WATER TRANSFERS IN CALIFORNIA: 20 YEARS OF PROGRESS, VIEW TO THE FUTURE

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ABSTRACT

Throughout the 1980's the California Legislature authored changes to California law that encouraged market-based water transfers as an alternative to development of new water supplies. At that time, and continuing to the present, projections in the California Water Plan were that many regions throughout the State would be short of water by 2020. The belief was that market reallocation of existing developed water supplies would reduce environmental impacts associated with water supplies and allow water to go to higher economic uses. Notwithstanding the new legislation, water supply conditions were not severe enough to trigger the need for water transfers until 1991, the fourth year of a prolonged drought.

This paper provides a background on water in California, and a summary of the practice of market-based water transfers in California with an emphasis on short-term transfers (defined as one year or less). Transfers begin with the 1991 State Emergency Drought Water Bank and continue to the present. Historical data and several case studies are provided for illustration. The paper addresses the future direction of this important water management tool for providing increased water supply reliability for both agricultural and urban water users. This includes several examples of long-term market-based water transfers that are either underway or being contemplated.

INTRODUCTION AND BACKGROUND

Physical and Legal Setting

California has a temperate Mediterranean climate and abundant water resources. It has a population of 38 million people, and more than 9 million acres of irrigated farmland. Roughly 2/3 of the population is in the southern part of the state, and 2/3 of the water resources in the northern part.

It rarely rains during summer months. Consequently large surface reservoirs have been developed to capture water during the wet months (November through April) for release in the dry months (May through October). California is fortunate to have natural "reservoirs" in the form of extensive groundwater basins and seasonal snow pack in the Sierra Nevada Mountains. All of these water resources contribute to a diverse, large water resources mix. Figure 1 is a map showing California's principal agricultural regions, river systems and water projects.

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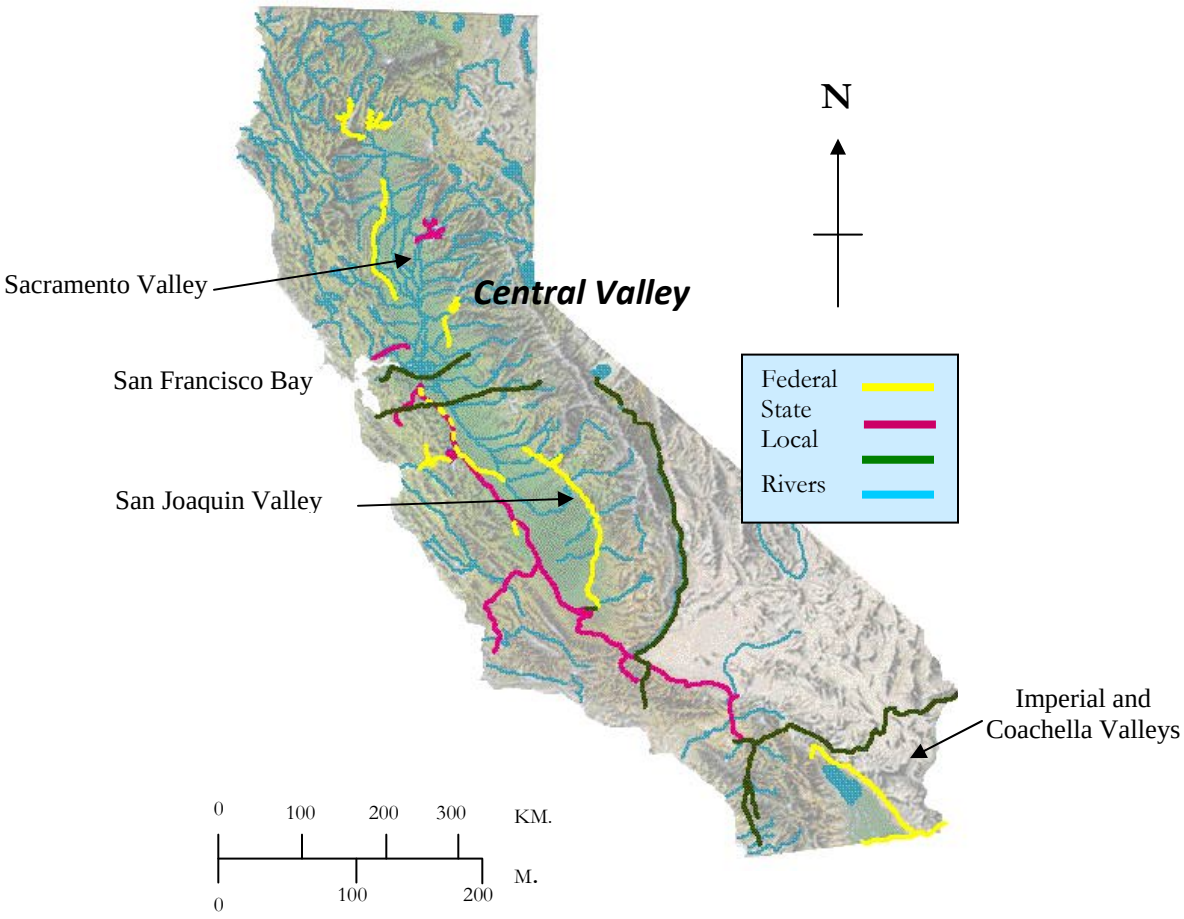

