agriculture in agriculture by … however you fund the buying of easements whether it's public or part-public or philanthropic. That's got to be a big part of it. Maybe as irrigated agriculture decreases, the intensity of what remains in irrigation will increase, whether that's the value of crops were more efficient use of water.

Participant. This may be a little redundant, but we talked about greater public support, such as watertight to land with tax credits. We talked about losing water and alternative transfers. We talked about water becoming a "cash crop." We talked about the hope for Super Ditch. We hope it succeeds and has a "snowball effect" around the state. Locally produced and locally grown food for sustainability around the state. And, flexibility in regulatory processes.

John Mackenzie. We talked about more higher-value crops and more "intensive" crops. We talked about drastically less open space, but we do have higher-value crops grown on these different innovations. And, we also talked about more open space – that maybe we could use more existing open space, but more intensively. But, on the other hand, maybe a scenario would be that we take some of the marginal land out of production - most of that soil, or maybe pumping from aquifers and things like that. One of the things we came up with here was – whatever scenario that you think may happen, you really should assess some sort of probability or likelihood of that occurring in the future. I think we need to do our modeling more with that in mind and come up with our scenarios after we've run the model.

Don Ament. Let me say right off the bat, I'm actively involved in the farming business and I think a lot of my city cousins would be shocked at how we've changed farming practices through the years. Nobody's mentioned GPS yet but it's amazing how tractors and combines are now running with GPS unit. If you wonder why now the rows are so straight and why fertilizer companies go through and spread and when they harvest and they don't miss a kernel, it's because of GPS. So I guess the "dumb farmer" has a GPS

and his tractor that will blow your mind. So, why am I telling you all this? Because we've become so much more efficient. When I first started farming with my grandfather – whether it was seed corn or her irrigation practices or whatever – our first crop was 90 bushels/acre and we thought that was really something. Now were looking at 200 bushels/acre and it's amazing – and that's because of irrigation efficiencies. We don't flood irrigated anymore, cutting ditches and so on – we use center pivots. Some of my neighbors are even going to drip, so certainly our irrigation is a lot better.

Next of all, seed genetics – Monsanto and their research – I just happen to use them because it's on the top of my mind – they claim we are going to get up to 300 and 400 bushels/acre. So this is what's going on in genetics.

Tillage practices – we don't till much anymore at all. Most of the stuff we do is no-till, so we change that whole dynamic. About every place you look at the production end of it, we become more and more efficient.

We are having a discussion about what the "baseline" needs to be. The agricultural community is being asked to know "how many acres are available to irrigate?" Well – do you know how many acres there are? The answer is 66 million, statewide, and 3.5 million is irrigated. Okay – so that's our base. I would say – we don't want less. So when we think about that? When people are yakking about agriculture having all the water, where only irrigating 5% of our tillable land. So is that enough? Well depends on what you want to spend for food.

So the whole thing is efficiencies right? Well I want to end up with one thing. The thing we worry about the most- whether it's West Slope or East Slope or San Luis Valley - is agriculture going to be the default for the rest of the municipal and industrial or recreation or endangered species recovery. Is agriculture going to be the DEFAULT for those gaps?

By what metrics should we measure the agricultural and economic sustainability in Colorado?

Jim Pokrandt. In terms of how to measure the sustainability, we talked about the number of operators that might still be in the farm census, the number of acres that might have some perpetual preservation to it. Then we got onto the states 35-acre rule- how that's really "anti-agriculture" or contrary to the sustainability of agriculture. And, the state also has a clustering law and how can "not clustering something" somehow be put on par 35 acre rule.

Jeff Tranel. If you want to keep water and agriculture, make agriculture profitable. So we used two metrics. One is the farmer family income – what are the contributions by the farm business to the family? And secondly – as was discussed this morning and one of the sessions, we need that [knowledge] infrastructure, , so if the next generation is discouraged from farming, it's much more difficult to build back up. So we said that we needed a metric around the number of, or the percentage of, the next generation that returns to the farm. So we have that infrastructure, we have people coming back that are truly tied. It's much more difficult to come from the outside [of farming] and to get in.

John Stulp. It seems like the first would lead to the second. If it's not profitable, it would almost be impossible to get new people or young people to keep farming. But there's three ways to get in the farming – and that's the womb and the tomb and the groom.

John Mackenzie. We first discussed "what are your goals and what are your objectives?" Our discussion centered around who is making these goals in these objectives for you? So once you do that, you decide that you want to come up with some metrics. Some of the ideas that we came up with were whether or not we need interstate compacts, carrying capacity in Colorado, and then also we talked about how you could borrow some of these indices that are done for national income accounting, like GDP – but they used them for things like environmental quality. So, you could look at things like human capital and environmental capital and natural capital. And, it essentially come up with some sort of "index." And then we talked about "who is going to use these metrics?" – I suppose that if a policy-maker is going to use these, they could be somewhat esoteric. They have to be fairly simple. With all these metrics, they have to be transparent and open and can't really be "black boxes." People need access to these metrics, and how the person came up with them.

Other Commentary:

Dr. Frank Ward. This idea of what we are paying for food and, how much more do we want to pay? – could relate to an important mission for irrigated agriculture. When you look worldwide at agriculture's mission, it's really about food security, I suppose. So the question of irrigated land in Colorado – I wonder if someone couldn't do an analysis or an empirical model that would look at how much land, that is irrigated in Colorado, that is needed to put a ceiling on increased food prices? Because food is security is really what agriculture is all about. Farming, crop production – all those are instruments to food security at least worldwide and it is in this country too. So the question of "what it would take, in the face of climate change and other "shocks" to keep a lid on food price increases depending on the food production in Colorado" – would be a very legitimate question.

Dr. Michael Hanemann. So California – maybe 2% of the economy is directly associated with agriculture, and if you include processing and all the other, – that gets up to 8% – but that's still a tiny percent. And so much of what is produced in California is exported, so there is not as strong a high between food security and water for Californians because it's food security for the whole world, but not California. In terms of local food, or in terms of California, I think there is an emerging distinction, if you like, based on "loco-vores." That is - for many of these foods, they can be produced in California or somewhere else in the United States or in some other country where there is a global market, and it's not necessary that it be produced in-state. On the other hand, for other foods – the sort of things you get at a farmers market - of course it's essential that this not be imported from China – the whole point is that it's produced locally, it's distributed locally within a very short time from being harvested. And so, you can imagine this kind of niche market where this locally-produced in high-quality food – it gets a premium, because people are willing to pay the premium – and that something you want to preserve near the urban areas because that's the point of that type of food. So you wind up with sort of a split or a bifurcated food supply and that might be something that makes sense here to [in Colorado] in major areas, such as Denver, Boulder and some of the others. You'd have the same market for distinctive food supply.

The question of "is agriculture the default if you need water for instream flows or for cities or whatever?" – In a sense, yes it is the default because it uses 90% or some large percent of the water. The water supply isn't going to grow appreciably over time, so as we have more uses, it's got to come

from one or another of the existing uses. So, in that sense it's inevitably the default, but a second question is "who pays?" Payments might come from the general taxpayer, or from urban areas. In other words, there is a distinction between 1) where the water comes from and 2) where the money comes from to make it possible for water to move. And that's another conversation which needs take place. And I think an obstacle is that so much land use planning is done at the local level. This squeezes out space from a statewide perspective. As a state, how much open space, what type of open space – dual usage such as farmland and habitat together. Everything is controlled by County zoning, which has an obvious interest in maximizing tax revenues. There is no base for a larger statewide perspective on what the land use should be, but it's the land use that is driving the water. So, this is one of those many places where you really can't plan water without thinking of land. So the challenge is to create a mechanism for a statewide perspective beyond just the local perspective on land-use.

Participant. I'd like to ask Prof. Hanemann a question. A number of years ago a professor at UC-Davis suggested that California should outsource all of its food production to Mexico because the labor costs were so much cheaper and the land prices in California were so valuable that that the use of it for agriculture was just a waste. I don't know if that was meant ironically or if you were serious, but is that something that is discussed?

Dr. Michael Hanemann. Well – knowing it was an economist, I'm not sure that I can expect irony. But, California agriculture has outsourced a lot to Mexico, but also to Chile, so there is this remarkable fact that Chile is the mirror image of California on the other side of the equator. So major farming companies – wineries and grape growing, whatever – have diversified to Chile. As we are learning, there are issues with quality, specifically water quality with some of the imported food from Mexico. That is not the reason to discourage outsourcing, but that is a advantage of not relying on outsourcing completely. And so, I think the economist was perhaps not speaking with full sincerity, but perhaps exaggerating, but this trend towards finding the highest value for land, which is urbanization, and the most profitable locations to produce – of those trends have gone on for a century and will continue. And, I think those trends will also apply in Colorado.

Reeves Brown. It is certainly interesting to hear perspectives that we didn't talk about. More information from our two experts here has been interesting. This sharing part of this has been the biggest learning experience that I have gotten from this meeting. I think the more we talk among ourselves, and actually get individual perspectives – it always refines what we think. So, I always appreciate that more than the one thing.

Brad Wind. How are we going to address agricultural concerns in the Colorado Water Plan?

John Stulp. This is very informative. Alternatives to agricultural water transfers are an important part of the Colorado Water Plan. We wouldn't have gotten an executive order if it hadn't been for concerns within the governor's office about agriculture, and how do we address that, at the same time being respectful of the prior appropriation system. We want vibrant growing cities. We want productive sustainable agriculture. We want a robust recreational economy. And we want to have an environment that is reflective of healthy streams of fisheries. So that's the big order in order to bring all those together, with agricultural water use being one of the major focus of the Colorado Water Plan.

Appendix C

Text from Breakout Session 1B – Harry Seely and Tom Binnings

What are the future scenarios for agriculture in Colorado, in particular irrigated farming?

Mark Smith. We started with – we first have to consider the future of national farm policies and how they affect the agricultural sectors. This includes ethanol production, sugar, dairy, price supporting crops. And then we raised the question of "what crop mix should we be growing?" And so – crop mix can be determined by market forces, such as demand for crops, water availability and the CSU Agricultural Extension should have a role in helping farmers identify and develop appropriate crops. Marginal lands – this is the third point – marginal lands now in production should come out of production. And then we talked about technology for a while – greater efficiency irrigation technology is needed and will probably happen, but there are important legal ramifications of how the conserved water is used. Cases were given that showed improved irrigation efficiency, but increased consumptive use at the same time, so you are not necessarily getting a reduction in consumptive use. In terms of talking about technology, we thought that there was scope for partnerships between municipal and industrial users and irrigators, to get ineffable and industrial users to help finance irrigation improvements, and that water could then be shared. Efficiency rules should not penalize farmers as in the example from the Arkansas Valley.

Participant. Coming from the conversation that the Family Farm Alliance had this morning about the least cost-effective forms of irrigation, our table thought that this was lawns. So our table thought that there has to be some work on conserving water right eliminating or at least reducing the number of logs that are out there, whether that has to be legislative, or some sort of market incentive to do so. But, we think that there is a lot of savings to be had there to protect agriculture or agricultural water in the future. Of course, those kinds of things required education and pretty much every conversation we had was having to do some kind of education. There are a lot of folks that have really no idea what we're talking about here today. Urban schools really need to understand this stuff a lot better.

