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Expanding Institutional Arrangements for Acquiring Water for Environmental Purposes: Transactions Evidence for the Western United States

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ABSTRACT *Market purchases of water rights for environmental purposes in the western United States have involved purchases by public agencies of at least 88 850 acre feet of water over the last five years. Annual water leasing for environmental purposes has been more active, with 1.72 million acre feet leased in the western United States. The most frequent reasons for these transactions are for wildlife (primarily waterfowl), recreation and fisheries. The average price paid for a water right is \$609 per acre foot, while it is \$30 per acre foot for an annual water lease. As evidenced by the ability of government agencies to purchase water in voluntary transactions, environmental uses of water are often competitive with many low-value agricultural crops in the western United States.*

Introduction

In many countries there exists increasing competition over fully utilized water supplies. In arid countries, traditional uses of water such as irrigation and municipal and industrial uses often utilize all the available water, resulting in dry stream beds, dropping aquifers and falling lake levels. Lakes in countries as different as Russia and the United States are often drawn down to the detriment of fisheries. In the United States, groundwater pumping by the states of Texas and Nevada has so drawn down natural springs that two fish species are listed as endangered under the US Endangered Species Act. Diversions from the Colorado River in the southwestern United States result in highly saline water deliveries to Mexico and a dying Colorado River delta ecosystem. Some rivers are seriously depleted during summer periods to produce low-value crops such as alfalfa, when economic analyses often show that keeping the water in-stream for hydropower, fisheries, recreation and higher-value agriculture downstream is more valuable (Watts *et al.*, 2001).

Until recently, environmental values of water were not observable in the marketplace. At first such environmental values were largely ignored, and all the available water was allocated to market uses such as agricultural, municipal and industrial uses. Now most western states in the United States have programmes or laws that recognize in-stream flow as a beneficial use. As will be

seen in the transactions evidence, however, some states facilitate active implementation of their in-stream flow laws more than others. Over the last two decades economists have developed techniques to shadow price environmental values of water. The methods include such approaches as the travel cost, contingent valuation and hedonic price methods. Government agencies have embraced these methods and incorporated them into their cost-benefit procedures (US Water Resources Council, 1983). While the methods are widely used by economists, there remains some suspicion among water development agencies over the resulting values. In some cases, water development agencies' failure to distinguish between financial and economic values of water results in economic values without cash transactions being treated as 'second-class' values. This sometimes leads to irrigation districts and hydropower producers being asked to relinquish water for in-stream flow purposes reportedly of higher economic value to counter with a 'show me the money' attitude.

Because most water in the western United States was allocated to off-stream uses before in-stream values were formally recognized, protecting in-stream flows often requires reallocation from these off-stream uses. Over the first part of the 1990s what water reallocation took place generally followed a regulatory process. For example, in California, the State Water Resources Control Board amended Los Angeles's water right so that more water would remain as in-stream flow and go into Mono Lake (Loomis, 1995). However, administrative reallocation is strongly opposed by existing off-stream water users (Gillilan & Brown, 1997). For example, the USDA Forest Service has attempted to impose in-stream flow requirements as a condition of permitting a utility company's dams on national forest lands, but the agency's efforts have been met with vocal opposition by Colorado's traditional water users. Voluntary market transactions meet with less opposition. In this spirit, the Colorado Attorney General has recently proposed that federal agencies such as the USDA Forest Service should use the federal Land and Water Conservation Fund to buy water rights for the in-stream flows they desire (Salazar, 2001). As Colby (1990, p. 1116) notes, "Where instream flow maintenance is recognized as a beneficial use so that water rights may be held for that purpose, market transfers could become an important means of accomplishing instream flow protection".