Figure 1. California River Systems and Water Projects, Principal Agricultural Areas

The Sacramento Valley is in the water-abundant north, and most of the region has ample water supplies in even the driest of years except for periods of extraordinary drought (e.g. 1977). There are more than 2 million acres of irrigated farmland. Return flows from irrigated agriculture are available for downstream users, and consequently water conservation measures are generally not considered for water supply reasons. A major crop is rice. The San Joaquin Valley has extensive productive farmland with a wide mix of crops. Agriculture benefits from local and imported surface water as well as extensive groundwater supplies.

Southern California is very dry, and most of the cities rely on water imported from Northern California and the Colorado River to the east. Cities near San Francisco Bay get their water supplies either directly from sources in the Central Valley or from reservoirs located in the Sierra Nevada on the east side of the Central Valley. Most water projects are designed to sustain a recurrence of the droughts of 1928 - 1934 and 1987 - 1992. Northern California has adequate water supplies in most years, while the large population in Southern California is very susceptible to drought.

Much of California's developed surface water supplies are in the Central Valley, drained by the Sacramento River in the north and the San Joaquin River in the south. These two rivers join in the Sacramento-San Joaquin Delta (Delta) and flow into San Francisco Bay. The Delta is a tidal estuary where salinity is maintained by releases of fresh water from upstream reservoirs.

Several major water projects store water in reservoirs on these rivers, and divert water from the Delta. Salinity concentrations are managed at levels sufficient for both urban and agricultural uses in the export areas, as well as local uses in the Delta itself. Water is pumped from the Delta to other areas of California, including cities in the San Francisco Bay Area and Southern California. Water is also pumped to farms in the southern portion of the Central Valley. The region where these two rivers join is important not only to California's water supply, but also to the state's natural environment. The Delta is home to more than 750 species of plants and animals, including resident and anadromous fish. Conveyance of water through this artificially-managed tidal estuary was intended to be a short-term measure prior to development of a fresh water canal to divert water around the end of the Delta to the urban and agricultural water users to the south and west. Significant environmental conflicts, changing public values, and years of litigation have stalled a long-term solution to water conveyance through or around this estuary. As human demands for water increased over the past 20 years, as well as the understanding of environmental water needs (quality and quantity), there has been the continuing erosion in the reliability of water supplies for all purposes.

California surface water rights were initially riparian and self-enforced. Towards the end of the 19th century appropriative water rights were added to the institutional framework, and such rights have been administered by state government since 1914. As to groundwater, no rules have been developed other than the general rule that overlying landowners have a higher priority to use of underlying groundwater than water users located elsewhere. Overlying landowners have the right, similar to an ownership right, to withdraw groundwater for use on their property.