Participant. We first talked about the challenges related to water as a commodity essentially, and the fact that water goes to the highest bidder, which puts rural communities in a tough position all the time. Also, determining future scenarios, we discussed commodity prices as something that will determine what kind of future we will have with agriculture. Crop prices go up or down, and that change is what people want to do with their water. Increasing urban demand, which is our trend right now – obviously we talked about this this morning, we're all looking for alternatives to "buy and dry," which is itself of course one future scenario. These "buy and dry" scenarios can be with and without re-vegetation, which offers its own set of complications. There is also of course the alternative of getting more creative, and creating opportunities to keep agriculture functioning in rural communities while trying to bridge that demand. We discussed changing urban land use planning to offer greater benefits to agriculture and rural communities - to "build up," so to speak instead of "building out." Additionally, as was mentioned

in some talks morning, changing our whole paradigm of keeping agriculture as the constant variable that would have to change, depending on land use. It should be the other way around.

Cindy Lair. Looking at collaborative water transactions and perpetual agreements between municipal and industrial, tourism, agriculture to achieve some type of a balance in water resources, well keeping the "body" of that right in the current hands, where it is now in agriculture. We have not begun to explore and exploit that a relationship - what we give to the tourism industry through agriculture as diversions. We are lengthening that season so we do have blue-ribbon trout streams. If it weren't for agriculture, those trout streams would not exist. We would not have season-long white-water rafting and things like that. We also talked about oil and gas. What kind of impacts is this industry bringing on for agriculture? It's an opportunity for a lot of producers to be able to sell, or lease water for that use, however the price that oil and gas is willing to pay for that water could inflate the price for entry-level ag water users which could cause problems down the road. It's an issue of finding balance.

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Chris Kraft. I just think that this is such a complicated issue. We all just try to put one number on it. I've been thinking about this a long time – I can't do that. But there are a few. We are talking a lot today about fallowing ground. I think we're talking more about irrigated agriculture, not necessarily ranchland so on. We're talking about where you put water on the ground to grow alfalfa corn and so on. That's what I mostly concerned about. I have a bunch of cows I have to feed. They eat alfalfa and corn, so there is no price [that will work for me]. I cannot follow any ground. I cannot do it. It's not going to happen. So – the following concept is great because I think we have a little bit of extra room in the system, but as soon as our costs go up, there isn't going to be any room in the system, and so the following is not going to be there. Because, the people that are producing the food are going to be doing all that they can with the water and the land they have. So, to me I think we are making a mistake of thinking that we can solve our problem totally by the "buy and dry" concept or the fallowing, to try to prevent that from happening. So I think that we have to look further. I think we have to start thinking really seriously about paying the price looking at "how can we capture more water through efficiencies, through storage through other ways, and look at these other [conservation measures] in expanding urban areas, and trying to be saving water on the side of it?" Because we are already saving water in agriculture. if it can be done. But basically it takes [a certain amount of] water to grow corn crop and that's what it takes to feed the people. I don't see a way around it.

Participant. So we discussed, similarly in line with Table 1, in terms of the economic metrics of measuring net incomes on farms as well as gross sales, but looking directly at the financial output of agriculture in a community. We also discussed the idea of critical mass and how much agricultural land

can be retired or lease through water leasing, without jeopardizing the integrity of that community in the agricultural integrity of the community. This is an issue that will be unique depending on each community. We spent a lot of time discussing this issue of, "at what point would be the tipping point of leasing or selling too much water to bring the agricultural community out of agriculture?" That was a key point.

Participant. We talked about a little bit more on the education side of things. Our number one metric was really trying to educate people about the percentage of disposable income that they spend on food, and how that could change over time. Making sure they really understand how valuable that is to them, especially if you start spending 25% or more of your disposable income on food. Continue to measure acres that are in production, and the value of that production. We also talked about measuring the decrease – over the long period -measuring decrease in the number of "buy and dry" outright purchases of water in exchange for more leases and more of these ATM projects that are coming along. If you saw that slide this morning, in Colorado there are a lot of purchases whereas in California they do more leases, so trying to measure that over time – see if we're actually gaining on keeping water in agriculture in some form.

Chris Kraft. I had a question about that – I think that Colorado has more privately held water in California, by far. So, in California they can't sell it – they have to lease it. To me, that's a salacious number and it doesn't apply to our situation here. I'm very afraid that will make public policy based on not looking "under the hood."

John Salazar. I've always been a strong proponent of keeping water on the land for food production. But when you look at future growth in Colorado, for example along the Front Range, where we will probably be doubling the population by 2040 - water molecules shouldn't be a limiting factor so far as growth. It's how we plan for that. So when we hear people talking about planning for the future, we always talk about "how much water we will need to be available for the growth in the state?" Well – in the space station, they use water molecules many times. As long as it's not use consumptively, water should not be a limiting factor so far as population growth. It's when they start using it on lawns, golf courses, for consumptive use. Right off the bat, if we were to plan and build the next Colorado to where it would grow up [as opposed outward] – immediately when you put people in a 4-plex, you minimize water uses by 76%. And as long as you are willing to invest the technology, the water can be used over and over again.

How will the full irrigation requirements for Colorado agriculture change?

Participant. We had some questions about the question itself, but our discussion led to all the variations in application method and irrigation technology, and how efficiencies improve over time. Comment came up about changing our storage to reduce evaporation. Going from large surface area storage facilities to low service area with the same quantity of water stored. Policy is obviously going to be huge factor too. How irrigation is used on the land and innovation as well.

Mark Smith. We said "full" should mean "optimum" defined in terms of farm income. And then – we finished our conversation with thinking of increasing flexibility in the water system, which would include temporary leases rotational fallowing, fallowing agreements to improve water use.

Cindy Lair. Using the example of the Ogallala aquifer, which is going to change substantially over the next few decades if the neighboring states that use that water resources don't get a handle on conservation and how they will agree to use it collectively – and so that, in the future – if something doesn't change now, that will change irrigated agriculture in Yuma County and Baca County considerably. So I think that is a huge irrigation-dependent ag economy that will suffer tremendously if we don't figure that out.

Other Commentary:

John Salazar. Do we have any reactions to what was said at other tables?

Al Tucker. I've got a question about marginal lands coming out of production. I know in Huerfano County, most of our ag land is marginal and when I heard that, and thinking about the ranch lands where we do cattle grazing. Because that's usually the lowest price of land you can have. I guess I question the wisdom of bringing these marginal lands out of production. So that is my concern, because there is a lot of work in a land that supports a lot of cattle. Some of it is even irrigated. We have dairy farms and we have regular cattle ranches. That's where I had concern because a lot of our agricultural land in southeastern Colorado is for cattle ranching.

Mike Stiehl. I worked for the Division of Wildlife. It was really surprising to me that all the beauty in the state withheld privately. Almost all of it was in cattle. These were the fastest vistas that were just so beautiful to look across and I guess that has value, so we call that "marginal" because it's not a productive use, but I think that the value for the state of Colorado and for being a Coloradoan, having this kind of ranches with its "marginal" value – and by that definition, is probably an unfair definition.

Harry Seely. As far as "marginal" lands and ranchlands, where you can take the water off, or a portion of the water off – you may reduce your herd size and your caring capacity may go down, you may have to supplement feed – but on balance, if you are looking at the place to potentially reallocate water, that is one spot to look. You don't lose your scenic value typically – I mean, there have been high meadows for hundreds of years, and there will be high meadows again. I offered that may be as just a devil's advocate view. I've been on both sides of this. I offered that perspective just to promote discussion.

Tom Binnings. Just a couple comments that struck me. The notion of lawns being the worst use of irrigation. That makes sense, and when you look at what's happening in most urban areas, there is a pretty strong movement, just from pricing as well as rationing, more towards getting rid of urban grasses and lawns. When I look at the future scenarios, I don't buy the future scenario of growing demand for food. As the population grows worldwide and nationwide, then there is going to be growth in demand for food. However, exactly how that will play out is the uncertainty. But I have to assume that – when the ability to supply due to the limited input of water, and when you have limited supply and demand is growing, prices of commodities will tend to go upwards. So when I look at it through 2050, my fundamental belief is that we will see growth in commodity prices, which may make agriculture

more productive from an income point of view. At the very least, we are going to keep leasing to municipal and industrial and were going to keep the paradigm. In more of a short-term phenomenon it can be a great bridge to get there. Although, then you have to deal with the issue of – for urban areas – "do they become overreliant on those leases?" And so that has to be factored in somehow

Dr. Chuck Howe. Well you touched a note again, in terms of the relationship between urban uses to the availability of water for agriculture. And of course, in places like Las Vegas, they have been paying homeowners – paying them per square foot - for taking their irrigated areas out of production (meaning lawns?) There has been increasing amount of discussion about coordinating – I'm thinking of municipalities now – coordinating land-use planning, which has to do with the expansion of the urban areas, with water planning. I know some of us were involved in water planning. You feel a little helpless when you don't really know what direction land-use is going to be moving, so I think there is an opportunity to a greater extent to coordinating urban planning and the availability of currently consumed water in the urban areas for agriculture.

Harry Seely. It's interesting when you look at per capita water use, here in Colorado where we think that 140 gallons per day is pretty good. But – take a look at Australia where 140 Liters per day is pretty good. So clearly on the urban side, there is a lot of conservation and to make do with less as population grows. I think there have been studies out there that have been supporting the fact that, absent even conservation programs, the demographic shift in the US is going to lead to less lawns. Who wants to mow lawns when you are retired? I think some of this will take care of itself, but I think education – conservation programs on both sides – are going to be a critical piece.

Chris Kraft. Don't you think that it is important to talk about this now? If we make public policy, and it takes us in the wrong direction – it can be tough to go back.

John Salazar. The conversation has to change. We have to supplement more water for the growing population, instead of saying that we have [a fixed amount] of water and we're going to accommodate the population with this fixed amount. So – that whole conversation and mindset has to change in my opinion.

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Participant. We had some questions about the question itself, but our discussion led to all the variations in application method and irrigation technology, and how efficiencies improve over time. Comment came up about changing our storage to reduce evaporation. Going from large surface area storage facilities to low service area with the same quantity of water stored. Policy is obviously going to be huge factor too. How irrigation is used on the land and innovation as well.

Mark Smith. We said "full" should mean "optimum" defined in terms of farm income. And then – we finished our conversation with thinking of increasing flexibility in the water system, which would include temporary leases rotational fallowing, fallowing agreements to improve water use.

Cindy Lair. Using the example of the Ogallala aquifer, which is going to change substantially over the next few decades if the neighboring states that use that water resources don't get a handle on conservation and how they will agree to use it collectively – and so that, in the future – if something doesn't change now, that will change irrigated agriculture in Yuma County and Baca County considerably. So I think that is a huge irrigation-dependent ag economy that will suffer tremendously if we don't figure that out.

Other Commentary:

John Salazar. Do we have any reactions to what was said at other tables?

Al Tucker. I've got a question about marginal lands coming out of production. I know in Huerfano County, most of our ag land is marginal and when I heard that, and thinking about the ranch lands where we do cattle grazing. Because that's usually the lowest price of land you can have. I guess I question the wisdom of bringing these marginal lands out of production. So that is my concern, because there is a lot of work in a land that supports a lot of cattle. Some of it is even irrigated. We have dairy farms and we have regular cattle ranches. That's where I had concern because a lot of our agricultural land in southeastern Colorado is for cattle ranching.

Mike Stiehl. I worked for the Division of Wildlife. It was really surprising to me that all the beauty in the state withheld privately. Almost all of it was in cattle. These were the fastest vistas that were just so beautiful to look across and I guess that has value, so we call that "marginal" because it's not a productive use, but I think that the value for the state of Colorado and for being a Coloradoan, having this kind of ranches with its "marginal" value – and by that definition, is probably an unfair definition.

