

**Transaction Costs: Valuation Disputes, Bi-Lateral Monopoly  
Bargaining and Third-Party Effects in Water Rights Exchanges: The  
Owens Valley Transfer to Los Angeles: 1905-1935**

by

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## **ABSTRACT**

Between 1905 and 1935 over 869 farm property owners in Owens Valley, California sold their land and associated water rights to Los Angeles, 250 miles to the southwest. This agriculture-to-urban water transfer increased Los Angeles' water supply by over 4 times, making the subsequent dramatic growth of the semi-arid city possible, generating large economic returns. The exchange took water from a marginal agricultural area and transferred it via the Los Angeles Aqueduct. No other sources of water became available for the city until 1941 with the arrival of water from Hoover Dam via the California Aqueduct. The Owens Valley transfer was the first and last, large-scale voluntary market exchange of water from agriculture to urban. Despite gains to both parties from the re-allocation of water to higher-valued uses, the Owens Valley transfer serves today as a metaphor, cautioning any agricultural region against water sales to urban areas. In this paper I examine the Owens Valley water transfer controversy to determine why it was so contentious and became so notorious. There were serious information problems for valuation, a lack of trust, and third-party effects. The most contentious negotiations took place within a bi-lateral monopoly context. These factors raised the transaction costs of negotiation. A comparison of the agricultural economies of five Great Basin counties reveals that the Owens Valley was not turned into a wasteland by the export of water as some have suggested. Agriculture throughout the region declined in the 1920s and 1930s as part of a general agricultural depression, although the export of water did reduce the number of farms and increased farm size. Broader conclusions for bargaining, when the aggregate gains from trade are enormous, but distribution very skewed, are drawn.

“It seems to us that the importance of the Owens River Project to the City of Los Angeles cannot be overestimated.” Los Angeles Board of Water Commissioners, *Report on Water Supply* (1906, 6).

“Do you have any idea what this land would be worth with a steady water supply—About 30 million more than they paid for it.” J.J. Gittes (Jack Nicholson) referring to land in the San Fernando Valley, in the movie, *Chinatown*, 1974.

“Probably nowhere in the history of any country has one community...adopted a policy ... which has wrought the havoc and produced the mental agony and suffering that the policy of the City of Los Angeles and their representatives has produced in a little community in which we live.” W.W. Yandell President, Ione Seymoure, Secretary, Farmers Ditch Company, Owens Valley, 1924<sup>1</sup>

“...farmers remain suspicious of the ‘Owens valley syndrome’...The ‘theft’ of its water...in the early 20<sup>th</sup> century has become the most notorious water grab by any city anywhere...the whole experience has poisoned subsequent attempts to persuade farmers to trade their water to thirsty cities.” *The Economist*, July 19, 2003, 15.

## **Introduction.**

The most rapid population growth in the U.S. is in the urban areas of the semi-arid West. This growth is fueled by shifts from an economy based on agriculture and extractive industries to ones based on service and technology. Most western cities, such as Los Angeles, San Diego, Phoenix, Las Vegas, and Tucson, do not have sufficient local water sources to supply this growth in urban demand. Accordingly, there are efforts to acquire water from agriculture, where approximately 70-75 percent of western water is allocated. But this process generally is slow and controversial, resulting in sharp differences in urban and agricultural water prices.<sup>2</sup> For instance, groundwater for farming near Marana, Pima County, Arizona costs approximately \$25 per acre-foot (approximately 325,000 gallons), whereas the same water for urban use costs \$200. In recent efforts to secure Imperial Irrigation District water, San Diego offered \$225 per acre foot for water that farmers used for \$15.50.

This paper explores the problems of negotiating water transfers from agricultural to urban uses by analyzing the Owens Valley water transfer to Los Angeles between 1905 and 1935. The Owens Valley transfer to Los Angeles is the first example of a large-scale, market-based exchange of water rights in the American West. Unfortunately, it is also unquestionably the most notorious. It is held up by critics as an example of water theft, as the above quote from the *Economist* suggests, and of all that can go wrong from transferring water from rural to urban areas.