Major Water Supply Infrastructure

The U.S. Bureau of Reclamation's (USBR) Central Valley Project (CVP) has five large reservoirs and more than 500 miles of canals. The CVP has water supply contracts to deliver more than 8 million acre-feet per year of water to more than 100 water and irrigation districts in the Sacramento and San Joaquin Valleys. Most of the water is for irrigation, although it delivers some urban water supplies within the Sacramento and San Joaquin Valleys and the San Francisco area. More information on the CVP can be found at: http://dataweb.usbr.gov/html/cvp/html/. The Department of Water Resources' (DWR) State Water Project (SWP) consists of 28 reservoirs, 500 miles of aqueducts, and other facilities. Total contractual commitments are to deliver 4 million acre-feet of water per year to 29 public water agencies. The SWP delivers 75 percent of its water to cities throughout California and the remaining 25 percent to farms in the San Joaquin Valley. More information on the SWP and DWR can be found at: http://wwwdwr.water.ca.gov.

California has a substantial number of regional surface water projects, developed primarily by regional or local water utilities. Such agencies include the Metropolitan Water District of Southern California (one of the world's largest urban water utilities) with its diversions from the Colorado River, East Bay Municipal Utility District and its diversions from the Mokelumne River in northern California, and the San Francisco Public Utilities Commission with its diversions from the Tuolumne River.

While California has very extensive surface water resources and infrastructure, water users also rely on extensive groundwater withdrawals to meet demands. Much of the state's groundwater use is within the Central Valley. For much of the last 30-40 years, the average overdraft (pumping more groundwater than is naturally recharged) has approached 2 million acre-feet per year with much of that in the San Joaquin Valley portion of the Central Valley.

What is a Water Transfer, Early Driving Forces

So what exactly is a water transfer? Water transfers typically involve changes in the place, purpose and/or method of water use. California water transfers have typically been from agricultural use to urban use, although transfers to high-value agriculture are increasingly common and in recent years transfers have been developed from agricultural use to environmental uses. The term "water transfer" is used in this paper to refer to the more modern market-based water transfers, and not to the historic permanent transfer of water from one basin to another that was typically associated with large water projects and extensive infrastructure. Market-based water transfers were developed initially to meet emergency needs during drought conditions, as described below. They had a policy basis in laws passed by the California Legislature during the 1980s to encourage transfers and remove legal/institutional barriers. These laws had substantial support from key environmental groups as a means of reallocating existing developed water supplies as an alternative to building more surface storage facilities.

Both short-term and permanent water transfers have used the same market mechanisms: buying water from other water users. This kind of program requires three components: (1) the institutional support for buying and selling water; (2) adequate water infrastructure to transport the water from the buyer to the seller; and (3) the ability and willingness to solve problems affecting other parties that may result from the transfer. Implementation requires most of the elements of any commodity market, as well as a layer of public policy since water is considered a prominent public resource. No water transfer can be implemented without adequate infrastructure to move water from the seller to the buyer. California's successful programs have been possible due to more than a century of water development resulting in the water resources infrastructure pictured earlier in Figure 1.

STATE EMERGENCY DROUGHT WATER BANKS, 1991-1994

1991: A Large-Scale Experiment

Since the 1980s, California water law has allowed and encouraged water to be sold from one user to another, but there was very little practice of these market-based water transfers until 1991. In January 1991, California was in the middle of a severe drought, and for the first time implemented a large-scale water transfers program. The California Drought Water Bank acted as a central buyer for transfers. Sellers were primarily farmers in the Sacramento Valley growing relatively low-value crops. State government forced all transfers to go through the drought water bank, and effectively prevented transactions outside the drought water bank. This was done initially since there was no effective water market. The lack of institutional history and an emergency need to assure that public health and safety water needs would be satisfied, resulted in this centralized approach. This approach was taken for the drought years 1991, 1992, and 1994, but left open the possibility of different water market models for the future. Further, drought water banks were created for a duration of one year. This limited risks to sellers and buyers, and helped to emphasize that the centralized program was designed for emergency water supply conditions.