Harry Seely. As far as "marginal" lands and ranchlands, where you can take the water off, or a portion of the water off – you may reduce your herd size and your caring capacity may go down, you may have to supplement feed – but on balance, if you are looking at the place to potentially reallocate water, that is one spot to look. You don't lose your scenic value typically – I mean, there have been high meadows for hundreds of years, and there will be high meadows again. I offered that may be as just a devil's advocate view. I've been on both sides of this. I offered that perspective just to promote discussion.

Tom Binnings. Just a couple comments that struck me. The notion of lawns being the worst use of irrigation. That makes sense, and when you look at what's happening in most urban areas, there is a pretty strong movement, just from pricing as well as rationing, more towards getting rid of urban grasses and lawns. When I look at the future scenarios, I don't buy the future scenario of growing demand for food. As the population grows worldwide and nationwide, then there is going to be growth in demand for food. However, exactly how that will play out is the uncertainty. But I have to assume that – when the ability to supply due to the limited input of water, and when you have limited supply and demand is growing, prices of commodities will tend to go upwards. So when I look at it through 2050, my fundamental belief is that we will see growth in commodity prices, which may make agriculture more productive from an income point of view. At the very least, we are going to keep leasing to municipal and industrial and were going to keep the paradigm. In more of a short-term phenomenon it can be a great bridge to get there. Although, then you have to deal with the issue of – for urban areas – "do they become overreliant on those leases?" And so that has to be factored in somehow

Dr. Chuck Howe. Well you touched a note again, in terms of the relationship between urban uses to the availability of water for agriculture. And of course, in places like Las Vegas, they have been paying homeowners – paying them per square foot - for taking their irrigated areas out of production (meaning lawns?) There has been increasing amount of discussion about coordinating – I'm thinking of municipalities now – coordinating land-use planning, which has to do with the expansion of the urban areas, with water planning. I know some of us were involved in water planning. You feel a little helpless when you don't really know what direction land-use is going to be moving, so I think there is an opportunity to a greater extent to coordinating urban planning and the availability of currently consumed water in the urban areas for agriculture.

Harry Seely. It's interesting when you look at per capita water use, here in Colorado where we think that 140 gallons per day is pretty good. But – take a look at Australia where 140 Liters per day is pretty good. So clearly on the urban side, there is a lot of conservation and to make do with less as population grows. I think there have been studies out there that have been supporting the fact that, absent even conservation programs, the demographic shift in the US is going to lead to less lawns. Who wants to

mow lawns when you are retired? I think some of this will take care of itself, but I think education – conservation programs on both sides – are going to be a critical piece.

Chris Kraft. Don't you think that it is important to talk about this now? If we make public policy, and it takes us in the wrong direction – it can be tough to go back.

John Salazar. The conversation has to change. We have to supplement more water for the growing population, instead of saying that we have [a fixed amount] of water and we're going to accommodate the population with this fixed amount. So – that whole conversation and mindset has to change in my opinion.

Appendix D

Text from Breakout Session 1C – Dr. Colby and Dan Keppen

What are the future scenarios for agriculture in Colorado, in particular irrigated farming?

Joel Schneekloth: Fewer people involved in production agriculture. This is what we've seen over the decades – it's what's been happening and what will continue to happen. Higher prices may affect some of these trends, as younger people will want to remain in production agriculture. We will also be dealing with less water and more competition in the future for that water.

Jacob Bornstein: We've heard a lot of anecdotal evidence about agricultural producers moving out of state to Kansas or other places, and so one scenario would be that – either agriculture moves out of the state, or elsewhere in the state. So that would be one potential – is that a lot of that [agriculture] goes away essentially. Another one would be that the nature of agriculture in Colorado changes, so instead of producing what we've currently been producing, the crops change. We didn't get into too many specifics, but there was some talk about "higher value crops" – maybe cooler weather crops, etc. And then the third scenario would be that agriculture retains its viability, and there was a lot of discussion about how this could only happen if there was some alternative. Again, I'm not plugging the state, but the suggestion was that this date would need to get involved in finding a role to help incentivize these alternatives for agriculture in order for it to be maintained.

Craig Godbout: We looked at one scenario and that was the expansion of irrigated agriculture in Colorado due to several factors. One [factor] would be improvements in technology, such as conveyance system improvement or irrigation improvements, say – going to drip irrigation for crops that are suitable for that. Another [factor] was possibly changes in our land-use patterns or perhaps cropping patterns – going from open agriculture possibly to greenhouse production so we could get two or three growing seasons per year. That would also mean changing the type of crops that we grow. Instead of sugar beets, we'd be growing tomatoes. I'm a firm believer in technology. I think we can really achieve a lot of improvements through technological advances, and we don't know what is going to come down the pike – we don't know. Hydraulic fracturing is an example – we thought we were going to have an oil shortage, but now we have a new way to access energy. So who knows what technological advances are going to occur in irrigation? We also discussed switching the type of crops, the type of agricultural products -going from commodities to "high-end niche products" through changing preferences, and the developing world, China and India. As an example, in China they eat a lot more beef than they used to. One example was the increase in land production, so we switch our resources into producing those kinds of "high-end crops." Another possibility was worldwide increase in demand for all commodities, due to population increases. One of the figures I heard was we were going to have to grow more food over the next 50 years than we have in all of human history to accommodate the population projections worldwide. So, for any commodity that demand is going to increase and raise the price, so possibly than agriculture could compete on an acre foot basis with municipal and industrial, so we be keeping more water and agriculture.

Aaron Citron (sp?): We figured the most likely scenario is a continuation of the status quo. A steady slow decline and a consolidation of irrigated acres – not necessarily of production as was said before – but that conversation focused a lot on the potential for changing perceptions and maybe education that could lead to a broader public understanding of the need for more food, or all those other benefits, whether you call them ecosystem services benefits, or amenities that agriculture provides. So – I think we were optimistic that the status quo is likely, but we're seeing some positive progress in the last few years in people starting to recognize that agriculture – just because they use the most water, doesn't mean that they are out there wasting water. They actually provide more benefits than [most of the public] recognizes. The opposite could also happen – and there could be a new oil rush on water, and we could focus much more on that need, and worry about food later.

By what metrics should we measure the agricultural and economic sustainability in Colorado?

Joel Schneekloth: For the metrics, we looked at production per irrigated acre, production per unit of water diverted or pumped, and the other thing we have to look at is as population increases, what is the production per unit of population in the state? Looking at – we have to feed people, we have to keep that production at a steady or increasing rate to either keep them fed, or keep other people fed through exports.

Jacob Bornstein: We discussed cost and productivity.

Craig Godbout: We briefly discussed unemployment figures. One of the metrics that would indicate an improvement in agricultural production would be an increase in the number of people involved in agriculture. On the flipside of that, we don't want to witness the demise of the family farm, which might be a result of switching over to more large-scale industrialized farming. So, we might actually have a reduction in people employed in agriculture, but still an increase in agricultural production.

Jack Flobek: With all these people living here, and all being happy in farming – it would put such a strain on the Colorado River, the Rio Grande, the Arkansas – everyone might not be so happy in Texas and Kansas and Utah and Arizona and California, and unless we renegotiated the compact and dealt with salinity contents, we might not have enough water to do all this.

Aaron Citron (sp?): Continuing soil health might be a worthwhile metric. That is something that we will need to pay attention to in the future, and if we dry up land or switch to monocultures, we might have some issues down the line if we realize that we really do have to grow a lot more food. It would be unwise to sacrifice all that soil capacity that we have developed over the last generations. And, I'm not sure if this is a metric, but we also did discuss like a lot of the other groups - talk about the likely transition to "higher value and lower water use" crops, primarily vegetables. It may be at least economically desirable.

How will the full irrigation requirements for Colorado agriculture change?

Joel Schneekloth: Being the researcher that I am, and knowing what has changed over the past 30 years in crop water use requirements, we looked at more of what water law says in terms of consumptive use, because that's the way Colorado water law looks at things – there will be no changes in full ET and crop water requirements over the future. Unless, you want to look at climate change. Because in 30 years

we've never increased ET needs – we've just increased production per unit of ET over 30 years, by improved management and improved genetics.

Dr. Bonnie Colby: I will just put in a word for the attention to the effects of increased temperature on crop consumptive use. In Arizona we've been doing some fieldwork with that work, and we're definitely concerned. Of course Arizona is already an experiment in crop production under extreme temperatures. We are actually bringing in varieties from hotter parts of the world, to see how those do in the states and in our deserts.

Joel Schneekloth: We've seen over the last 20 years – ET rates pretty much holding steady other than one year. This was last year [2012]. Last year was a record because of the heat we had.

Dan Keppen: When you say "production per unit population," were you just looking at this from a statewide perspective?

Joel Schneekloth: I think for irrigated agriculture, you're going to have to look at that statewide. Because irrigated, dryland, cattle production and livestock – it's all integrated in Weld together. One can't live without the other.

Jacob Bornstein: I think that this really does relate to scenarios, and were not really talking about scenarios from a technical point of view in the room today, but climate change – we certainly have done studies. We can see just on the West Slope, irrigated agricultural [consumptive use] increases - if [all production] stays the same - by half-a-million acre-feet just from increased temperatures. We haven't done the study on the South Platte, or the Arkansas or the north or south flows. We do know that just the urbanization and other issues – that the amount of the irrigated acres will likely decline, so there was a discussion about a decrease in irrigation requirements, maybe not statewide, but it does seem – in terms of the amount of productivity per acre foot, with new technology and all that – there will probably be a decrease in irrigation requirements, on an acre by acre basis.

Robert Sakata: When you are talking about "high-value crops," what sort of crops are you thinking of?

Betty Konarski: I think I have a little bit more faith and farmers than some of you people do. You were all sugar beet farmers when I first came here, and I don't know too many sugarbeet farmers anymore. People are adjusting to the economies that are out there. In Oregon, we have all these little "truck farms" where somebody will bring their nice little vegetables to the restaurants. Those crops require a major city to be near you to be able to do that. I think farmers have to stop looking at alfalfa, and start looking at something else. I think they will.

Aaron Citron (sp?): We didn't directly answer this question, but – there is no "silver bullet" to meeting the full irrigation requirements, but agriculture as an industry, in fact the whole history of agriculture, involves increasing productivity per drop of water, and that is going to continue through some combination of technology. We talked a little bit about self-regulation, and recognizing at least in certain basins – for one all this is very spatial – if you're depending on a more renewable surface-water driven system versus a groundwater systems, your time horizon for your planning is going to be very different and making sure we have water resources for a new generation to take over is going to be critical. This might mean changing some of our practices in the short term to make sure that this will continue.

***Other Commentary*:**

Robert Sakata: In reality all give you my perspective on [”high-value crops”] and why my farm is gradually going to be getting out of vegetables. It’s because vegetables are so much different than grain crops, and the sense that appearance and standards are so much more restrictive. They are a lot less tolerant to deficit irrigation. So, for example like sweetcorn which we grow, the consumer will not buy an ear of corn that is less than 6 inches. They will not buy a corn that might have a dry tip on the end. They will not buy an ear of corn where the husk is brown on the outside, so if we miss an irrigation with sweetcorn, we’ve lost the whole crop. It’s not a loss in tonnage – it’s not a percentage loss - we’ve lost the whole crop. And the other thing about vegetable production, or even any “high-value crop” is you have to remember that the inputs are also very high, and so your potential losses that much greater as well so you have to really make sure that you have a secure water supply because of black issue. And so I like the idea about education, because as I was walking around I heard a lot of good things, and I hope that we continue conversations like that to learn about the different issues that are arising.