Between 1905 and 1935 representatives of the Los Angeles Board of Water and Power Commissioners and some 869 farm and ranch owners and 825 town lot owners negotiated the sale of land and appurtenant water rights. Under the appropriative water rights doctrine that exists in the western U.S., water rights can be secured through land purchases, and by 1935, the agency had acquired 95 percent of the agricultural acreage and 88 percent of the town properties in the Owens Valley.<sup>3</sup>

Owens Valley water was transported to Los Angeles via the Los Angeles Aqueduct, which became one of the nation's largest public works projects at the time, second only to the Panama Canal.<sup>4</sup> In 1920, seven years after the aqueduct was completed, Owens Valley provided a flow of 283 cubic feet per second of water to the city, whereas the entire local Los Angeles basin water supply provided a flow of just 68 cubic feet per second.<sup>5</sup> The water brought about the growth of Los Angeles from 250,000 people in 1900 to 2,208,492 by 1930. The city became the largest on the West Coast and hosted the X<sup>th</sup> Olympic Games in 1932.<sup>6</sup> The additional water also was the basis for dramatic increases in land values in the San Fernando Valley, in some cases from \$20 to \$2,000 per acre. By 1920, Los Angeles County, for a time, became the nation's largest

agricultural county in terms of value of production.<sup>7</sup> The gravity flow of water from Owens Valley to the city allowed for power generation, and the Los Angeles Department of Water and Power became the largest municipal electric utility in the country.<sup>8</sup>

Despite all of the apparent benefits of the water exchange, the standard assessment is decidedly negative. It is generally viewed as an unequal exchange due to an imbalanced struggle between representatives of a politically-powerful and wealthy city against small, rural land owners. The alleged outcome was destruction of the valley's agricultural economy and the desertification of its lands (Wood, 1973, 8; Reisner, 1986, 60-107; Kahrl, 1982, 38; 387, Kahrl 2000, 255; Ewan, 2000, 42; Wheeler, 2002).<sup>9</sup> Other authors have a more balanced view of the transaction, noting the valley's limited agricultural potential and the impact of the water transfer on the growth of Los Angeles (Nadeau, 1950, 126-28; Hoffman, 1982, xviii-xiv; Vorster, 1992; Walton, 1992, 192-97; and Sauder, 1994, 124-34, 151-64).

Although difficult to test, the legacy of the Owens Valley water transfer appears to have been harmful for the contemporary development of water markets. Ostrom (1971, 449) noted that the experience in Owens Valley deterred subsequent efforts to re-allocate water from the Feather River and other areas in Northern California to urban centers in the south, and Haddad (2000, xv) argued that the "Ghost of Owens Valley" inhibited *all* proposed water transfers from rural areas to cities in the West. Hanak (2003, 5, 123) pointed to the "devastation" to the Owens Valley economy as motivating county restrictions on water transfers in California. The 1974 movie, "Chinatown," starring Jack Nicholson and Faye Dunaway, dramatized conspiracies involving Owens Valley water

and land speculation in Los Angeles, adding to a popular notion that the outcome of the exchange was not a positive one.

The questions that arise, then, are what were the sources of the bargaining conflicts between land owners and the city of Los Angeles that raised the transaction costs of agreement and gave the land and water exchanges such negative notoriety? What was the ultimate impact on the valley?

Addressing these questions is the objective of this paper. The analysis makes use of detailed records—letters, reports, memorandums from 1905 to 1935 between the Los Angeles Water Board, its land agents, and land owners in the Owens Valley as deposited in the Los Angeles Department of Water and Power Archives.<sup>10</sup> These documents describe the bargaining history between the Board and farmers as they negotiated over land and water rights. Bargaining positions, strategies, and key issues of contention are described in the data. Additionally, there is a compilation of 869 farm land purchases, including year of purchase, amount paid, location of property, name of owner, as well as other property characteristics. These data are used in the statistical analysis. Other data sets exist for sellers' pool membership and for town lot sales.

The information provides a rich basis for examining the bargaining conflicts that occurred in Owens Valley in a manner that has not been done previously. The added transaction costs of negotiating land and water rights sales in the early 20<sup>th</sup> century centered on three issues: disputes over valuation of property, bi-lateral monopoly, and third-party effects. Insights from the analysis not only explain why the Owens Valley negotiations were so lengthy and rancorous, but also why current efforts in the early 21<sup>st</sup>

century to transfer water from agriculture to urban and environmental uses in the semi-arid West likely will involve similar problems.