More than 150,000 acres of irrigated farmland was idled to support the program. Other farmers sold their surface water supplies and relied on greater withdrawals of ground water. Still other water districts sold surplus water from smaller regional surface water reservoirs. The Drought Water Bank was managed by DWR in cooperation with the U.S. Bureau of Reclamation, and was staffed by 100 people as an emergency effort (the author was manager of this program).

The Experiment Continues

The Drought Water Bank continued in 1992 and 1994, and provided substantial institutional experience for large-scale water transfers and marketing. The price for water in 1991 was as high as $125 per acre-foot, but dropped to less than half that amount in 1992 and 1994 as the water market gained more experience and water supplies were less severe. The $125 per acre-foot price was also based initially on crop idling, which was not employed in 1992 or 1994.

Water transfers came about in the early 1990s for several reasons. Foremost was the long hydrologic drought, with record low reservoir storage levels after four consecutive critically dry years. A second factor was the feeling throughout California that the drought was a water supply crisis, and historic regional water conflicts were set aside for the common good. A third factor was the appeal of the economic theory of market-based reallocation of water, which had been promoted by many environmental groups and academic researchers over the prior decade as an alternative to building new reservoirs. A fourth factor was the extraordinary cooperation of a large number of federal and state regulatory agencies, and their assurances to both sellers and buyers that they would support a water market through expedited regulatory approvals. A final factor was the

high price for the water that the buyers were willing to pay, and a willingness on their part to pay in advance for the water rather than waiting until the water was delivered.

While the drought ended in 1995, water transfers continued to play a role in helping to meet periodic water shortages. A summary of interbasin water transfers from agricultural water users to urban water users for the period 1991 through 2001 is shown in Table 1. Note that these are market-based transfers between different hydrologic basins, and are in addition to substantial transfers that may have occurred within each basin as well as long-term transfers among basins due to facility development and/or long-term agreements. For example, this does not reflect the long-term transfer agreements between Imperial Irrigation District and both the Metropolitan Water District of Southern California and San Diego County Water Authority, or the water transfers and exchanges that occur frequently among water users on the Sacramento River. The amounts varied from year to year due to changes in hydrology, as well as storage and water delivery conditions for the primary sources of long-term supplies.

Table 1. Summary, Agricultural to Urban Transfers in California, 1991-2001
(Source: internal records, DWR, August 2001)

Year	Number of Transfers	Amounts, Acre-feet
1991	670	349,000
1992	300	31,000
1993	245	31,000
1994	360	25,000
1995	160	1,000
1996	260	1,000
1997	480	35,000
1998	200	2,000
1999	170	2,000
2000	170	2,000
2001	740	50,000
TOTAL	3,755	529,000

The sources of many of these transfers (but not all) are water users in the Sacramento Valley. In addition to the transfers shown in this table, there were substantial "Agriculture to Agriculture" transfers largely from low value to high value crops. In 1991 the source crops were primarily alfalfa, pasture and field corn. Due to changes in crop commodity prices and other factors, a substantial amount of rice was fallowed in 2001. Similar conditions returned in 2008 and 2009, driven by high international rice commodity prices.

This history reflects that California water users look to the Sacramento Valley as a source of market-based transfers to supplement their reduced dry year supplies, although there are water-short areas in northern California as well. A principle adopted by DWR in 2001 was that local needs should be met first before transfers from the Sacramento Valley proceed.

From 1995 through 2007, California experienced a number of normal and dry years. Following the completion of the 1994 Drought Water Bank, water transfers continued to occur through transactions directly arranged by sellers and buyers without centralized management.