Participant: Are your vegetables grown organically? Because what I’m finding is that when you go to the farmers market, for myself – I work in Golden and I live in Littleton - and when they go to farmers market, they expected to be less perfect, they wanted to be less perfect, because they think it’s healthier for me. It doesn’t “shine” like it does in the grocery store, it might have a little dirt on it.

Robert Sakata: I would agree. There’s other countries that generally have that philosophy. They like to see a warm on it, because if a warm is going to eat it, that means it’s good. But, for the majority of consumers, if you go to the major grocery chains, or the major suppliers, they won’t accept those types of standards.

Dr. Bonnie Colby: We have a lot of vegetable production in Arizona, and we sometimes think that the way agriculture will do better there is more acres of the specialty crops – the lettuces, the carrots, onions, avocados, etc. – because their return for acre foot of water in an average year is great. It’s something like 10 times that of grain crops. But, the variation in the returns is huge, so the risk factor is so much higher and farmers have to the financial structure that can deal with years where they lose it all, as [Robert Sakata] just explained. So [in Arizona] we’ve kind of given up on anticipating a lot more of expansion in the “high-value crops.” And, they have market windows. If you don’t get your lettuce to the market right when the window is for your region, the value falls 50% or 100% and you wind up with a loss instead of a profit.

Participant: To me this just raises a question – can a farmer mix their crops? Can they try combination of something more traditional, like alfalfa, but not use water for the second and third cutting on a more “high-value crop”?

Robert Sakata: That is part of our adaptive management. We grow less vegetables now. We’re growing less acres of vegetables. There’s also the issue of who the buyer is. It used to be that we had a buyer in Denver, but now we have to deal with some office in California or Arizona. They can’t afford to jump through a lot of different farmers all the time to buy their products so if you are not able to provide them a consistent supply, they are going to find somebody that can.

John Weiner: Why can't we get away from year-to-year financing for this unbelievably important part of all human futures, the health of agriculture? Why is that always on an annual, short-term variable interest rate, take it or leave it basis, compared to anything else of any critical importance in infrastructure? What's wrong with this picture? Why can't we do better?

Participant: [question to Robert Sakata] Would you address what you have to go through in your GAP regulations, and also your safety audits, because I don't think most people, when they think about - you know, "high-value crops" – let's raise vegetables – that's the panacea. Give them the reality of that.

Robert Sakata: Vegetable production in Colorado – of course we have a four-week window over harvesting, so we have issues with finding enough help. Our food safety is such a critical concern, you know we had the cantaloupe issue, and there's a lot more scrutiny. So we had to have a third-party auditor come in, and so for this eight week period, this audit itself cost $12,000 to have. So there's a wide range of issues. For example, the auditor came out and she saw raccoon tracks in one of our cornfields along the bottom of the field. So – our score went down because she saw raccoon tracks. Keep in mind that this auditing scheme comes from Europe. We also had to show what we are doing to enhance wildlife.

Participant: What is the role of crop insurance, both at the federal level and perhaps even at a private market level? Do you all see that as having some hand in the economic sustainability over the long term?

Dr. Bonnie Colby: We have a very active Federal crop insurance program. It's available in differential amounts to different kinds of crops. The specialty crops, in general – vineyards, fruits, vegetables don't share in the same kind of programs that the large grain crops do, primarily because the Midwest is really big on the grains and we share in their lobbying programs that really supports certain kinds of producers and not others. So crop insurance is incredibly important, but it's not equally accessible to different kinds of operations.

Dan Keppen: There are no programs for livestock too. Livestock insurance really needs to be reinstated. You all probably know that there is an effort underway to try to tie crop insurance eligibility to conservation measures, right now, which people have differing views about.

Dr. Bonnie Colby: We were also talking about the paperwork involved in all these programs. [Farmers] are already busy trying to run the farm, and then it just gets more complex with every Farm Bill.

Dan Keppen: It could actually get more complex, especially with the produce industry, the FDA has these proposed water quality regulations, and the rulemaking comment period for that ends in about a month, but it's got a lot of folks very concerned.

Participant: I know for the growers in my area – I'm from the northeast part of Colorado – they are really interested in seeing some insurance coverage for deficit irrigation, because in our area that's where we're headed to elongate irrigated agriculture in our area, so if we could get some assistance for deficit irrigation, that would be very beneficial.

Dan Keppen: We are talking a lot about moving away from permanent acquisitions of water, and more towards these lease programs with incentives. What kind of incentives are we talking about?

Lisa: The idea being, in terms of incentivizing – I was actually referring to incentivizing the other side of the market. What we've created is especially in the Front Range, is an economy where people can't afford not to sell their water and not to sell the land. Pretty soon there's going to be a corridor of homes going from Fort Collins to Greeley, North and East. Economically, it simply doesn't make sense for many of these people, many of whom are some of the most awesome business people I've ever worked with – it doesn't make sense. So, what we were kind of talking about his incentivizing the other side of the market. How could you incentivize the urban or municipal demand such that it's not available at such a ready [comer] to the buying market? One of the ideas that we were talking about is – using the state and state funding as a rule to actually create regional, joint facilities that could be used by both municipal and agricultural interests, and actually spread the water out more efficiently, and administer it, such that water is not such a heavy burden to the agricultural industry, and perhaps the burden of some of it on the urban side is flattened. So – I don't know if that's an incentivization program, a subsidy, or simply the state taking on the role. I think that we are dancing around at the Roundtables - these roles or advocacy for projects - and I think that this is an excellent example of an alternative to an ag transfer being a state project.

Jacob Bornstein: One of the other things that we do talk about at the state level is – creating another option. So, right now it's sort of: either you stay on the farm, or you sell it to [another entity] for a permanent agricultural transfer. So, the question is, "do we have a viable alternative – something else?" Dr. Colby, you talked about some of the alternatives that are out there with CWCBs alternative transfer methods program, so we're working on finding those viable other options, and that's still tricky, and there's still in the pilot phases, and so until those take hold in a market type of way, we have to keep trying to incentivize those, to make those real opportunities.

Lisa: In the water court, administration and efficiency, it does go towards the redefinition of the water court process, and the redefinition of the role of the State Engineer.

Aaron Citon: We're doing a really good job at identifying the tools that we can use for alternative agricultural transfers – something that I've always thought is difficult to get in those shorter-term transfers – you know long-term transfers, you can demand an extremely high value for your water, but the inherent value of water is not – the economist can probably tell me I'm wrong, but you can't demand is much for a short-term lease of your water, so being able to capture a larger value for a short-term use, because you're still providing – it's not just water for a city, but because of all the other values – we talked about this morning in agricultural water that your giving up. Tools are great, but figuring out how to incentivize agriculture to participate in those programs and be compensated for what they are foregoing or what the benefits they provide is difficult.

Dr. Bonnie Colby: It's a great idea to think about urban demand, and what might flatten it a bit and take some of the pressure off agriculture. Of course, economists love the water rates that really reflect the cost of the different blocks of water used in urban areas. Colorado cities have had to become really cognizant of that, but you could push on that a little if you wanted to – the rate structures and the

programs within cities, because there is still a lot of what we now call “demand management” but it’s basically just urban water conservation.

Appendix E

Text from Breakout Session 2A – Dan Keppen and Harry Seely

By what justification or rationale should policy measures have a role in the free-market transfer of water rights?

What central message needs to be conveyed regarding the value of ag water?

Sean Chambers: Specifically, the central message that needs to be conveyed regarding the value of agricultural water in Colorado – our table discussed a lot of different values and advantages, and the things that we thought were really critical to communicate our – this idea of food security that seems to be a little bit lost on the general public and then the basic necessity of food production, as a function of society. And then moving on to some more softer benefits, such as the open space that is created with agriculture, and helping the folks that we want to communicate to understand that this is a byproduct of agriculture, but it doesn't "just happen." Wildlife habitat – non-consumptive needs in both recreational and environmental areas where – as one group member said, "the water that you play on, whether you're in the snow or with your fishing pole, ends up as water that produces food." So – we have these dual uses of nonconsumptive recreational and environmental types of uses. Economic production, just in its inherent value in itself that it produces an economic benefit. And then tied to that was the diverse, stable economic base and revenue generator for communities.

Ginger Davidson: We discussed the indirect values of water in agriculture, but we also discussed the effects of losing the water from agriculture and how it has ripple effects throughout communities. Even if that's outside of agriculture, less money in that economy will directly affect things outside of agriculture like your places to eat. So, losing the water off the land and losing that agricultural land has ripple effects. It threatens that way of life that is also part of that community and the values that are held there. Then it has the indirect value for the public through rivers and lakes and streams and riparian areas for recreational and environmental and geographically – the open space.

Matt Lindberger: We talked about the need to educate folks from urban areas about the connection with what goes on at a farming operation, and then how water helps to preserve that. Some actions could boil right down, succinctly to bumper stickers that need to be issued to everyone that say "No Farm, No Food."

Don Ament: Certainly food security is something that we all accept as outstanding, but people take food for granted, so I think an important thing that was brought up at this table was some of the aesthetic things, you know – "Why do you like to live in Colorado? Do you like green, or mountains, or streams, or the recreation that goes with it?" You can take that farther like the other tables have mentioned – certainly an Endangered Species requirement that's kind of new for us. Recreation has always been a big

thing. It's interesting how you see recreation change – we as water users at the end of the river always thought it was pretty cool, because you can recreate on snow, and when it melts, it goes into a river – you get to fish on that. It goes into storage – you get the play on that. It seems like we get to play on it all the time. What we get upset with is when you try to divert it from returning to the river, and like somebody set over here that water your fishing on and skiing on and playing on – is the water that going to grow your meal in the evening. So I wanted to get that whole thing in about your whole attitude about seeing water put to beneficial use, like the open spaces, the soccer fields, golf courses – you name it – you see it all the time – and those things may be are impacting your view more than the thought that this [agricultural water] is growing food for us.

Jack: We came up with – food security, but how do we keep the water in agriculture?

Dan Keppen: One thing I didn't hear anybody bring up just now was something I see resonate when I talked to folks – and that is the role of the young farmers and new farmers - if you tie that into the message somehow as well. And then not only are we in danger of losing chunks of agriculture, but it's communities around agriculture. Talking about Jason Peltier, he prays at his dinner table, "God bless farmers and the communities they build." A lot of these rural communities are impacted disproportionately. We are in danger of losing that rural way of life, which our country was founded on.

Harry Seely: The one thing that I see missing in the communities where I'm from is a message where agriculture is a partner with environmental groups, with municipal groups – is there a way to create some coalition that will build momentum that can help maintain agriculture going forward? I think these coalitions are important as well.

Dan Keppen: Yes – there is a coalition. And it's got momentum. And it's got great potential – it's called the Western Agriculture Conservation Coalition, and [the Family Farm Alliance] is part of it. Trout Unlimited is part of it. The Nature Conservancy is part of it. The Environmental Defense Fund is part of it. Wyoming Sod Growers. California Farm Bureau. There are about 12 or 13 of us, and we focus specifically on advocating for a conservation title in the Farm Bill that helps farmers and helps the environment. That's where we're starting and I think there is potential to do more good things there.

Jeff Tranel: I remember some of the first meetings of the Arkansas Roundtable, in the Convention Center, in that room. You saw agricultural people, and you saw the "bird people" and there was initial hesitation, but it's evolved. Have there been squabbles, and fights? Absolutely. But at least they're in the same room talking. And, it's been refreshing as an outsider from a university perspective and probably much better from the perspective of someone on the inside.