## **II. Background: An Historical Summary of the Owens Valley Water Transfer, 1905-1935: Valuation, Bi-lateral Monopoly, and Third-Party Effects.**

Table 1 provides a brief, chronological summary of the Owens Valley water transfer to Los Angeles and the negotiations between the Los Angeles Water Board and land owners for land and water rights.

Table 1

The search for additional water in Los Angeles began early. Between 1880 and 1900, the population of Los Angeles grew five fold, from 50,393 people to 250,000, and given the city's climate, links via the intercontinental railroads, and position as a major West Coast port, prospects for continued growth seemed promising, except for the absence of sufficient water.<sup>11</sup> The city was in a semi-arid region where annual precipitation not only was extremely variable, but averaged just 14.62 inches, whereas Chicago, for example had mean rainfall of 34.12 inches.<sup>12</sup> Los Angeles relied upon the meager Los Angeles river watershed rather than rainfall for its water supply. But by the turn of the century, there was growing concern among city boosters that more water had to be found if the city were to achieve prominence on the west coast.<sup>13</sup> And there was water, 250 miles northeast in the Owens Valley on the eastern slopes of the Sierras. Between the Owen River's flow and ground sources in the valley, there was a supply of some 37 million acre feet of water available, about the same as that held in Lake Mead today.<sup>14</sup>

The Owens Valley was approximately 120 miles by 2 to 6 miles bisected by the Owens River that eventually dumped into an alkaline, desert sump, Owens Lake. In 1920

prior to major land purchases by Los Angeles, there were 7,031 people in the area on farms and in five towns—Bishop, Big Pine, Laws, Independence, and Lone Pine.<sup>15</sup> There were 140,000 acres of farm land in the valley, of which 65,163 acres were irrigated, and 20,906 acres were in crops in 1920, mostly alfalfa, some grains, and small orchards (apple and pear).<sup>16</sup> Livestock was the principal agricultural product. The elevation of the valley (ranging from 3,600 to 4,300 feet), short growing season (150 days), alkaline soil, and limited access to markets constrained its agricultural potential, and its production was more characteristic of Great Basin agriculture, than of elsewhere in California.<sup>17</sup> Figure 1 indicates the location of Owens Valley northeast of Los Angeles.

Figure 1

The lands of primary interest to the Water Board were those that carried the most water and were either properties riparian to the Owens River and some feeder streams or more importantly, organized as part of formal irrigation ditch companies. The major ditches in Owens Valley were the McNally Ditch, Bishop Creek Ditch, the Owens River Canal, the Big Pine Canal, the Rawson Ditch, and Farmers Ditch.<sup>18</sup> Approximately 49,000 acres of land was associated with these ditches, about 77 percent of all farmland in the region.<sup>19</sup> In total, there were 110 miles of primary and secondary ditches lacing the north valley where most agriculture took place.<sup>20</sup> The construction of ditches required cooperative investments so that farmers joined to incorporate ditch companies and to place joint appropriative water claims. The amount of water held by each farmer depended on the number of shares he owned in the ditch company. Once the Water Board completed purchase of a farm located on a ditch, its allocation could be released to flow instead down the river to the aqueduct.



Between 1905 and 1921 the Water Board purchased land in the southern part of Owens Valley to acquire the right of way for the aqueduct as well as riparian claims to excess water that had not been diverted for irrigation in the northern, most agricultural part of the valley. These purchases did not interfere with irrigated farming. Southern Owens Valley lands were mostly desert and average purchase prices ranged from \$1.25 to \$23.86 per acre. By contrast, mean purchase price for lands bought later in the north was \$198 per acre.<sup>21</sup> Once the city's purchases of land and water rights in the southern Owens Valley were announced, successful, but contentious elections for two bond issues for \$24.5 million to buy land and construct an aqueduct were held in 1905 and 1907.<sup>22</sup> The elections were controversial because of suspicions that land speculation in the San Fernando Valley was the primary motivation for Owens Valley water, not impending shortages.<sup>23</sup>

