LOOKING FOR TROUBLE: ANTICIPATING IMPACTS OF CHANGING ALLOCATION OF IRRIGATION WATER

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ABSTRACT

New forms of water transfer are beginning to appear, after decades of calls for increased flexibility in allocation as well as reduction of impacts from the traditional Western practice of "buy-and-dry" – moving water from farming to cities by ending irrigation forever on subject lands. Colorado's interest in improved water transfers increased with recent severe drought, continuing high growth rates of urban and ex-urban populations, and examination of needs for future water supply by the Statewide Water Supply Initiative (SWSI). Colorado does not want a state water plan, but has invested in improving water information and assessment of supply and demand. This study exposed potential shortfalls and may have accelerated competition for agricultural water. Colorado is experimenting with a water bank, but the first effort was severely limited in application and design, and normal agricultural innovation practices were not employed. Now, new forms are being developed in and out of the SWSI.

The Statewide Water Supply Initiative "phase 2" technical roundtables narrowed several issues, including alternatives to "buy-and-dry". Three basic additional kinds of water transfers appear to meet demands, and a small set of principles for water transfers are recommended. This paper reviews the three forms and the principles, and the presentation will report preliminary results from further inquiry into potential problems from use of the more flexible transfer forms. Anticipation of problems is desirable to maximize the certainty and predictability of new transfer forms, in order to help make them attractive compared to "buy-and-dry", and to more accurately compare costs and benefits and their distribution.

INTRODUCTION

The trend of water moving from agricultural uses in the West (National Research Council 2004, Western Water Policy Review Advisory Commission (WWPRAC) 1998) will continue, but how will these transfers take place, and with what impacts? Traditionally, irrigation water has been moved by permanent sale to cities. Some transfers included a few years of "lease-back" to farmers if the water was not presently needed. Eventually, water transfer decrees required that formerly irrigated lands not be re-watered. This is called, "buy-and-dry", and the local consequences are often severe due to loss of agricultural activity or sharp

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reduction if the land is converted to range or "dry-land" farming. Colorado's water law is among the most advanced in making water rights a fully adjudicated (judicially defined) form of private property with a very high level of protection for other water rights that might be affected by changes in place, kind, or time of use. That principle of "no injury" has been articulated by the requirement that parties seeking a change bear the burden of proof, and in practice that has meant high engineering and legal fees to get change decrees from water courts (Nichols et al. 2001, Corbridge and Rice 1999, Hobbs 1997 et seq.) . Further, there have been only very limited opportunities for leases or temporary transfers, or the kinds of sharing or conditional transfers that academics have recommended (and which are the subject of this presentation). Colorado's lead in formalizing the transfer process has helped to very clearly specify the property rights, which is important for markets. But this is also an inflexible system with high transactions costs (costs of making a deal), which discourages small-volume transfers and may also favor the small set of large-volume buyers relative to many more sellers, operating in a competitive private market. Inflexible water allocation is associated with economic inefficiency, and there have been many calls for improvements in water markets (Howe 2000, WWPRAC 1998).

The transfer of water from one use to another has been further complicated by the historic legacy of 19th century frontier misunderstandings of groundwater hydrology. Even now we are still adjusting to modern hydrologic modeling capacity and the ability to manage coherently. In Colorado, well-users are still not fully integrated into prior appropriation, as recent shut-downs in the South Platte have shown, while the Rio Grande Basin is developing management changes, and in California there have been odd disconnections such as allowing surface rights leases to the Water Bank and use of ground water, for example (McGuire 2006; Slater 2005, Strawn 2004, Hobbs 1997 et seq.). Transfers and substitutions are being rationalized, but the high engineering costs of modeling depletion of surface flows from well pumping, and specification of required augmentation of flows has slowed adjustment.