Who should convey this message, and to whom?

Matt Lindberg: We talked quite a bit about agriculture, and who better to tell agriculture's story than agriculture themselves? There was little bit of commentary that that might appear self-serving, but

agriculture is a great spokesperson for their own interests certainly. Schools were brought up – and educating our young folks – getting them out on the farm – letting them know what goes on outside of city boundaries. Municipalities – maybe talking to their own constituents. There was an idea that maybe they move the state fair around from place to place to generate an educational exercise.

John Mackenzie: We had Earth Day in 1969, and since then people have started to recycle a lot. And, look at the local food movement with organic farmers, and markets – the people that were doing that in the 60s and 70s – it was kind of a counterculture movement – and now that is mainstream. Recycling is, and so is organics, and farmers markets, and local food, and security. And I was thinking about, "why is that so?" My hypothesis is that we've done a good job indoctrinating our kids in school. So – I think through the educational system of grade school and junior high and high school, I think we've stressed a lot of these issues. They go home and tell her mom and dad – you should recycle, you should eat organic food, you should not take water from farms. But, there is a lag time. If we started now with this messaging, maybe we would see the results in 20 or 30 years.

Dennis Hisey: I think so far as who's going to take the message we can probably do something like the "Hugging a Hunter" or "Hug a Fisherman" campaign that you see on TV. So, you go to the green space people, who really appreciate the green space and play off that. It would have to be "Hug a Farmer" but I think you go to the groups that appreciate what they bring, or get a benefit from it. They may not know that they are benefiting, but they are the target audience.

Jack: I think we need to start with the kids in school. Most of us older folks, we were on the farm working in driving a tractor, or whatever you know when we were six, seven, or eight years old. But now – I don't know but I don't think the government will even let them work until 16 or 18, and by then they have their minds set up that they are going to do [other things]. So, I think that we need to educate the government that the farmers teach their kids how to drive a tractor and irrigate and whatever else you do. So I think it begins with education, in the school and on the farm.

Sean Chambers: We talk a lot more about how do you effectuate I guess "range in education" – and so communicating more quickly to elected officials and focusing on elected officials and a lot of different roles at different levels of government. So we talked about everything from our city councils, county commissioners, town councils to state government and then on up to federal advocacy. I mean we heard this morning – Dan talk about empowering the Bureau of Reclamation for storage projects. We saw a more immediate change out of communicating the value of agriculture to all those people and making sure our elected officials have a clear understanding of what those values and benefits and agriculture are.

Dan Keppen: Based on what I saw yesterday, Peyton Manning is your guy. [Laughter]

This message should be conveyed with what specific goals in mind?

Matt Lindberg: We talked about water management and how were going to provide water for the next 5 million people that moved to Colorado. What are some of the trade-offs in how we provide that additional supply? What's our stomach for additional transfers from agriculture? What are our other options out there, and how then does policy guide that?

Don Ament: I haven't heard too much about good science. People have been yakking about "what is the definition of good science?" But, and I think when we're talking about a message and what should this message say and with what goals in mind? – I think we really need to talk about the role of good science in all this. Because, honestly it's good for us to take political positions and emotional positions and so on, but I think you need a little bit of good science. That's why at the legislature, we used to always invite CSU to come in there as a "disinterested third party" and give us some good science. Ducks Unlimited has done a really remarkable thing, especially where they have actually built duck ponds to get that surface water out there, and then because they were storing a lot of that water, there was obviously some return flows, some recharge going on and then they gave that recharge back to the farmers who needed augmentation credits. So – there is another very good example of how you – and that conveyed the message to all the "duck guys" right away – "Hey, we can get involved in this stuff" so, the point I really wanted to make was – I'm back to Dan Keppen and we asked him that question at our table on all this about coalitions and so on – and you need them to help tell the story. Ideally, in a representative type of government, legislators like to get elected so they answer to the people, we hope, and consequently you would get the message across, as it comes to the policy part, that we need agriculture.

Sean Chambers: We look to the first question, and a discussion evolved about how the free- market would make decisions that wouldn't impair a farmer's private property rights and we had some discussion that at least centered heavily around the private property rights. And so when we went back and answered Question 4, we said the preservation of ag values which were all those direct ag values, community economic values, nonconsumptive values… So, we said the preservation of all those values in a way that doesn't impair and irrigator or farmer's private property rights, and we don't know what the answer to that is – it's a difficult question obviously – but we thought that was an important goal – was to preserve all those values without the impairment of private property rights. And I was just going to add on to the groups discussion, but I think good science is the huge piece of that, and we heard that in the second session this morning that Idaho and other places are finding ways to do real-time science that benefits decision-makers. So I think that's part of the answer.

Reeves Brown: We in the Arkansas Valley have wrestled with – when beef production went down the tube, and farmers weren't making any money, and down came the big dollars [from the municipalities], and farmers had a right to sell that water, and a lot of them did – and now I wish they hadn't, or a lot of communities [wish they hadn't]. What do you do to prevent that short-term gain, which ends up as a long-term negative effect? I really don't like to deal with this Public Trust Doctrine either, but this is a real issue – in how a short-term gain for individuals [that results in a long-term damage, can be ameliorated]? I wonder if there any answers to that.

Jeff Tranel: A point to be made about farming. Production agriculture, by its very design, is meant to have zero profits. Think about it. As the free market system, we produce commodities – now this is generally, the same farmers can vary – but generally speaking, as farming becomes more profitable, what we do? We pay more for land, or equipment – we get bigger. That's when the technology comes in. We buy more land, and land prices go up. Land rents go up. So, then it drives that marginal profit closer to zero across the board. Now, again - individual farmers can vary from that, and they do. We have some who make money, and some who lose money. So, it's a matter of how do we make farming profitable? We can't in a free market system, by its very nature. But, we can do other things. We can change regulations. We can change succession planning and estate planning.

Joe Frank: *[Responding to Reeves Brown's question],* strictly from a water standpoint, we talked about, obviously a little bit about the free market – not, of course getting involved to where you're impacting someone else's private property rights – but the incentives to provide options. We talked about the leasing, the ability to provide incentives for leasing water instead of selling water, for the farmer. He talked about the options for the end-user [cities] to have other options to supply water, storage projects, infrastructure. Also, conservation easements are a perpetual ability to keep farmers on the land. Obviously it's voluntary, but you have to have those incentives. You have to have those dollars available to put into the pot, so that conservation easements can be done. So I think those incentives are alternatives to "buy and dry" both on the farmers end of things, and on the water supplier end of things. These are alternatives to the free market – you know taking its own path – but it doesn't interfere with the free market. These are not ways of regulating the free-market ability on a willing buyer and willing seller basis.

Dan Keppen: Somebody brought up the issue of inheritance, and finding ways through changing the laws or incentives to address that, so maybe the person who raised this point could just reiterate it? You had a good discussion about that.

Participant: This is just my take on things – a West Slope perspective – all of my friends that are in agriculture have a median age of about 65. And, I've seen very few instances where there has been a successful transfer from one generation to the next, for a variety of reasons. There is more kids – so you can't just give it to one, and have the other three kids not get anything. That doesn't work – you don't have any other assets that you can give to them. You might not have any kids who are interested. So, we need incentives to avoid "buy and dry." I think the incentive is to have temporary arrangements where there is fallowing or whatever and not permanent transfers of water from ag. And, realistically if you are 65 years of age, you can't pass this down to one person in your family who's going to operate it – it's going to get divided up and it's going to get sold if your family isn't interested in operating it. And those folks – the next generation – they're not going to be interested in temporary arrangements with water, because they're not going to be there operating it. I think that's a huge impediment to avoiding "buy and dry" and so you need mechanisms in place so that it can be passed down to avoid inheritance taxes. I don't know what other incentives you could provide with it, but I think we need to be looking at

incentives that have allowed farms and ranches to be passed down generation to generation, because I think right now – for the next 10 years, these people who are 65 years of age – they are going to be needing to be doing something with that property. I think we are at a critical time. I think things will really change in the next 10 years if incentives are not put in place.

Jeff Tranel: Only 58% of Americans have wills. We've talked about a message to school kids and others. Are we talking to our own children? I've pulled many farmers, and those that have been in attendance and have participated in workshops that CSU Extension has done on this issue – the majority of them do not talk to their own families about succession. So, if we can't talk to our own children, how are we going to talk to someone else? And it's not – I'm only giving it to one kid – they don't want to talk about giving it to anyone. Sometimes there is a fear, that if I talk about it, it means I'm going to die. We need to talk to our own children first, or nieces and nephews. But, were not having those conversations. And – maybe that's our segue into the schools? Even in rural schools, many of those kids have never been on a farm. In Lamar, Colorado – maybe 8000 people – farms surrounded them – and those kids have never been on a farm. We've got a spread this message somehow.

Harry Seely: I am just struck by the fact that – and this isn't unique to Colorado or even this part of Colorado, but – agriculture controlled the vast majority of water through water rights, or contracts, or whatever it may be. You have stewarded that water for over 100 years. Times are always changing, right? So, don't be afraid of having the conversation about change, and having it affect things as they once were, because it's going to happen. You will be better off if you can come together as a group, and figure out how that change can occur in a way that maintains the type of lifestyle and communities that you are hoping to maintain.

Dan Keppen: One of the tenets of the Family Farm Alliance is that the best solutions come from the local and the state level, and anyway the federal government can support those efforts – that's good for us. But, that doesn't seem to be happening right now at least in other parts of the West.

Participant: One of the things we didn't talk about, is how to decrease the competition from urban areas for agricultural water. And, we are the only state out of 50 states that doesn't allow rainwater collecting, and we have passed a graywater bill so as soon as our County Commissioners and County Health Departments establish some regulations, will be able to use graywater. So, I'm wondering how much of that's going to diminish our need to take water from agriculture. And another thing that I was sure was going to come up today was tracking, and how that exercise introduces competition for agricultural water and will impact the demand. So, I'm wondering if that's one of the solutions – to decrease the demand from urban areas, and to put a halt to the competition between fracking - the entities that do that are outbidding the farmers now for the water that is available?

Appendix F

Text from Breakout Session 2B – Dr. Hanemann and Dr. Colby

By what justification or rationale should policy measures have a role in the free-market transfer of water rights?

Gary Barber: The main issue is – is there really such thing as a free market and then when you get into policy measures, then you get into the question of whose policy? By whom? Land use is a County issue. Sen. Schwartz talked about a clustering law statewide that would affect that, and the 35 acre subdivision rule. So, then we got into the discussion about – in many ways the cost of water is driving the efficiency and 1041 and local control sort of things. So, the question about by what justification would policy measures have a role to intervene in the free-market? – I would say the conclusion – I'll let folks contradict me here – was that going forward we need to have more collaboration. There are examples of it but there are not incentives for, so the question becomes "how do you incentivize that collaboration?" So, you need agriculture, municipal interests, and the environment together, but also a recognition that land-use policy is the direct driver of water use and cannot be left out of the equation.

Chris Treese: Certainly the rationale, the justification, the government has a rationale to be involved – their role is to ensure the public good, especially as it regards public goods – that all stakeholders need a voice and public policy is that voice. The policy framework is, at least in part, the legal structure of the system. No injury. Beneficial use. These are good structures that need to be protected. The role of government and how you find the "appropriate amount" of government. What is limited government? What is too much government? Clearly this is a balancing act and our table came to the firm consensus that we want "Goldilocks government" – not too much and not too little. [Joking aside] there is an appropriate role for protecting the losers (i.e., the parties who are not part of the discussion or transactions, those who are not compensated but who may nevertheless be impacted).