The reallocation of water brought dramatic property value gains in Los Angeles.<sup>24</sup> Although Los Angeles subsequently grew more rapidly than predicted, requiring more water for urban demand, much of the initial water went to irrigate lands in the San Fernando Valley.<sup>25</sup> When the aqueduct began flowing in 1913 it supplied 4 to 5 times domestic urban demand, but under the appropriative water rights doctrine the water had to be in beneficial use in order for Los Angeles to retain ownership.<sup>26</sup> Accordingly, water was made available for farming in the San Fernando Valley, and irrigated acreage in Los Angeles County expanded by over 124,000 acres. The Board provided Owens Valley water only to areas that agreed to be annexed by the city, and this provision led to the dramatic increase in the size of the Los Angeles by over 325 square miles. Gradually, as

urban water demand increased, agricultural use of Owens Valley water in Los Angeles declined.

At the same time that Los Angeles was planning to acquire Owens Valley water, its residents were seeking a federal Reclamation Service project for drainage and increased irrigation. Ultimately, these were competing uses for Owens Valley water, and Los Angeles' officials moved aggressively to secure access to federal lands for right-of-way and for reservoir storage sites. The Reclamation Service investigated prospects in the valley beginning in 1903, but suspended activities in 1905.<sup>27</sup> The view in Owens Valley was that the political influence of Los Angeles had doomed the project.<sup>28</sup>

Much is made of this in the historical literature as evidence of the city's political power and lack of concern for the welfare of the valley's residents.<sup>29</sup> But recent research indicates that the Reclamation Service's decision was based on limited funds and more favorable sites elsewhere in the West.<sup>30</sup> In any event, the loss of the reclamation project and the diversion of Owens Valley water to irrigation in the San Fernando Valley, where huge capital gains were earned, caused resentment and reduced trust among Owens Valley farmers toward the Water Board, thereby raising the transaction costs of subsequent bargaining.<sup>31</sup>

Beginning in 1923 in the face of drought and rising population growth in Los Angeles, the Water Board began to purchase lands in the more agricultural and densely populated part of Owens Valley, and these negotiations are the source of the bargaining conflicts that characterize the Owens Valley transfer. From 1923 through 1934, the Board moved aggressively, securing an additional 863 agricultural properties covering 145,867 acres.<sup>32</sup> 1,300 town parcels also were purchased beginning in February 1931.<sup>33</sup> All in all,

at least \$103.8 million in bonds were eventually floated to build and maintain the aqueduct and power system, secure land water rights in Owens Valley, and expand holdings into the Mono Basin between 1905 and 1931.<sup>34</sup>

Not all bond elections were successful, and the Water Board, charged with supplying Los Angeles with dependable water, was under scrutiny by taxpayers and water ratepayers to manage the funds effectively.<sup>35</sup> For instance, at least two proposed bond issues in 1917 and 1929 were defeated by Los Angeles voters, and as the situation in Owens Valley became more controversial, funding of city purchases became more problematic politically.<sup>36</sup>

In negotiations between land owners and the Water Board there were three general classes of problems, although they overlapped: valuation disputes, bi-lateral monopoly conflicts, and third-party effects.

#### **Valuation Disputes.**

There were two conflicts in determining prices for Owens Valley lands. One was the basis for general valuation of properties, whether it should be based on the value of agricultural production in Owens Valley or based on the value of Owens Valley water in Los Angeles. The second was the determination of the value of any particular property when farms were heterogeneous. In terms of the first issue, the Water Board wanted to use Owens Valley farm values in determining the prices it offered land owners, whereas land owners wanted to use Los Angeles land and water values in determining the prices they demanded for their properties. For example, before the Board, one land owner claimed that she priced according to “the comparative value of what that water is worth to you....because we know you want water and not the land...that is what you want and

all you want....”<sup>37</sup> Given the observed land value increases in Los Angeles after the arrival of Owens Valley water, relative to those possible from agriculture in Owens Valley, there were considerable gaps between offered and demanded prices.

The valuation of particular properties was a continuing and important source of contention because the value agreed to for a particular property determined the owners “share” of the aggregate gains of the water exchange. As discussed in Section V, these aggregate gains from trade, especially in Los Angeles, were extremely large, and each farmer in Owens Valley wanted as large a portion of them as possible.