Conditions changed dramatically in 2008, a second consecutive dry year during which reservoir levels began to drop to low levels. Water users throughout California began discussions regarding potential water transfers. It was clear early in the year that DWR would not organize and operate a drought water bank. Indications are that transfers were in the range of 125,000 to 250,000 acre-feet. Transaction costs were fairly uniform between sellers and buyers, at $175 per acre-foot. This was based largely on the value of water to the sellers, who would otherwise use the water to irrigate crops.

The lack of direct involvement from state government, coupled with a pending change in the leadership of the federal government (national elections were held in November 2008), resulted in poor coordination among state and federal water, fish and wildlife agencies. Many of these agencies have regulatory roles regarding water transfers, and there was no central point of coordination. This greatly increased transaction times and costs over what they had been in the 1990s. In addition, declining budgets for many of these regulatory agencies substantially reduced the staff available to review proposed water transfers. A final concern was the lack of centralized, uniform rules. Many potential sellers were frustrated over the lack of clear rules, and one of the largest water users in the Sacramento Valley – the Glenn Colusa Irrigation District – decided not to sell water during 2008 for this reason.

Reservoir water throughout California continued to drop in the summer and fall of 2008, bringing attention by the Governor to continuing drought conditions. In July 2008, the Governor declared a “drought emergency” and called for the creation of a drought water bank to match potential water sellers and buyers together to help meet critical water needs in the following year. This timing was very important since most sellers are farmers who typically harvest their crops in late summer, and begin planning in October for the following year. Conditions at this time were different than they were in 1991 when a “drought water bank” was first created. Based on experience with subsequent water market transactions by various urban and agricultural water utilities, the Governor did not require that all transactions go through a centralized program although a state Drought Water Bank was again developed. There was some confidence that many sellers and buyers would make their own transactions without direct intervention by state government. The 2009 Drought Water Bank was identified to meet three purposes: (1) develop and sustain a robust water transfers market; (2) provide water for critical health and safety needs; and (3) coordinate and facilitate compliance with regulatory (primary environmental) requirements.

Table 2 summarizes all transfers during 2009 that were known to DWR (personal communication, State Drought Coordinator Wendy Martin, August 24, 2009). DWR initially expected that most water transfers during 2009 would go through their process.

In fact, only about 15 percent of transfers went through the Drought Water Bank, although all transactions had to go through some form of DWR regulatory approval.

Table 2. 2009 Water Transfers
(Source: Personal Communication, State Drought Coordinator Wendy Martin, August 24, 2009)

Water Transfers	Amount, Acre-feet
Drought Water Bank	81,275
Private, north to north	80,640
Private, north to south	250,500
Private, south to south	200,000
TOTAL	612,415

These results require some explanation. The drought water banks of the early 1990s occurred during an era where there was little transaction experience. It was also a time when state government essentially forced all transfers to go through the centralized function of the drought water bank. Over time, sellers and buyers gained enough knowledge to negotiate and implement transactions themselves. Such direct transactions also provided opportunities to speed the transactions and reduce costs.

The "north to north" transactions were all within the Sacramento Valley, keeping the water supplies in the local region to assure that all needs would be met within the selling region. The "north to south" transfers were similar to the drought water bank – farmers in the Sacramento Valley selling to water users in the San Joaquin Valley and Southern California. These transfers did not go through the drought water bank, and most of this water went to urban Southern California.

2010 promised to be another intense water transfers year due to continuing drought conditions. However, abundant rains throughout the spring filled a number of larger reservoirs with the exception of the SWP's Oroville Reservoir. Consequently many short-term transfers in 2010 were limited to SWP water users. No data on quantities was readily available at the time this paper was prepared.