Participant. Water is a property right. Policies should continue to protect the property right that is water. We also discussed voluntary programs that could facilitate transferring water rights. We discussed the parallel of conservation easements in terms of land as a voluntary option for producers to change the use of their land, in an incentivized fashion. Essentially emphasizing that policy can create viable alternatives to "buy and dry" to keep water on the land.

Participant: We talked about slowing agricultural land transfer, preserving rural communities and we kind of wondered how to have an effective policy. We looked back at the question, and we said "what's the justification or the rationale for having some policy" that would involve a free-market transfer. We decided that a justification was that water is a scarce public resource, with private use rights, subject to competing demands – both urban and agriculture.

Participant: When we start talking about policy, and how it's going to be enforced and that sort of thing, I think back to some of the "buy and dry" sales that I've been familiar with – I don't know what kind of policies they have put in place since the original sales – possibly they are trying to enforce the anti-

speculation rule. Conservation easements seem to have come along and done some good in some places. Surprisingly in the law I think we started to talk about a revegetation. The problem there is, "who enforces that and who decides whether or not it's done?" I'm sure there are others but those are the ones I can think of. These are policies that have come along that might affect the sales. There just are not a lot of them out there.

Dr. Michael Hanemann: I will make just a couple of observations. First of all, in any market, law and policy shapes the outcome of markets, it defines property rights and it limits property rights, but also public actors can active buyers in the market or create incentives in the market as participants. So inevitably, there is no market that is completely unaffected by public policy and public actors. A couple of things: 1) under appropriate rights – under the Colorado Doctrine - you have the ownership of the right to water – but throughout the history of the West, land and water are connected because you need both of them in order to get wealth in farming, so there is inevitably a tie. And, that's one reason, one way that public policy can influence what happens with water, is in part through public policy affecting land-use and land ownership. A related factor is the conversion of agricultural land to other uses, is almost always completely irreversible, so among other parties who are affected, our future generations. So – I may own the water and I may own the land, and I may decide to sell it in 2013, but in fact it's going to change what will be their 50 or 100 or 200 years from now. I think that creates some level of public interest in what happens. And so, we live with this tension between the right of ownership – the private property on one hand – but on the other hand, trying to create a livable community which people are comfortable with. This is why we have zoning, so it occurs to me this type of tension will continue to exist with water. I think there is another point I'll make, which is land-use is controlled at the local level, and the problem with that is – there is a certain statewide interest in land use, not necessarily on what happens on this blog, but the overall balance within this state. Open space. Habitat versus urbanized or farmland. And so, there is a certain tension between strong local control of zoning on one hand and statewide interest – a mix of landscapes and a mix of aquatic and riparian habitats. These are some of the considerations that need to be factored in - into the market for water.

Dr. Bonnie Colby: It occurs to me that when we use the word "incentivize" – this implies that a pot of money exists somewhere. You have to get that money somewhere, so I would encourage creative thinking among all of those who have the expertise in finance and economics and the law – How do you create those pots of money and offer incentives to accomplish the various goals you are articulating? One thing I've often thought would be extremely useful – a very small fee on the value of water being transacted, because all state change water right procedures have an administrative fee, but it doesn't vary whether it's $1 million per acre foot of water moving or $1000 or $100,000. In other words, it doesn't reflect the value of what is being transacted. I think they did this calculation at one of the Western Governors Association in Denver last year – that a very tiny fee – half of one percent – on the value of the water being transacted – whether it's a lease or a permanent sale – would generate significant pot of money that could be used to accomplish some of the incentivizing that you are referring to. So, for that to occur you would have to identify a fund. It's not going to come out of general state appropriations. But this is a very reasonable way to do this, a very tiny fee on the value of water is

not going to dampen the transactions that otherwise have a significant benefit. Nobody likes the word "fee" or taxes, but you can't incentivize without financing to accomplish that.

Participant. [question for Dr. Colby] Given what you said during your talk, about the fact that Colorado's water market has lots of small transactions, presumably the value of the water in each one of those transactions is also very small, I wonder if what you are talking about makes more sense in Arizona or California where the transactions are high.

Dr. Colby: In response, so the transactions here are small in volume, but the prices are higher per unit than they are in other states, so I would argue that – as a financing mechanism it still does essentially have a lot of promise. You have many smaller transactions, but your value per acre foot of water transacted is relatively high, except for a few odd parts of the West. Does anybody know where the record is for the highest amount paid per acre foot? Hint: it's not in Colorado. So, it's in the little pueblo of Tasuke (sp?), North of Santa Fe where there's some phenomenal custom estates. So you are right, there are small transactions, but large numbers of small transactions, and so that would help as a potential mechanism of raising money to accomplish some of what you are discussing.

Chris Treese: A pot of money is always attractive, but there are other incentives, as we talked about transactions – you can streamline the transaction, reduce the transaction fee, providing streamlined process for the desired outcome.

Dr. Colby: As a water bank potentially …

Chris Treese: Yes as a water bank, or you could give bonus "development units" if certain activities – it doesn't actually, necessarily require a pot of money to reward somebody with.

Dr. Colby: That's an excellent point. There's other forms of incentivizing. I've always thought that we should have drawings for a new pickup trucks – for farmers who want to be the first to doing innovative new leasing arrangement. But – somebody's probably got the still pay for the new pickup truck.

What central message needs to be conveyed regarding the value of ag water?

Participant: We thought that the central message should be that there is a high value on agricultural water in Colorado, for a variety of reasons. One – it has high economic value. Two – that it has environmental values for wetlands and wildlife, for example. And, three – that it supports our national policy of providing food, both domestically and for ag support.

Participant: We had a similar conclusion to question number two – that we need to promote the message that the agriculture community is working together with the recreation and the environmental communities to protect agriculture. Agriculture provides a number of benefits beyond food security, which is also something that we care about and want to educate the public on. But agricultural land provides open space, habitat, recreation, tourism – all of these sort of secondary benefits besides food production, but the general public might have more of a relation to. So – coming to that message with an alliance of entities from the agricultural communities and environmental communities and recreational communities – to give that message to the public in a cooperative manner. We also

mentioned that one message could be "what would we eat when we drive all the farms?" To make that connection with consumers on where their food comes from.

Chris Treese: Some of the additional thoughts we had might be more medium then message, but some of the farmers markets are a great and valuable tool and a valuable medium in conveying this message of connecting people to that food security question, and where their food comes from, what water is used for. Also that, in addition to the benefits of food security our energy security and reduced carbon footprint. And then also that the desire for the removal of a message that's out there, the dismissive message or the characterization that the small acreage farmer is automatically the "hobby farmer" when in general they are often producing something like specialty crops, and often using water very efficiently in the process.

Gary Barber: Chris Kraft put forth the point that our US food is the best bargain in the world. We heard some of that from Dan this morning. The other message that I heard listening was that movement from water out of ag into other uses is a one-way movement, and whatever the cause was, or the history, it is now [situated in its new use], and it is not going back the other way. So, we have to think about how we approach this, because it's a one-way ticket.

Dr. Colby: It is interesting that the question was phrased to focus on a message, because the way I think of it as an economist is based on research and analysis that we have done of water transactions in lots of different areas of the world – is when pressure is on, the housing market, the state's economy is booming – there is so much pressure to move at least some increment of water out of agriculture – so public education and outreach would be useful, but it seems that if you want to tackle that kind of pressure when it next get strong again, which I would argue that it will be, based on what I've been looking at in the housing market and so on – something more than a message is needed. Public education is is a good place to start. We've talked other places about policy measures, but having a public that is informed and possibly sympathetic – farmers markets are probably the best places for outreach. These could be great places to lobby people about the importance of farming in their region.

Dr. Hanemann: I would agree with what Bonnie said. It's not just the message – it's the policies and the incentives that you create, because economic incentives push people, and with developers, let's say there's a hot housing market – if he has to spend more money to buy water or to buy land or to buy materials, he will do that. So the important thing is the notion of creating countervailing pressures for maintaining agricultural land and agricultural water that use in certain areas, or with certain characteristics, say dual-use, such as overlapping farming and ecosystem habitat. So, I think the message has to be: first – that this is a goal, but second you have a set of policy measures which hang together, which makes sense and that's what you are relying to protect and preserve and agricultural way of life, and agricultural landscape and agricultural economy. There has to be a coherent and credible plan.

Sen. Gail Schwartz: I think inherent in free markets is that they are "agnostic." There are no values in free markets. And so, it is policy that drives that, but also pricing. So we talked a little bit about the value of that tap water and that value or that cost can drive consumer behavior. And I think there needs to be policies around expectations for efficiency, and conservation on the municipal uses. So, when I can the

dry up this productive agricultural land, so you can grow bluegrass. So I think values are something that policy often times will instill and try to reflect that statewide interest.

Gary Barber: I have to defend my lawn here. Please don't ask my kids to play soccer on gravel. There is a place, I think, for the right recreational use of water, as represented by bluegrass in parks and other places. And, as a total consumptive use of the water supply, it's maybe 2%. So, if you are going to go get the water to try to figure it out and be more efficient, my friends over here at Colorado Springs Utilities have rendered the utility rates such that there are no more trips of grass between the sidewalks. I spend several hundred dollars, which was still less than what my one month bill was in June, two ripped out two of the four zones of my turf. So – we are going that direction, and I think in terms of the other take away here, this can't be just a message – this has to be an ongoing dialogue, and for me I'd also be curious to know what our experts think about this Roundtable process in the Interbasin Compact Committee, because in one respect I see it is a very social experiment. One of the theories that we've applied at the Arkansas Basin Roundtable, is that we have no authority – but we have some moral standing to say, "that's good, and that's not so good, and we don't like that." And that's been the driver for us to put this conference together, to try to get to – where is a place we can stand and say, "that's good." So not just talking to each other, but bringing in folks from the outside.

Who should convey this message, and to whom?

This message should be conveyed with what specific goals in mind?

Gary Barber: I will add Chris's here about the importance of water, but the idea of bringing in various incentives for good behavior.

Chris Treese: Understanding and accepting that you live in the arid West and that there is a responsibility associated with your decision or your position of life in the arid West. We did touch briefly on the nontraditional messaging – things that are catchy and new media and maybe even edgy like Denver Waters conservation media outreach is appropriate.

Participant: We discuss the goals of this messaging should be increasing the awareness and appreciation of irrigated agriculture for food security but also for the other benefits – open space, tourism, recreation, etc. And, that collaboration and increasing our alliances should be the way to get there. We had the common theme of building alliances that –the ag voice has more room to grow in presenting this message to the public. That might be the environmental community and the recreational community might have a closer tie to urban citizens as well, to building the rapport with the agricultural community. We can take a multifaceted approach to getting the message across, from PR, education, advertising campaigns. We discussed "buy and dry" and how that process has sort of been put in a – the negative impacts of the "buy and dry" process have been made more apparent, more public through an advertising campaign and alliances that were built. We can continue to do that with increasing the value of irrigated agriculture in urban areas. And, the message would be delivered primarily to consumers as well as policymakers.

Participant: We talked about "who should be delivering the message" and we thought it should be at the local level – utilities, press, water and agricultural groups, state government, schools, service clubs,

environmental groups – and the message should be delivered to everyone – all citizens. The goal – we thought it was basically focusing on minimizing "buy and dry." Promote conservation – we recognize that what we seem to be saying was that we want to maintain the status quo, and I think we had a minority report that said, "growth may be necessary to maintain communities."