Owens Valley properties varied in value according to inherent land fertility, access to water, topography, other growing conditions, and farm size. Each land owner had the most complete information about the agricultural potential of his property, but at the same time, had incentive to exaggerate its value. Accordingly, to assemble offer prices, the Board relied upon a committee of expert appraisers to assimilate local farm price information. To reduce disputes with the land owners, the Water Board selected a committee that would be viewed as credible and acceptable to both parties.

In 1925, the Water Board assembled a special Appraisal Committee of “three of the leading citizens of Owens Valley:” George W. Naylor, Chair of the Board of Supervisors of Inyo County, V.L. Jones, Inyo Assessor, and U.G. Clark, former county Assessor.<sup>38</sup> Even so, since the appraisal committee was employed by the Board, it was viewed with suspicion among land owners. During negotiations with some farmers in 1926, the credibility of the committee’s prices was questioned: “You hired that committee; we had nothing to say about it...if you people hire these men, you expect them to go into the field and do as you tell them don’t you?” Both the appraisals and the

committee often were rejected: “They have been your committee for a long time. Let us forget them.”<sup>39</sup>

During the valuation process, Board land agents would collect information about each farm—location, water rights, amount of irrigated land in cultivation, pasture, “brush” land, orchards, improvements, and submit the information to the Appraisal Committee. The Committee, in turn, would compare this information with that for farms that had already been purchased to arrive at an “appraised value.” The Water Board generally used a fixed multiple, usually 4.1 times appraisal value, to determine its offer price.<sup>40</sup> The Board wanted its offer prices to be based “on the fair average prices which the city had paid for substantially similar property in that region.”<sup>41</sup> It repeatedly resisted adjusting prices beyond what it had offered for comparable lands in an area. Further, in 1926 in asking the Appraisal Committee to determine offer values for properties under consideration, one of the Board’s land agents stated: “It is also to be understood that these properties are to be appraised in the same manner and on the same basis that you have appraised other properties of substantially the same character and in accordance with previous values....”<sup>42</sup>

Nevertheless, land owners challenged the committee’s appraised values, and called instead for binding arbitration in price disputes, using outside arbitrators. Challenges were based on disputes both regarding the relevant comparison properties, as well as assessment of individual farm characteristics. For example, one owner, who had been offered \$3,100 for her property, complained that a neighbour had been offered \$10,500, even though he had 1.25 acres less than her, with only 2 inches of water from the ditch, while she had 3 inches.<sup>43</sup> Another wanted her land appraised against a different

group of properties, selecting five farms whose owners had received more than she had been offered.<sup>44</sup>

In 1925, farmers who were in conflict with the Board over price asked that the two sides set up a “valuation commission” to resolve their valuation conflicts, saying that “no more honest attitude can be taken by either party.” Even the special Appraisal Committee agreed, but the Board rejected this offer, claiming that “valuation by third party would mean abandonment of purchase plan adopted with concurrence of your committee and thus far followed in dealing with your neighbors.”<sup>45</sup>

Agreement on property valuation also was complicated by a lack of trust on both sides. Board officials viewed land owners as attempting to fleece taxpayers with exorbitant price demands. Land owners, by contrast, viewed the Board as attempting to undervalue their lands while property values in the San Fernando Valley were rising rapidly. This limited trust meant that neither party held the other’s pricing claims as credible or honest. This condition increased the transaction costs of negotiation and lengthened the time necessary for agreement.

Although much of the Owens Valley bargaining record involves conflicts over price between the city and land owners, with the latter claiming that they were underpaid, there is evidence of concern that the city was paying too much for land. For example, a land buyer John Merrill asserted in 1927 that while the city had paid an average of \$200 per acre for Owens Valley lands thus far, the lands could have been secured for \$50 to \$75 per acre for a total expenditure of \$5 million rather than \$12 million.<sup>46</sup> The *Hollywood Daily Citizen* ran an editorial objecting to any payment for town properties

beyond appraised values.<sup>47</sup> These allegations were of concern to the agency and its ability within the political climate of Los Angeles to raise funds through additional bond issues.