Can we do better? Desirable features would include less cost and delay (it takes literally years, usually) and less missed opportunity (Howe and Goemans 2003, Nichols et al. 2001). Better markets with adequate technical support and administrative capacity would enable rather than defeat efforts to achieve efficiency of use, while protecting other water rights. Better institutions would increase knowledge of water prices, and allow low-cost estimation of what is transferable. Ideal markets with good technical support would also provide greater knowledge of the resources available, and some foresight of the cumulative limits and thresholds of impact that can abruptly limit activity, such as need to respond to water quality or endangered species situations. Better markets would not include concealment of dealings and prices (see Olinger et al. 2005). Better markets would include participation by important recreational and environmental interests, by modernizing limits on allowed uses of water (Neuman

1998, Hobbs 1997). Better public information would increase ability for all interests to seek what they value in the market. Recreational and environmental interests increasingly appear in markets for land resources; 24 billion dollars in local conservation funding was approved by voters between 1998 and 2003 (Newburn et al., 2006). Recreation and environment are a very large part of the economy and are at risk from dependence on resources they cannot rely on (Environment Colorado 2006, Harmon 2005, Weller 2005, Governor's Commission 2000).

Re-allocation of agricultural water affects many public interests and public goods. Those benefits are shared by almost all, in some sense, but are provided by the actions of a few at their own expense, and so are likely to be under-provided. There is also public interest in avoiding uncertainties and high costs from sudden imposition of limits such as may be imposed by total maximum daily loads affecting water quality and Endangered Species Act limitations, as shown in major river basin programs on the Platte and Colorado Rivers (e.g. Bureau of Reclamation 2003). Environmental problems often arise from changing the place of use of water, which changes flow timing and patterns that may be critical for fisheries. Social and socio-economic issues include a large range of externalities, worst in particularly agriculture-dependent areas (Howe and Goemans 2003, Howe 2000). These include losses of economic activity and local tax bases, which affect many interests not involved in the sale of the water. Also, the problems we confront include synergistic interaction with impending climate change. No assessments are optimistic for irrigated agriculture in the Central Plains (Edmonds et al. 2005, Barnett et al. 2004) or mountain west. It is important that the practical implications for the rural economy are the same as for rural environmental stability (Environment Colorado 2006, Matthews 2006). For many reasons, we need quick progress in establishing management which can provide the adaptive capacity to respond to changing conditions and maintain resources, and that in turn requires the social process of institutional change (Wiener 2005). Finally, there has been too much investment in existing property rights to expect an easier answer than ways that respect those rights and the laws defending them.

MISSING FORMS OF WATER TRANSFER

The Colorado Statewide Water Supply Initiative has included technical roundtable review of different forms of water transfer, including different kinds of leases, and other alternatives to "buy-and-dry" (Colorado Water Conservation Board website). Three forms of transfer may serve to meet many of the needs noted above, provided that no additional barriers to participation arise.

1. Spot Market (Water Bank) For Short-term Transfers

There is substantial West-wide interest in improving short-term transfers (often kinds of leases) with very low costs and rapid implementation, for a wide variety of purposes (see survey in Clifford et al. 2004). In Colorado, short-terms of up to 2 years may be best, with administrative rather than judicial approval, but subject to review of presumptions of transferable historic consumptive use and other findings of fact. Where a spot market exists, it has served agricultural as well as municipal interests (Howe and Goemans 2003, Michelsen 1994). Flexibility is valuable for irrigators to react to surprises and opportunities which may occur, (e.g. expectations for markets due to local or competitor region conditions), and for security of investment in high-capital technology where infrequent needs arise to maintain investment (e.g. fruit trees, greenhouses). The persistence of an established water market is important, because it supports expectations even with variable prices (Slater 2005, Neuman 2004, Howe and Goemans 2003); other commodities are often traded this way (e.g. gasoline). "Thick" often-used markets provide price discovery and information. A working market like this exists only in the unique case of the Northern Colorado Water Conservancy District, because of the legal framework allowing almost instant cost-free transfer of water which has already been transferred to the District. No other Colorado district has this legal structure, and in the US it is almost unique, though some entities allow easy transfer within districts if the use stays in farming.

2. Rotational Crop Management For Long-term "Base-load" Transfers

The idea came to us from California examples in large Bureau of Reclamation client irrigation districts (Raby and Devine 2004, MacDonnell and Rice 1994). Crop rotation designed to accommodate predictable reductions of irrigation water on part of the area would "free up" transferable water while minimizing disruption of farming. The most innovative feature is a very long-term contract, lasting many decades, which would require extensive negotiation and probably effort to self-organize by transferors. The intended use is to provide "base-load" annual municipal supply (perhaps for high-value agriculture as well). This has been authorized (HB06-1124) by law signed May 25th, 2006, but not yet attempted.