Dr. Hanemann: Something like this is an exemplary process, and I haven't seen anything comparable in California. First of all, meetings, interacting with one another – over a period of time, you learn to see where the other people are coming from, and what's their interest in what's their concern. And that's tremendous. I'd say that's essential to making some headway. The alternative is – you each have attorneys 20 attorneys show up in a courthouse and that's how this move forward. And that's not as good of a process. An added reason why this is so valuable is the observation that water is a public resource – this is a standard observation is nothing novel – it goes back to Roman law and the law of many countries. I want to stress that there are several reasons why I think that's valid. Aridity is one of them. In an arid area, there is a public interest in maintaining a sustainable use of water, rather than in a very humid area. But there are other economic reasons. Water is immensely capital-intensive. The infrastructure is essentially collective for surface water. And, if the water supply dries up, you strand the rest of the users, and you lose their economic value. There is a strong justification for public involvement in water supply just because of the economics – because of the economies of scale and the need to finance and put in place a huge amount of infrastructure before any water is delivered. Now, that's in tension with the notion of private property rights and the idea that if you own property, you should be free to dispose of it. The notion of private property is an important one, and I don't want to ride roughshod over it. But, it is a fact that there is this public interest in water, and therefore there is always going to be this tension of respecting private property rights, but also I think recognizing the public interest in a sustainable and will use water supply. And I think this type of process – the Roundtable process – is a very wise and smart way to try to move to get effective decision-making with regard to what is a public resource.

Dr. Colby: I will mostly say "ditto" to what Michael already said. If you don't do this – and then what do you do?

Appendix G

Text from Breakout Session 2C – Dr. Ward and Tom Binnings

[Forthcoming]

Appendix H

Notes from Breakout Session 1

Scanned copies from note-taker written comments to follow:

PEXECUTIVE ROOM

Valuing Colorado's Agriculture: Workshop for Water Policy Makers

Monday, October 7, 2013| Cheyenne Mountain Resort| Colorado Springs, CO

Hosted by:

Colorado Ag Water Alliance

Arkansas Basin Roundtable of the IBCC

Questions for Breakout Session 1 (1:45 – 2:45 PM)

Breakout Session 1: Goals for Colorado agriculture and the connection to water

The goal of Breakout Session 1 is to focus on establishing and clarifying ideas that can help better define what it means to protect agriculture and safeguard agricultural water.

Instructions: Review all questions and allot enough time to consider each

1. What are the future scenarios for agriculture in Colorado, in particular irrigated farming?
2. By what metrics should we measure the agricultural and economic sustainability in Colorado? Please provide some examples of measurable outcomes by which this sustainability can be measured. (*For example, could measurable outcomes be based on acreage, crop production or water availability?*)
3. How will the full irrigation requirements for Colorado agriculture change?

technologically efficient

Sam Eberson said last few seconds were cut off from recording → Gene Manuello said two more considerations are storage & ATM's

① future scenarios
- expanding: being more productive w/ demand for food
- efficiencies, technology
- however, world wide supply will increase too
- we may develop some high-end niche markets

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- Relaxed → suffocated

fallowshed

EPA - 16,000

6,000 window

Dr. Ward -

Dr. Hanemann

① grow - A scenario, higher value crops, less lower valuable crops, maybe less intensive crops / Scenario - model, D with risk

② less open space - bad more higher value, crops due to innovation.

③ use open space & marginal land more intensive

④ Marginal lands come out of production.

What are goals & then assign the metrics?

② Metrics ← objectives
- sustainability
① meeting intergenerational compacts / -0
② Carry capacity =7 in Colorado
- Turn it to a metric
③ Water → -ed, drainage
④ Human cap environmental cap physical / natural cap
capital - do the accounting like GDP
⑤ Index
Who assigns the goals? Bhutan Happiness Index

Sustainable Value Approach

choose a metric that can influence people carbon footprint
need to transparent, open principles of

who uses metric →
{ policy makers, scientists, economists
{ general population

Farm Family
Income

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Future scenarios - irrigation. 6-1 irrigated

1.) Better public support - water tied to land w/ tax credit.

2.) Lose water

3.) Widespread water fallowing - alternative transfers. Water as cash crop Ex Ark Valley - "Super Ditch." Complexity and approvals in question Ex Highline Ditch.

4.) Food security/organic locally produced.

2.) Net exporter

3.) Less demand due to trucks. Methods of irrigation - fallowing or drip

wtr tied to land w tax credit
better public support / take with alt Ftrs

I Cash crop - wtr
superditch
Ag Ftr shown to be profitable -
snowball effect
Flex thru reg process
locally produced ~~Organic~~ local vore local grown eaten sustnblty

II $ell/ surplic + exports (net exported) by hsehold dollars 4 ag

III Longer grwng season
less demand bc of Ftrs
less wtr demanding crops eg alfalfa
following methods of irrig

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3. How will the full irrigation requirements for Colorado agriculture change?

(1) dairy mode,
efficiency got to become part,
create supply, improve water quality
increased capital costs
Diff parts of state, in diff directions
extending ag economy now in NE col
estate planning

(2) # of operators
perpetual preservation

clusters
on 35-acres

(3)

Valuing Colorado's Agriculture: Workshop for Water Policy Makers

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Colorado Ag Water Alliance

Arkansas Basin Roundtable of the IBCC

Questions for Breakout Session 1 (1:45 – 2:45 PM)

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(1) EPA
New crops & production practices
Technology
Marketing (new mkts & different strategies)

(2) Farm Family Income (contribution of farm to family income)
Next generation of farm families returning to farm

(3) There will be more pressure to have more water available for agriculture.

WHITERIVER II (Page 1)

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3. How will the full irrigation requirements for Colorado agriculture change?

(1) What is the future of national farm policies: - ethanol
- sugar
- dairy
- price-supported crops

(2) What crop mix will be grown?
- demand for crops (e.g. barley for beer)
- H2O availability
- role of CSU in helping farmers identify & develop crops

(3) Marginal lands now in production should come out of production.

(4) Greater efficiency in irrigation technology that will depend on legal ramifications of conserved water.

- Use of deficit irrigation (ex. CSU tests on alfalfa)

(5) - Note: consumptive use can increase with improvements in irrigation efficiency → better delivery to rate zone.

(5) How can improvements in irrigation efficiency be shared with M&I users? How can irrigators partner with cities to finance these improvements?

(6) Efficiency rules cannot penalize farmers. (Arkansas example.)

(7) Increased rotational fallowing.

Question II

(1) Net farm income and its trend over time.

(2) Net return / acre-foot H_2O

(3) Farm income should include all products including livestock, crops, leasing water, etc.

Page 2

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Question II (cont.)

(4) The measure should include an output (physical output) not just revenue.

Question III.

(1) Full should mean optimum defined ~~as~~ in terms of farm income.

(2) More temporary leases back i

→

for the ~~for~~ from M & I to
irrigations shall be realized.

Breakout Session I 10/7/13

1. Future scenarios for ag in Colorado, in particular irrigated farming
   (1.) Buy & Dry - no action
   (2.) Oil & gas water needs brings "opportunity" for ag water rights holders ↗ but the price O&G pays for that water could inflate price of ag water for entry level ag water users.
   (3.) Collaborative water transactions between M&I, Tourism & Ag to achieve balance & sustainability
   (4.) Increased exports keeps ag commodities prices high which will keep land in production.

2. Metrics to measure economic sustainability
   Fallowing can be an alternative to buy & dry but it comes with a cost - potentially increasing food costs

3. How will irrigated ag change?
   (1) Ogallalah aquifer

① Future Scenarios for Ag in Colo, esp. irrigated farming?
Fed. Support - corn, beef
Importance of sugar beets increasing
Key: What crop mix will be grown & if have to get by w/less water?
Barley, Potatoes, Alfalfa > get better cash crop w/less water
Dry up marginal lands
Maybe opportunities in incentivizing technological improvements
-- will need recognition/coop by State Engineer
- more efficiently irrigate root systems to increase productivity and reduce consumption of water
★ Need to see more efficiencies incl. p's/ships between Ag/municipal
--should provide protections for farmers water rights

② Metrics should be used to measure ag and economic sustainability
Measure return against ac/ft water
→ Net income of farm household
- Efficiencies improved on farm ~~will increase productivity~~ along w/ coop Ag/municipal will result in increased productivity.
Lease water to municipality
- but have to have evidence of increased production and increased net income to Ag w/ decreased cost to municipality

③ Full irrigation - What is it?, We're not sure
Optimum not maximum irrigation
More temp uses of irrigation

Ntnl Farm Policy/
Crops
Tourism (agro, fishing, rec, hunting, etc)

1B

10.7.13

Q: 1: Future Scenarios:

(a. Challenging!)

b. Water is a commodity → goes to the highest bidder
- And it's SCARCE
- Rural communities have to compete
- Need to value keeping water local
- Most important use doesn't necessarily equal its economic value

c. Price of commodities
- If crop prices good, no one will sell H_2O

d. Increasing urban demand
- Buy & Dry → with or without reveg
- OR water sharing; ↑ creativity to meet demand while keeping ag whole
  - Keep farmers on farm while leasing a %

e. Δ urban land-use planning
- Build up instead of out

f. Ag use remains same, M & I must adapt

*Super Ditch
*Las Vegas

Q 2: Metrics:

a. Critical Mass
- How much water can you take out while keeping ag viable?
- 2° economic benefits ie. tractor mechanic
- How much ag can you lose while keeping rural communities viable?

b. Measure amt. of ag products sold from community ($ sales)
- Gross sales / net income

What do we value. Value is greater than solely economic.

*Incentives

Q 3: Δ Irr. Requirements

a. Δ application method
b. Δ storage to ↓ evaporation
c. Policy
d. Depends on innovation

*

~~New Supply~~ Planning, innovation, efficiency with EXISTING supply

10 7 13.

TABLE 1.

What are the future scenarios for irrigated agriculture

① The least cost effective ~~agr~~ irrigation in towns!

② Conservation needs to be the first step.
- Education
- Legislation
- Property Tax Rates.

③ 30% of disposable income on food.
④ Access to production
⑤ Value of production
⑥ Measured decrease in B+D and ↑ in ATM's.

(B)

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3. How will the full irrigation requirements for Colorado agriculture change? C ↑ Δ → ET ↓ Δ
   CROP mixes,
   Farming systems

my answers in 3 St presentation

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(1) Status Quo - steady, slow declines + consolidation.
OR greater education (ecosystem services/value of ag broadly to sustainable future) leads to ~~decline~~ steady or increase or increase ⇒ or the opposite + expedited buy + dry up from ag to ~~food~~ ecosystem services

(2) Soil health, efficiency (crop per drop)
• Δ to higher value, lower water use (veg)

(3) History of ag is increase in crop productivity
- Technological
- Self-regulating → increased time horizon to ensure something left for next gen.
- Or, it won't

WHITEPINE 1A

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2.9o cal.

6.6 million a/c

% SURFACE AREA 5, ½ %

- Efficeney (center pivets)
- seeds production (stock)
- Tilliage practice (known)
- CORN, Alph. "Price"

⊕ BASELINE of Ag A/C

⊖ what is exported

How do you Loss the Image that Ag Having H_2O ?

- Food Production +
- Age of Ag. producers (TURN OVER) +
- TROPHY RANCHES (Ag the culture)
- A of USE OR Method

+ • FARM Family INCOME

+ • INFRASTRUCTURE

+ FARMING capacity

+ Ag INDEX

- tentes (Don't own LAND) put limits
- OPEN SPACE VALUE
- County LAND USE
- H_2O Quality → Food production

CASH

8 million A/C

3 A/C / A/C RATIO

efficency

▲ goal Reduce H_2O usage 20% By Gov't

ARK ROUND TABLE SE

36 A/C LAW (Rule)

Regulative

ceiling (for A/C) To keep A cost From INCREASING.