### **Bi-lateral Monopoly Disputes.**

Disputes over valuation took place, at least for some properties, within a bi-lateral monopoly context. The Los Angeles Water Board generally was the only purchaser of Owens Valley lands and water rights. Once the Los Angeles aqueduct was constructed for over \$23,000,000, the city had a large fixed, immobile investment that depended upon Owens Valley water. While officials of the Water Board could walk away from stalled negotiations with one land owner, they could not walk away from Owens Valley as a whole. Land owners formed sellers' pools to collude in their negotiations with the Board. Although, these pools never included all of the farmers in Owens Valley, they did involve those with the most water, and by the latter part of the 1920s in the face of drought and continued population growth, Los Angeles was dependent upon securing those lands for filling the aqueduct. Under these circumstances, bi-lateral monopoly conditions existed.

Bi-lateral monopolies have indeterminate pricing outcomes because they depend upon the relative bargaining power of the parties. Each party has incentive to misrepresent its position in order to extract a greater share of the gains of trade in such negotiations, and there is little competitive pressure to force more accurate information revelation. According, bi-lateral monopoly negotiations often break down and take a long time to complete.

The farmers who held shares in ditch companies had a ready organizational tool for colluding in their negotiations with the Los Angeles Water Board that was not available to those who were not on ditches and were scattered across the valley. Three

sellers' pools were formed along three of the ditches: the Keough pool on the Owens River Canal with 23-30 members, the Watterson pool of about 20 members on Bishop Creek Ditch, and the Cashbaugh pool of 43-48 members on Bishop Creek Ditch.<sup>48</sup> These pools were loose negotiating groups, dominated by the largest land owner. Members may have had to pay a commission to pool leaders for any higher prices they received.<sup>49</sup> At most, the pools involved about a quarter of the farms along the major ditches in Owens Valley, but probably much of the irrigated acreage. The limited numbers likely reflected efforts to maintain more homogeneous negotiating groups, as well as the aggressive efforts of the Water Board to buy ditch properties before they joined a pool.

The Keough pool was the most concentrated and tightly organized group with a Herfindahl index (based on farm size) of 1,583. The Watterson pool had a Herfindahl index of 1,163, the Cashbaugh, 410, and non-pool, ditch farmers, 216.<sup>50</sup> Negotiations between the Water Board and pool members, especially those in the Keough pool, were among the most contentious and drawn out in the Owens Valley.

The Board paid \$1,389,364 to buy out the properties in the Cashbaugh pool between 1924 and 1927. The largest land and share owner in the pool, however, William Cashbaugh held out through 1927, and received a 21 percent premium over the city's initial offer price of \$145,180 or \$174,680.<sup>51</sup> The most successful pool was led by Karl Keough with 4,482 acres (60 percent) of the 7,862 acres on the Owens River Canal. In 1926, the Keough pool demanded \$2,100,000 for its properties, and the Board first offered \$1,025,000 and then increased it to \$1,250,000. The pool countered with a price of \$1,600,000, which was rejected by the Board.<sup>52</sup> Price negotiations for Owens River Canal properties, both in and out of the pool, continued on and between 1925 and 1931.



By the end of 1927, 60 percent of the 4,837 shares in the canal company were acquired by the Board, but the remaining 40 percent held by pool members were not secured until 1931. G.L. Wallace offered his lands in 1926 for \$417 per acre, while the city countered with \$254 per acre. Final agreement was not reached with him until 1931 at \$466 per acre.<sup>53</sup>

Pool leaders resorted to violence to pressure the Board to meet their price demands when negotiations broke down, threatening the security of the city's water supply. Between 1924 and 1931 the aqueduct and city wells were repeatedly dynamited, although the aqueduct was never seriously damaged.<sup>54</sup> These episodes of violence, labelled "California's little Civil War" by the press, attracted state and national attention, and compelled the Board to reach agreement with remaining property owners on price.<sup>55</sup> The Board viewed the dynamiting as a negotiating tactic, but was extremely worried about disruption of the aqueduct flow.<sup>56</sup>

By contrast, sales agreements with non-ditch, non-pool farm owners appear to have gone smoothly. Many of the 869 farm properties purchased between 1916 and 1934 were not on ditches or in pools, and there is no evidence in the record of discord in those negotiations. In the data set used below of 595 farms, 228 were not on ditches. These properties tended to be the least productive in the region and they received the lowest prices. The Water Board reported that "the prices paid, with few exceptions, have been entirely satisfactory to the seller."<sup>57</sup>