Transferees would probably incur initial costs for infrastructural investments such as check-dams and canal improvements to enable flexible irrigation management. But, acquiring water this way avoids the need for cities to issue bonds and pay interest on money to buy the water right (e.g. at 3.25% interest, and 1-3% cost for establishing the bonding mechanism, a million dollars on a 30 year term costs almost $1.6 million). Billing through water rates and tap fees for "pay-as-you-go" matches costs and benefits far more accurately across the time and users. Municipalities limited in their bonding capacity may benefit from conserving debt capability, or avoiding creation of new entities.

Payments for increased system operation costs, with ditch companies and irrigation districts being parties, would probably accompany payments to participants, perhaps larger to those foregoing irrigation; the size and distribution of the pie are negotiable, and the parties can make their own deals. The asset value and appreciation would be retained by the transferors, subject to the servitude created by the contract, and subject to the deal agreed concerning the options at the end of the term as well as other contingencies. After many decades, it seems unlikely that users of a long-operating and installed contractual and physical system would suddenly face hot competition, but risk allocation is the essence of a contract and this can be anticipated. The most remarkable consequence is the prospect for long-term stability in the agricultural operations, perhaps for the first time. The people, land, and un-contracted water are as free as before the contract.

3. Interruptible Supply Agreements for Long-term Occasional Transfers

The interruptible supply idea for very long terms is quite similar to the rotating crop management idea, but the transfer would take place on specified contingencies (including requests for any reason if so agreed) which are not as temporally predictable. This form would serve three main purposes for transferees: (1) *dry-year and post-drought recovery* "calls" on a schedule of price adjustments to account for the time when the option is exercised and cover expenses; (2) *facility-out-of-service* substitutions, same schedule of price/time of call; and (3), *wet-year calls* at different set of prices to enable storage filling, aquifer storage or recharge, etc. while the farmer uses the wet year for not, less or differently irrigated crops, probably on a different schedule of payments. All would involve negotiated risk sharing arrangements. Transferees would use these to firm supply, and in some cases, operate existing infrastructure with minimal additional investment (e.g. to fill storage not being filled by normal sources). Transferors would receive income just when farming is least likely to provide good yields, though prices for feed are most likely to be high and crops would be lucrative for those able to produce. As coordination and planning increase, one would expect to see *increasingly meshed sets of contracts* and agreements. Discussions indicate that farmers would prefer to have all options open, as one would expect, and to be able to use spot markets, for example, to support investments while engaging in long-term deals.

SUGGESTED PRINCIPLES FOR WATER TRANSFERS

Role of the State. The state should be the "referee" for technical and administrative management, to protect water and other property rights, defend interests in water quality, soil erosion etc., and manage social impacts as directed. It should provide adequate information and institutions to allow successful

markets and reduce transactions costs. It should assure certainty of priority. And, it should foster capacity of local governments to identify and secure needs and interests.

Role of the Market. Markets should provide fair and reasonably transparent opportunity for trades of resources and arrangements for risk distribution and management, including opportunity for third-parties and governments to seek or preserve conditions they desire, for amenity, tax-related, recreational, environmental or other interests, by purchase, lease, easement or otherwise. Market allocation is preferred to political processes because it allows negotiation flexibility for unique needs and desires, and certainty of property rights.

Certainty. Establishing alternatives to the sale of water rights requires low-cost specification of property interests and also adequate efforts to foresee and manage impacts and surprises. Failure to anticipate thresholds and limits will threaten certainty, so scales and quality of assessment must be sufficient to anticipate adverse surprises. Parties who are surprisingly excluded may threaten the legitimacy and certainty of arrangements privately made which suddenly prevent others' participation.

Allocation within Thresholds. Failure to anticipate thresholds has been very injurious, as recently illustrated in the South Platte where well users were abruptly brought into compliance with prior appropriation or shut down (McGuire 2006). However a threshold arises, from physical limits, water law, or policy, there will be need to allocate and reallocate within the limit as situations change.

Transferor "Internal" Allocation by Market. Two sets of internal adjustments should be possible within transferor organizations. First, resource re-allocation for purposes sought by outsiders, such as salinity reduction or environmental conservation may be important. Second, individual situations may call for flexibility within transferor organizations such as groups of mutual ditch companies. Farmers and their families may want different outcomes and things change. Certainty in the long term requires internal adjustability on the small scale, and adequate scale to accommodate individual property rights and preferences.