This paper reports on the progress that has been made since 1990 in water market transactions for in-stream flow in the western United States. In a sense, the purpose of this paper is to show the water resource development community the money. In the last few years, millions of dollars have been spent by public agencies and non-profit organizations to purchase water rights or lease water for in-stream flow purposes. This paper documents these transactions in the western United States, where such water market transactions for environmental purposes such as fisheries, recreation and wetlands have been most active. These transactions provide some indication that the shadow prices estimated using non-market valuation methods reflect real value, which agencies or organizations are willing to back with real money.

Water Transactions for Environmental Purposes

Water market transactions may occur as personal negotiations or via brokers, over the phone or, in some states, over the Internet. If there are so few market transactions in a given area such that a 'going' price is not available, negotiated

transactions determine prices and the specific conditions of the sale (Colby, 1990). Because market transactions obtain water through voluntary action, water right holders are fully compensated for selling or leasing their water rights.

The federal government, state agencies, private organizations and individual farmers are all involved in these markets and have gained extensive experience with market transfers. As an example of federal government water market involvement consider the Lahontan Valley (near Fallon, Nevada) water market, which was formalized by the US Water Rights Settlement Action (PL101-618). In this water market, the US Fish and Wildlife Service was offering a price of \$500 per acre foot for a water right and had acquired 40 water rights for a total of nearly 19 000 acre feet of water (Ise & Sunding, 1998).

Since water rights and water laws are very complex, most buyers perform a legal evaluation prior to purchase. The US Bureau of Reclamation has an extensive screening process that usually includes a title search, owner verification, seniority assessment, a review of historical cropping patterns and verification of acres irrigated over the last five years. Not every evaluation is as extensive as the Bureau's but it is very important to know the quantity, seniority and validity of a water right prior to the final water market transaction (Landry, 1998).

Types of Water Transactions

There are three different types of acquisitions that are available in a water transaction: leases, purchases and donations. This paper only discusses leases and purchases because only these reveal market values. A donation is free of direct market value (although there may be tax savings). A lease is a temporary contract that provides flexibility and has at least two advantages. First, leases provide an opportunity for water right holders to become comfortable with the idea of in-stream flow marketing. Water right holders have a chance to see how a lease affects their water needs and organizations can assess how effective the quantity of in-stream flow leased has been in achieving their environmental objective. Secondly, leases provide an opportunity for organizations to determine whether the effects of water transfers on local communities are significant or not. Many critics are concerned that shifting water away from irrigation may erode a community's economic base. Leases also offer flexibility to accommodate particular needs of both buyers and sellers. A variety of lease options are available, from standard annual and multi-year leases to dry-year and split-season leases. With dry-year options, arrangements are made in advance for access to water during a drought period. Split-season leases allow a portion of a water right to be used for irrigation early in the year, leaving the remaining portion of the right for in-stream or environmental use later in the summer (Landry, 1998).

Purchases of water rights involve permanent transfers that offer long-term solutions to a specific water-related environmental problem. Most private groups acquiring water for environmental uses prefer water right purchases to annual water leases. For example, the Oregon Water Trust has relied on leases in the past but considers them an interim device and is shifting its focus to water right purchases (Landry, 1998). Many organizations agree that purchases are the best option for streams that have chronic flow problems, and also for habitat for species that can only be saved with long-term water flows made possible by obtaining water rights.

Spatial Extent of Water Markets

Most water market transactions do not occur in fully competitive markets, with numerous buyers and sellers all having perfect information. At the present stage of western water market development, water transactions often involve a few buyers seeking out willing sellers from among a few individuals who have senior water rights on the particular river of interest. Thus, in some cases, such as a small watershed, a traditional competitive market does not exist because there may be very few sellers who have water rights on the river where the agency or group wishes to increase in-stream flows for a particular fish or environmental purpose. In other cases, such as providing water for large areas of wetlands in the Fallon area of Nevada, there are many irrigators who could supply the water, and more competition is likely on the supply side. In large river basins like the Snake River, the US Bureau of Reclamation can identify a multitude of water right holders who could provide the water, although the Bureau may be the dominant buyer. Thus, the extent of the market, or whether the markets are 'thin' with few buyers and sellers, or competitive with numerous buyers and sellers, will depend on the size of the watershed and the environmental purposes for which the water is being obtained.