TRANSITION: EMERGENCY SUPPLIES TO LONG-TERM RELIABILITY

Trends in State Water Policy

A major change in modern California water resources planning came about with the 2005 Update to the California Water Plan, updated even further in the 2009 Update. The original California Water Plan in 1957 was a framework for water development, and contained large-scale plans for developing reservoirs, canals and pipelines throughout California to meet the needs of a growing population. State law requires the Plan to be updated every four to five years, and the subsequent updates have largely been refinements on the original water development plans with a principal focus on reservoirs and canals. The 2005 Update took a much different approach, recognizing that water needs can be met in many different ways. To a large extent this reflected actions already

being taken at the local level since large water infrastructure was becoming increasingly difficult to implement due to environmental and cost considerations. The 2005 and 2009 Updates have a strong emphasis on integrated approaches to solving water resources problems, with a full range of water management tools needed to meet California's long-term agricultural, urban and environmental needs. One of the key water management tools identified was water transfers.

Other than development of large water infrastructure programs, the planning horizon for water and land resources historically has been relatively short – 20 years or less – and generally associated with financing time frames. This has changed in recent years, with increasing attention on long-term sustainability of water supplies to meet urban water needs. In 1990, state law was changed to require preparation of "Urban Water Management Plans" (UWMPs) by most water utilities, to be completed and updated every five years. Over time these plans have become increasingly important as a useful planning document as well as a potential target for litigation. This has focused the water community on the need to assure that such plans are as technically rigorous as possible. The trend is clear. Urban water utilities are increasingly being required to demonstrate that they have reliable water supplies well into the future. More and more urban water utilities are including water transfers in their mix of water management tools, in addition to more aggressive water conservation, wastewater recycling and distribution system improvements.

Long-Term Transfers, Water Transfer Lessons

Long-Term / Permanent Water Transfers. It was clear from the drought water bank transfers in 1991, 1992, and 1994 that this could be a new tool to aid in urban water supply reliability, since purchase of developed water supplies from agricultural water users was competitive in cost to development of additional water supplies. It was also clear from past experience that such purchases would be too expensive in the long term for agricultural water users except for high-valued crops. Consequently, long-term and/or permanent water transfers are typically from irrigation districts to cities.

Five examples of long-term and/or permanent water transfers are summarized in the paragraphs below. Locations of these individual programs are shown in Figure 2.

Figure 2. Location of Example Long-Term / Permanent Water Transfer Programs

1. **Metropolitan Water District of Southern California.** In the mid-1990s the Metropolitan Water District of Southern California (MWD) adopted a three-part strategy for transfers:

   - Permanent or long-term transfers, providing water every year.
   - An "options" agreement, where a seller would be given a small payment every year under the condition that MWD could exercise an option to purchase water in any year.
   - Purchase water in only dry years on the market, often referred to by economists as the "spot market". Each of these fits well into a typical urban water agency's water supply portfolio.

   A number of urban water agencies have adopted this general water purchase strategy. In the case of MWD, they have developed a long-term options agreement with the Palo Verde Irrigation District along the Colorado River in California. This agreement requires that MWD make an annual payment to the

sellers for the right to purchase water in a dry year. In years when the option is exercised, the parties agree on a market purchase price. MWD has developed a number of other water transfers and exchanges throughout California in furtherance of their 3-part water transfers strategy.

2. **City of Tracy.** The City of Tracy (City) had increasing concerns regarding the reliability of their existing 10,000 acre-feet per year of surface water supply from the federal CVP and 9,000 acre-feet per year of groundwater, particularly during below normal and drought years. At the same time, this growing city near San Francisco Bay had increasing potable water demands. The City developed a comprehensive water supply strategy that included securing 10,000 acre-feet per year of supplemental surface water supply. Based on this strategy, the City identified potential entities with surplus supplies, and negotiated a long-term agreement with two local irrigation districts that had service area boundaries near, or overlapping with, the City's water service area. Due to timing and cash flow issues, the City paid for and acquired 7,500 acre-feet per year of water supply immediately, and subsequently negotiated a set price for the transfer of the remaining 2,500 acre-feet per year. Payment for this second amount of water was deferred for three years to allow time for cash reserves to buildup. This deferral also worked well with the timing of increased water demands from new development.