Scale Matters, and Appropriate Collaborative Institutions. Impacts are related to scale and cumulative impacts are often regional. Identification of impacts and interests is somewhat new in relation to water transfers, partly because of the history of externality and mitigation issues without remedy and lack of public interest consideration in water transfer cases (Slater 2005, Howe 2000, MacDonnell et al. 1994). Adequate organizations (existing ditch companies or districts, or collaborative sets, perhaps) are needed to manage impact assessment and to adapt as needed. There may also be value in regional recreational and environmental considerations, to introduce interests new to the market and

identify opportunities for coordination and efficiency. Wider participation in markets should more fairly match and help internalize costs and benefits. Scale issues include the areal extent of transferor organizations, regional impacts and participant preferences, as well as costs of management and organization.

LOOKING FOR TROUBLE: WHAT IF WE GET THESE OPTIONS?

Although the alternative forms of transfer are not "new" (e.g. Michelsen and Young 1993, MacDonnell and Rice 1994), research to explicitly support them had not appeared to an expert panel convened in February 2006, in association with the Central Plains Irrigation Association meeting, or in years of inquiry and participation in water discussions. The following notes partly reflect that panel discussion. It was agreed that risks of a failed innovation may include discrediting the innovation instead of the attempt. No qualitatively different problems for these forms have yet been identified, compared to "buy-and-dry", except the need for innovative contracting negotiation and the retreat from an initial demand for "permanence" in water acquisitions for municipalities. This has been especially prominent where the officials perform professional roles oriented solely to acquisition and management of water supply rather than serving constituencies whose interests are complex.

On-farm issues partly overlap with the many problems created by "buy-and-dry", but since the new forms avoid permanent dry-up they reduce them a great deal, particularly soil and fertilizer management issues. Tillage and equipment usage would very likely be shifted, with no-till and anti-erosion measures emphasized as well as moisture retention practices. Capital equipment and financing problems are simplified with very long planning horizons, made possible by the very long term contracts contemplated, and it becomes possible to consider management for maximum economic yield rather than maximum possible harvests. The ideal rotations for either rotating crop management or safe use of interruptible supply agreements will likely involve reduced sizes of harvest, but profitability reflects expenses as well as gross revenues, and net for the operation will reflect payments for the water transferred and other contract terms. Compatibility with other activity (agritourism, wildlife access, and assorted USDA programs, etc.) may add value. Adjustments may take some time, though that would be available, for a change! Farm families would have more choice.

Off-farm social and economic issues appear to be considerably more manageable in comparison to the "buy-and-dry" approach. At least during adjustment periods, some reduction in activity and labor will likely induce secondary impacts to both forward and backward linkages to the farming enterprise, and pecuniary impacts to local economies, but these would be much less than where large volumes of water are sold, even if they are leased back for some period. Retaining an ownership interest supports intensification and improvement of agricultural activity; this may be especially important in marginal commodity production as

well as near-urban areas where agriculture's open space supports other values (Environment Colorado 2006, Hellerstein et al. 2002, Governor's Commission 2000). Preservation of ditches and irrigation districts as functional units may have social as well as environmental benefit.

Unforeseeable biological problems may result from de-watering agricultural land and canals which have become a partial substitute for riverine and wetlands environments converted to agricultural use. River mainstems have already undergone profound changes in fluvial processes and flow hydrographs, and geomorphology, resulting in biological community change and successional novelties little examined since they occur on private lands offering limited access. Additional concerns relate to soil degradation and loss of fertility due to discontinuation of irrigation after very long periods, and off-farm concerns for erosion and run-off. Mainstem ecological changes are widely observed, in problems of invasive species, but there is little investigation of cumulative impacts on private land and water. The irrigated areas are now "hybrid ecologies" (Crifasi 2005) highly dependent on human water management providing the partial substitute for riparian, wetland, and other environmentally important areas. Almost no water is unchanged somehow. But reform in allocation which did not include currently non-market interests and values, as discussed above, could mean hitting more thresholds faster.

The three most threatening problems may be (1) the lack of social organization needed for the irrigators to engage constructively with the opportunities as well as to defend their interests, (2) the myopic urban preference for permanent water sales regardless of long-term interests, and (3) the underinvestment in resource assessment that threatens public interests in environment, recreation, and amenity. All of these are curable, but delay is expensive.

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