Therefore, we can have either a monopolistic market (one seller) or a monopsonistic market (one buyer) for water rights. Although the market prices observed in our data may not necessarily be competitive prices, they are nonetheless the amounts that a willing buyer and seller agreed to. The prices provide an indication of the marginal benefit of the water for the environmental purpose, as well as the opportunity cost to the seller. As these transactions become more commonplace in large water basins, it will be interesting to see if prices fall to more competitive levels.

Data

The *Water Strategist* journal was the primary source of information on environmental transactions for this analysis (Stratecon, Inc., 1995–99). The journal reports on water marketing, finance, legislation and litigation. Since January 1995, there has been a special section in the journal called 'Transactions', which lists monthly purchases, leases and exchanges of water in the western United States. The 'Transactions' section documents the purchaser and the supplier of the water, where the water is located, the transaction purpose, the price and amount of water transferred and the status of the transaction. There is also a brief summary included, which may provide further details about the transaction. The journals used for this analysis ranged from January 1995 up to December 1999. The journals were quarterly issues until January 1999 and now are published on a monthly basis. The analysis began with January 1995 data because this was when the environmental transactions began to be fully documented in terms of environmental purposes.

The authors also located additional water purchase transactions for environmental purposes in Simon (1998), who reported several water transactions by US Department of Interior agencies. Using this paper and the 28 issues of *Water Strategist*, the authors catalogued 84 complete transactions. Ten of the 11 western states had fully documented transactions plus one Midwest state, Nebraska. The number of transactions per state ranged from one lease in Montana, and one

Table 1. Summary of water lease transactions in the western USA (1999 dollars)

	Annual water lease price (\$/acre foot)	Average quantity leased (acre feet)	Number of transactions
Arizona	41	2 000	1
California	48	40 109	24
Colorado	11	2 298	6
Idaho	19	84 586	7
Montana	2	72 270	1
New Mexico	6.50	23 500	2
Oregon	114	4 463	6
Washington	34	1 869	5

Source: Summarized from *Water Strategist*, January 1995 to December 1999.

purchase in Nebraska, to 24 for California. Tables 1 and 2 provide the complete list. The market values per acre foot of water for all of the transactions before 1999 were inflated to 1999 US dollars by using the Consumer Price Index.

Results

The water quantity weighted average price per acre foot of water in the study was \$609 for a water right and \$30 for a one-year water lease. Tables 1 and 2 present a summary of the water right purchases and water leases. Idaho represents the largest average quantity of water leased and purchased (mostly for out-migration flows for salmon). Nevada was a close second for water purchases, with a great deal of water being purchased by the US Fish and Wildlife Service for wetland maintenance and restoration for the Stillwater National Wildlife Refuge near Fallon, Nevada. California had the largest number of water lease transactions.

It is interesting to note that many of these lease values per acre foot are similar to non-market recreation values of in-stream flows estimated using the travel

Table 2. Summary of water right purchase transactions in the western USA (1999 dollars)

	Water rights price (\$/acre foot)	Average quantity bought (acre feet)	Number of transactions
Arizona	42	1157	4
California	2817	399	1
Colorado	1088	91	10
Idaho	131	8258	3
Nebraska	794	1288	1
Nevada	995	7315	5
Oregon	243	3858	5
Utah	1200	316	2
Washington	830	361	1

Source: Summarized from *Water Strategist*, January 1995 to December 1999.

Table 3. Monetary values paid for water right purchases and water leases for environmental purposes within the western USA

	Water rights ^a			Water leases ^a		
	Number of transactions	Percentage of transactions	Value (\$/acre foot)	Number of transactions	Percentage of transactions	Annual \$/acre foot
In-stream flow	18	56	753	35	67	45.82
T&E species	7	22	1010	6	12	58.32
Riparian	2	6	42	0	0	NA
Fish	10	31	511	29	56	40.82
Recreation	11	34	1245	4	8	9.80
Water quality	3	9	917	0	0	NA
Wetlands	2	6	1111	7	13	55.08
Wildlife	12	38	1019	10	19	35.53
Ecosystem services	11	34	1061	7	13	40.70

NA, Not applicable.