   These supplemental supplies significantly enhanced the reliability of the City's existing water supply, particularly during periods of reduced dry year surface water deliveries. The City's water supply strategy also identified other opportunities to diversify the City's portfolio of supply sources. The City participated in an entirely new treated surface water supply project (South San Joaquin Irrigation District Project) that receives its source water from a different, remote watershed not adjacent to the City. The City acquired an additional supply of up to 10,000 acre-feet per year, meeting their goal to further diversify its water sources. Consequently, together with other actions taken in the past few years, the City has two different treated water supply sources, groundwater supplies and recycled water supplies.

3. **Stockton East Water District.** This water district serves much of the urban area of the City of Stockton, in Northern California. It has negotiated two 5-year water transfer agreements with local irrigation districts as a trial program to see if the District wants to include transfers in their water supply portfolio. The combined purchases are about 11,000 acre-feet per year. These agreements allow Stockton East Water District to evaluate how the supplemental water supplies integrate into their water project operations, as well as determine if the institutional relationships will be good for a long-term period.

4. **State Water Project Contract Purchases.** As indicated earlier in the paper, the State Water Project delivers up to 4 million acre-feet per year of water to 29 public water agencies throughout California. In 1994, the water users agreed to allow purchases of contract supplies among the water users, principally from agricultural water use to urban water use. This is a form of market water transfers since the price is developed by both the seller and buyer, and is a transfer of contract water supplies. The limit agreed to by SWP water users was a maximum of 130,000 acre-feet per year, every year through 2035 (when all SWP water contracts are subject to re-negotiation with DWR). Prices for this water, as a one-time purchase cost, have been up to $6,000 per acre-foot in the past few years. This appears to have set a new market price for long-term urban water supplies, at least from this source.

5. **San Diego County Water Authority.** More than 25 years ago, MWD negotiated a long-term transfer of 100,000 acre-feet per year from the Imperial Irrigation District IID. The transfer was made possible through investments by MWD in more efficient irrigation within IID. This program developed water that could be transferred, since irrigation return flows from IID normally flow into an inland high-salinity lake (Salton Sea). About ten years ago, the San Diego County Water Authority began negotiations with IID to transfer an additional 100,000 acre-feet per year to the San Diego region of Southern California. While not without controversy, a long-term agreement has been reached that will provide for transfer of the water for the next 75 years.

In addition to those transfers summarized above and shown in Figure 2, a notable long-term water transfer was negotiated at the end of 2010 that may be an important precedent for the future. The cities of Davis and Woodland are located in the Sacramento Valley immediately west of Sacramento. Davis and Woodland have begun developing a surface water supply project to replace most of their historical local ground water supplies due to water quality concerns. In addition to acquiring a new state appropriative water right (approved on March 1, 2011), the cities need to acquire additional surface water supplies during summer months when water is no longer available for new appropriations in most years.

The two cities have negotiated an exchange with Conaway Ranch, an 18,000-acre nearby farm with rice as the predominant crop. The framework of the deal is outlined in a press release found on the website of the Woodland-Davis Clean Water Agency (Agency), the joint powers authority implementing the water project: http://www.wdcwa.com/detail/news/board_approves_agreements_to_purchase_water_rights_and_joint_intake_fa. The Agency has negotiated the right to acquire up to 10,000 acre-feet per year of additional surface water starting in 2016, when the new surface water facilities (water intake, treatment plant, pipelines) are scheduled to be completed. The agreement is complex and addresses issues of concern to all parties, including a shared, new water intake with state-of-the-art fish screens. The press release indicates

that the deal includes ultimate transfer of a portion of the underlying water right from Conaway Ranch to the Agency.

As of March 2011, the abundant rainfall and snowpack will likely decrease the need for short-term water transfers this year. However, the increasing need for urban water supply reliability in California continues to increase pressures for long-term water transfers. Early this year the U.S. Bureau of Reclamation and a consortium of its water supply contractors in the San Joaquin Valley and San Francisco Bay Area had begun a process to pursue a ten-year water transfers program starting in 2012. Details of this proposed "Long-Term Water Transfer Program" as they become available can be found at this web site: http://www.usbr.gov/mp/cvp/ltwt/.