Once the Water Board completed purchase of a farm, its ditch water allocation, riparian claim, or groundwater could be released to flow down the river to the aqueduct. If Water Board land agents could not reach agreement with one land owner, they would

turn to another. Holdouts could receive higher prices, but if the Board concluded that negotiations had reached an impasse, that there were no longer bond funds available to complete further purchases, or that the city had sufficient water rights and no more were required, then these holdouts could bear additional costs. Besides the opportunity cost of the lost sale revenue, holdouts who were on ditches could be left isolated with higher ditch maintenance and operating costs, since the city did not contribute once the ditch water was released from its properties. Weeds and insects from no-longer cultivated properties also could infect remaining neighboring farms.<sup>58</sup>

### **Third-Party Effects.**

As Los Angeles purchased properties in Owens Valley and took them out of irrigated agriculture, there were complaints that this action was hurting the local economy and damaging property values within the five towns. The magnitudes of the effects were disputed. Merchants claimed to have lost 1/3 of their trade due to the decline in the agricultural economy.<sup>59</sup> The general fall in agricultural commodity prices in the 1920s also hurt the community, but this effect was difficult to separate from those resulting from the Water Board's purchase of lands and export of water. For example, the value of Inyo County crops fell from \$1,503,195 to \$791,257 between 1920 and 1924, a fall of 47 percent. This decline, however, occurred prior to most of the property purchases in the valley by Los Angeles. Further during that same five-year period, the number of farms in the valley fell only 7 ½ percent, from 521 to 482, unlikely enough to account for the observed fall in the value of agricultural production.<sup>60</sup> Nevertheless, town property owners blamed the actions of the Water Board for the deterioration in economic conditions. The Board countered by pointing to the beneficial effects of its investments in

the valley to develop water and power sites and the growth of recreational activities from Los Angeles due to construction of new roads. Indeed, automobile registration and bank deposits in the region increased.<sup>61</sup>

In 1925, the Owens Valley Reparations Committee demanded either that the Board pay \$5,500,000 in reparations for the loss in town lot value or that the city purchase the properties for \$12,000,000.<sup>62</sup> Later in 1927, the reparation demand was reduced to \$2,813,355.<sup>63</sup> Not only were the prices for town properties well above what Los Angeles had been paying for other lands, but they carried few or no water rights. Hence, the Board was uncertain that it had the legal authority under the city charter to purchase such lands, which did not “supply the City with an adequate supply of pure water...”<sup>64</sup> Members of the Los Angeles Water Board concluded that they would be personally liable if they made such payments.<sup>65</sup> There were disagreements over valuation of the town lots, given both the export of water and the deterioration in the national agricultural economy in the late 1920s.

Legislation was enacted by the California Legislature in 1925, at the behest of Inyo County and other rural legislators, requiring cities to compensate for damages to businesses and property owners when water was taken from the drainage area.<sup>66</sup> The statute added pressure on the Board to buy the town properties or be faced with hard-to-measure-and-agree-upon reparations demands. Los Angeles officials held off the purchase of town lots until there was a state Supreme Court ruling in 1929 that authorized the purchase of town properties. After that, negotiations between the city and town lot owners were rancorous, requiring various appraisals, offers and counter offers.<sup>67</sup> The

Water Board was obligated to buy the properties and town owners knew that. The Board, however, was constrained by available bond funds.

A Committee of Ten was set up with five representatives each from the towns and five members of a Special Owens Valley Committee of the Board to determine prices. But the property value appraisals prepared by the Board's land agents were rejected by the town representatives. Negotiators for the towns offered counter appraisals that raised proposed values in the towns of Laws and Independence by 45 to 50 percent, in Bishop by 120 percent, and Big Pine by 60 percent. Members of the California legislature who owned properties in the towns threatened new investigations of the city's purchasing practices unless the new appraisals were accepted.<sup>68</sup> Ultimately, a compromise was reached and Los Angeles paid \$5,798,780 to 824 owners for 1,300 town parcels, most of which brought little or no additional water to the city.<sup>69</sup> The prices paid were based on 1923 values that existed prior to major purchases by the city in the valley, and they did not reflect the 1929 agricultural depression that was affecting rural land values throughout the country.<sup>70</sup> Funds to buy town lots and remaining agricultural properties in Owens Valley required a special 1930 bond election for \$38,800,000.<sup>71</sup>

In the following section an analytical framework is provided to guide statistical analysis of the purchase of farm properties. The data on individual town properties are too limited to allow for the similar analysis at this time.