^a Note that the percentages add up to more than 100% as buyers indicated more than one purpose on several sales.

Source: Summarized from *Water Strategist*, January 1995 to December 1999.

cost and contingent valuation methods as summarized in the literature (Loomis, 1986). Some of the market values in Tables 1 and 2 are quite high, with Oregon recording an average annual lease rate of \$114 per acre foot. In Oregon the emphasis of water market transactions has been on providing water for salmon and steelhead recovery, and recently for bull trout habitat flows. Not only do these prices represent the value at the margin for environmental purposes, but they also provide some insight regarding opportunity costs to farmers to lease water. As can be seen, the values are fairly low in Colorado and Idaho, and so the opportunity costs of providing in-stream flows in some areas of these states are rather low.

Environmental Purposes of Water Transactions

As shown in Table 3, the most frequent purpose stated for water right purchases was the general reason of increasing in-stream flow (56%). However, the more specific reasons for water right purchases that were commonly listed included wildlife (often waterfowl), ecosystem restoration, recreation, fish and threatened and endangered (T&E) species.

For water leasing, in-stream flows were also the most common reason stated, but in contrast to water right purchases, the second most common reason for water leasing was fisheries. Water leasing was used about half as often as purchases for T&E species, recreation, wildlife and ecosystem services.

Table 3 also presents the monetary values paid for water purchases and leases in the western states by environmental purpose. Several water purchases were in the range of \$1000 per acre foot for T&E species, water quality, recreation, wetlands, wildlife and ecosystem services. In contrast, annual water leases were in the range of \$40–50 per acre foot for most uses. The implied discount rate is approximately 5% to equate annual lease values with water right purchase values.

With several thousand acre feet being purchased and thousands of acre feet being leased each year at prices greater than competing agricultural values, the water development community has clearly been shown the money in environmental uses of water.

Comparison with Non-market Value Estimates of Water

Although market transactions with real money changing hands speak louder to water managers than do shadow prices of water estimated by non-market valuation methods, nonetheless the two types of values are in closer agreement than managers might suspect. Brown (1991) has tabulated many of the non-market recreation benefit estimates derived from travel cost and contingent valuation methods. Brown (1991) reports that many of the annual benefit estimates are in the \$1–12 per acre foot range, with \$25 per acre foot being the most frequent high value. Comparing these estimates with those in Table 3 yields some fairly close comparisons. Specifically, recreational lease values are reported in Table 3 as \$9.80 per acre foot, quite close to the majority of per acre foot values reported by Brown (1991). Annualizing the water right purchases for recreation at the implied 5% discount rate yields a value of \$62 per acre foot, a value greater than the two higher-end studies reported by Brown (1991). The point here for water managers is that non-market valuation techniques for recreation are providing estimates fairly close to, and perhaps on the conservative side of, what public agencies are actually paying for water for in-stream flow for recreation.

Conclusions

Water transactions for environmental purposes are becoming more frequent and commanding large monetary values. More than \$100 million of water has been bought or leased in the last five years in the western United States for a wide variety of environmental purposes including recreation, fisheries and waterfowl. The fact that public agencies and non-profit organizations have been able to purchase water in voluntary transactions suggests that environmental values of water now exceed the value of marginal quantities of irrigation water in some locations of the western United States, otherwise farmers would not sell some of their water rights. Water markets for environmental purposes will help facilitate the reallocation of water from older, lower-valued uses to new, higher-valued uses. As water markets evolve and the values of water resources are revealed through market transactions, those values will further demonstrate that environmental uses of water are valuable to society and should be recognized as beneficial uses, on an equal basis with traditional uses of water.

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