There are many more examples of successful water transfers in California, as well as examples of efforts that were not successful. The lessons learned to make transfers a useful tool for future water resource management activities are described below.

Lessons from California Water Transfers. The State Drought Water Banks in the early 1990s worked very well for a number of reasons. The extraordinary drought conditions over five to seven years were in the minds of the public, and regional political conflicts were set aside temporarily for the common good to meet critical health, safety and economic water needs. The feeling of a mutual crisis was widespread, and there was extraordinary institutional cooperation at all levels of government. This was also prior to severe environmental restrictions on water diversions out of the Delta, and prior to the severe depletion of endangered fish species populations. Finally, all transfers in California were forced to go through the drought water bank.

The 1991 Drought Water Bank was an extraordinary, large-scale water management experiment. As expected, there were a number of unintended consequences: some good, some bad. Critical water needs were met for urban water uses, irrigated agriculture and the environment. Unintended consequences included: (1) adverse impacts to groundwater levels in some regions selling water, resulting in some non-participants having increased groundwater pumping costs; (2) some unforeseen environmental problems; and (3) some negative economic impacts in regions selling water, resulting from the idling of agricultural lands. Strategies, rules and laws have been developed to avoid these problems in the future.

Water transfers have turned into a very important water resource tool for regional and local water agencies. The individual short case studies above show that urban water utilities are willing to invest in short-term and long-term transfers. For the most part, buyers and sellers can find each other and can implement transfers without additional institutional help – although normal institutional approvals will still be required. It is also clear that water transfers are important to sellers as an important source of revenue, particularly for investing in their own water systems. Indications from both buyers and sellers are that they would like to see a lesser centralized government role – this was already reflected in the results of 2009 water transfers. It is also clear that centralized regulatory control is important to assure protection of environmental resources that may be affected by water transfers, particularly any potential impacts to endangered fish and wildlife species. DWR has formed an Office of Water

Transfers to offer centralized technical advice and support to all parties wanting to pursue a transfer.

California is dealing with water supply and reliability shortages in dry years, and it is projected that there will be shortages in average years with a forecasted increase of 15 million people over the next 20 years. We have the further legal requirement, added in 2002, that construction of new housing subdivisions will require a certification that water supplies will be adequate to meet the additional water needs. There is very strong incentive to improve the reliability of our water supplies. The problems we are dealing with are similar in many respects to problems elsewhere. It is becoming increasingly clear that the pressures to increase urban water supply reliability are very great, and that market-based water transfers will be one of many tools to be considered in meeting future urban water demands. To some extent we may continue to see similar investments by farmers with high-value crops. California's water market is here to stay.

Finally, while not addressed specifically in this paper, more attention is being given to long-term water supply reliability of both surface and ground waters in all regions of the state. One concern is the long-term interrelationships between surface and ground water, and how that relates to water transfers that are based of the transfer of surface water by a farmer and a shift to groundwater use. Another concern (or opportunity) is the continued "banking" of surface water in groundwater basins to support future water transfers. There are increasing technical, environmental and institutional concerns in water transfer source areas, which become even more important for long-term transfers than for past short-term transfers. The past 20 years have brought market-based water transfers to the mainstream as an important water resources tool. The next 20 years are likely to see more advancement in the areas of technical knowledge and water management institutions.

California's major hydrologic regions are undertaking efforts to rely as much as possible on local and regional water supplies, recognizing that water imported from other regions is becoming increasingly problematic although it will remain an important part of the overall water supply mix. Due to the emergence of market-based water transfers, it is also clear that many regions will continue to depend on other regions during times of drought and other severe water shortage conditions, and to an increasing extent for adding to long-term urban water supply reliability.