Default 90% H_2O

But who pays ?

Question 1. EPA

NEW crops (rotation

Technology

marketing

LAND PREMISSED

TAX CREDITS

CASH crop

Local grown food

+

- Town
- Grown
- Women

Appendix I

Notes from Breakout Session 2

Scanned copies from note-taker written comments to follow:

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3. Who should convey this message, and to whom?
4. This message should be conveyed with what specific goals in mind?

Value to community, Ark Valley, private & public value, ripple effects, Zonings

Educational Component

① Recycling → 1969 – Schools, 70's 80's

② local food movement → Organic, farmers market 1970's 1980's counter culture

Golden Rule

Norms

Revise

User → State owns ← State level ← Water → injury

Minerals → Oil/Gas Commision

Land-zonings - SB 35

Session 2

#1 should state have role in:
slowing of land transfer?
preservation of rural communities?
how to have effective policy?

- competing interest in having scarce resource - need referee -
- water is a scarce public resource w/ private use rts - subj to competing demands

#2 HIGH VALUE OF AG WATER
1 economically valuable
2 environmentally valuable - wetlands
→ supports 3 cheap food policy
recreation
national food security

#3 who? local utilities, planners, water & ag groups, state & schools, local govt, service club & env groups
to whom? citizens?

#4 goals??? → minimize buy & promote conservation
maintain status quo
min: but growth may be necessary to maintain communities

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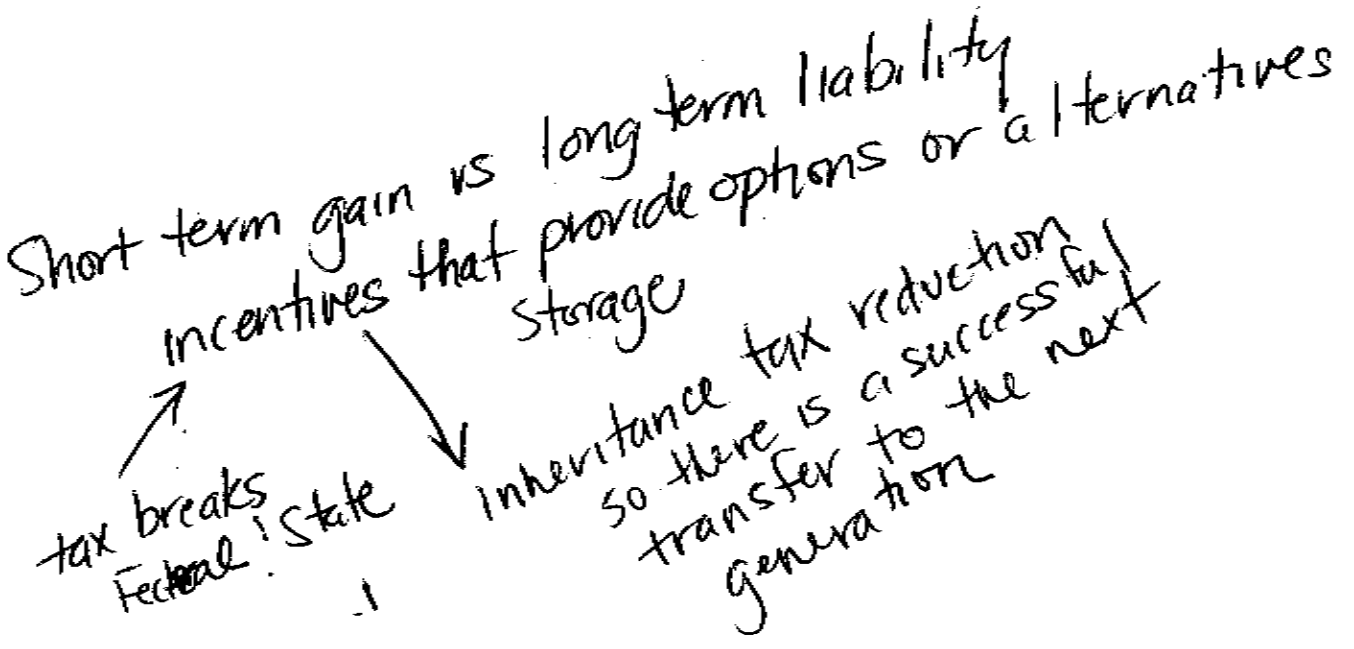
Losing the water has ripple effects to the rest of the economy
Threatens a way of life
Indirect value
↳ public value as well as
recreation
environmental
geographic effect

Goal Keep the Western Ag Conservation Coalition

Policy that affects public value

Policy can be used to make the process more effecient - less paperwork and prevent injury to parties involved


Short term gain vs long term liability
incentives that provide options or alternatives
storage
tax breaks
Federal / State
inheritance tax reduction
so there is a successful
transfer to the next
generation

Question 1:

- ~~State~~ our modern focus is water management as opposed to water development
- How to provide for next 5 million people?
  - Trade offs are going to be a consideration
-

Question 2:

- Ark basin RT - somehow need to preserve ag.
  - valuable to state - don't lose it
  - "No farms - no food"
  - ~~water~~
  - Local food supply
  - Need to connect urban food supply with agriculture - urbanites have an interest in food production.
  - Risk buffer - ag is a water buffer for municipalities through interruptible supply / rotational fallowing
  - Food security

Question 3:

- Ag. - can tell our own story
- ~~Schools~~ Schools - Ag days - educate
  - Municipalities
  - Governor

more state fair around state?

Question 4:

- show connection of ag and urban interests
- sustainability

food security

CHEYENNE MOUNTAIN RESORT
colorado springs
BENCHMARK HOSPITALITY INTERNATIONAL

MIDDLE GROUP

Breakout 2

1) "all the water of Colorado belongs to the people" — not one special group or class.

2) Central Message — A6 is beneficial

3) the message should be conveyed by A6 to the people of the state

4) the goal should be to improve relationships with A6

3225 Broadmoor Valley Road • Colorado Springs, Colorado 80906 • (719) 538-4000 • 800-428-8886
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① Should state place preferences on outcomes?
(• Incentives - ~~Alone~~ ATMs / short-term values + returns for ag
tied to long-term municipal supply
• Limit buy + dry
• Protect natural environment
• Extend decision-term
• Basin-specific
• Buy local
→ To both buyers + sellers
Colorado River Cooperative Agreement
as example
Super Ditch

② Broadened
- Food
- Environment
- Rural Econ
- Quality of life

③ Farmers
- WEF
- Ag + conservation

④ Farmers manage our water
+ benefit consumers directly
+ food security

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Discussion: Protection of Private Property Rights

From Breakout No. 1:

Goals:

4.) Preservation of Ag. Values, Production, Culture and values defined in No. 2; But without infringing upon Private Property Rights.
- Good Science.

Efficiency in use
Efficiency in transaction and Private Property Protection

Reves Brown Question;
- How are short term individual gains balanced w/ long-term need to keep land in Production and keep infrastructure viable for the future.

Jean Chambers;
Table Representative

2. Value of Ag.

- Food Security
- Basic necessity of Food Production
- Open Space Benefits
- Wildlife Habitat
- Non-Consumptive Recreational Dual uses
- Economic Production Activity
- Diversified Stable Economic Generation

- Who Should be telling the message?

- Who Should be hearing this message.
  - Elected officials at all levels
    - BoCC, City Council
    - State Govt
    - Federal Govt
  - Public Communication of Challenges, Goals, opportunities w/ Special interest Advocacy Groups, Offices of Econ Development, Chambers of Commerce, Housing + Building Organizations, Environmental Advocates, Wildlife Advocates, & Scientific Community, etc.
  - Public At Large.

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2. What central message needs to be conveyed regarding the value of agricultural water in Colorado? US, FOOD, BEST BARGAIN, INTERWOVEN
3. Who should convey this message, and to whom? ALL COLORADO CITIZENS.
4. This message should be conveyed with what specific goals in mind?
   ↳ THE SCARCITY + IMPORTANCE OF WATER.

2B 10.7.13

Q1: Policy & free-market transfers
a. Water property right →
(Voluntary) programs (i.e. Cons. Easement) for H_2O
• Policy could create viable alternatives to buy & dry, & keep water on land (voluntary + incentivized)
• Continue to respect private property (water) right

Q2: Central message:
a. Ag community to create alliances w/ Env. + Rec communities
• Ag, open-space, habitat, recreation,
b. "What are we going to eat if we dry up Farms?"
c. Must listen to rural communities
d. Educate voters
• Disconnect b/w recreation/open-space + contributions of ag to those
e. "CO beauty provided in large part by agriculture"
• How do water users "cash in" or "valve" & maintain viability

Q3: Who, & to whom?:
a. Formal alliances w/ Ag-Env.
(• Funding) (PR) (education) (ad campaign)
• Educate ppl on where food comes from
b. To:
• Consumers/constituents → ie. Crowley Co.: Aurora constituents got Δpolicy b/c buy & dry story was told
• policy makers

Q4: Goals of Message:
a. Inc. to awareness + appreciation of irrigated ag
• Ag to include 2° benefits ie. tourism, rec, birding, open space
b. Food security
c. Collaboration 1st; ↑ alliances

"Trust & Responsibility to the West"

3. Who should convey this message, and to whom?
4. This message should be conveyed with what specific goals in mind?

Session II

① Worded oddly

- rationale - public good
- all stakeholders need voice, public policy is that voice
- policy framework is legal structure
  - no injury
  - beneficial use
- role of gov't limited - balancing act - Goldilocks Gov't
- Compact compliance — protect the losers in privt. transactions

② Central message

- "critical component
  - social; environmental
- value in farm to mkt — providing connections to food
- "hobby farmers" dismissive - derogatory
- "food security
  - energy security
  - carbon footprint

③ Element of Colo Water Plan

Conservation Districts

CSU
extension agents

Policy makers - Elected

To whom - start w/ school kids - long term investment
to policy makers - revolving door - (by design)
media, including "new media"

Cont'd

Session II

(4) New water ethic - Understanding arid west

~~New model~~

Non traditional messaging

catchy, simple, edgy (e.g. D. Water ads)

Room 1B

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Breakout #2

- There are no "free markets". Politics always present
  Who's policy? Land use is county - statewide -
  There are a lot of players | state law allows clustering 35 ac/cluster
- 1/2 waterless - comes from court ⇔ legislature
  → COSTS of WATER - Driving efficiency
  \ How much conservation -

Melinda - rationale - state interests - 1041 criteria
local govt control -
Gov → preserve as important
Recorder → preserve envir & rec values

COOPERATION based on Win-Win -

GOING FORWARD → MUST INCLUDE COLLABORATION

SEVERANCE TAX - SOURCE of Funding

Bring incentives for good behavior

- Ag ombudsman → to reduce costs to individual

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(1) Policy one step from Political
Reduce policy constraints to induce alternatives
to ag water transfer
Storage needed to alleviate time + place

(2) Public trust doctrine
property right
Value in the community - impact of transfers
Reciprocal
Value of food + products that go to cities and
the boost to their economy
Support growing economy
farming essential to cities

Make sure you dont assume a level of knowledge

We are all connected & more so everyday & water is only getting fighter → Support Storage

3) Regional collaborative groups

teachers - education

Legislator + Govoner

Form local patnes with NGO Non Govt Orgn Environmentalist

4) Storage