### **III. Analytical Framework.**

Figure 2 illustrates the bargaining setting facing land owners in Owens Valley and representatives of the Los Angeles Water Board. The vertical axis represents the price per acre for land in Owens Valley and the horizontal axis represents acres of land in the

valley. Valley land is heterogeneous with respect to its agricultural potential, which is a function of inherent soil fertility, local growing conditions, such as elevation, and access to water. Along the horizontal axis, land ranges from the least productive at the origin to more productive, moving to the right. The actual, value of true productivity of each acre of land is shown by  $S_T$ , which has a positive slope, reflecting rising agricultural potential, and hence, greater farming value along the horizontal axis. The determinants of  $S_T$  for a particular acre of land are known by farmer, and this supply schedule represents the minimum that an owner would have to receive from the Water Board in order to sell. The Water Board in contrast, has less complete information about the true agricultural value of the land. Its Appraisal Board infers the value of productivity from assembled farm characteristics, observed output, and comparisons with similar properties. It also projects the amount of water associated with any land from shares of irrigation ditch water, any riparian rights to estimated stream flows, and anticipated potential to pump groundwater.

The Water Board uses information from the Board's appraisal to prepare per-acre offer prices  $S_2$ . These offer prices rise for lands of greater expected inherent fertility and water. The schedule represents the Board's willingness to pay for land in Owens Valley.<sup>72</sup> Farmers, who do not accept the Board's offer, counter with per-acre demand prices  $S_1$ , based on what they believe to be the value of water in Los Angeles.<sup>73</sup>

This framework sets up the bargaining situation, with at least some land owners demanding higher prices along  $S_1$  and Water Board officials offering lower prices along  $S_2$ .

In negotiations, land owners have the option of accepting the offer price or rejecting it and holding out for their higher demand price. The expected return from holding out is:

$$(1) N = [P_r S_1 + (1 - P_r) S_T] - S_2,$$

where  $P_r$  is the probability of successfully receiving the higher price.  $P_r$  varies across owners and depends on the likelihood that during negotiations new information will reveal the true value of productivity of their land, as well as the ability of owners to collude.

Equation (1) implies that each farmer compares the Board's original offer price with the expected value of holding out, which is determined by the probability of getting the higher price plus the probability of getting a price based instead on the land's true productivity. Hence, the expected value of the holdout is a function of  $P_r$  and the gap between  $S_1$  and  $S_T$ .

(2) If  $S_2 \geq P_r \cdot S_1 + (1 - P_r) S_T$ , which applies for some farmers with land within the range  $O A_M$  in the Figure, then the Board's offer is accepted. Whether or not (2) holds in this region depends upon the value of  $P_r$ . For low values of  $P_r$ , which would be the case for scattered, unorganized properties that could not easily collude and where production is limited and easily observed (low valued, desert areas), (2) will describe the situation facing farmers and the Board's offer will be accepted. There is no hold out and no negotiating conflict.<sup>74</sup>

(3) If  $S_2 < P_r \cdot S_1 + (1 - P_r) S_T$ , there will be hold-outs and two bargaining possibilities. Where  $S_T > S_1$ , beyond  $A^*$  in the Figure, the farmer will never sell because the value of the true agricultural productivity of the land exceeds any possible price that

the Board would pay. Between  $A_M$  and  $A^*$ , however, farmers will bargain over price, rejecting  $S_2$ , but seeking  $S_1$ . In the negotiations, there will be disagreements over valuation, the difference between the land's true productivity and the Board's offer price,  $EC$ , as well as battles over the rents received in Los Angeles from Owens Valley water,  $DE$ . These properties will be the center of bargaining disputes in the valley. Since the aqueduct's capacity is reached with cumulative land purchases (and water) at  $A_A$ , negotiations to fill it will be in the contested region.

In negotiations with farmers in the contested region, the Water Board would seek to stay on  $S_2$ , adhering to a pricing rule that pays the *same* price for similar properties, but raising prices for lands of higher expected productivity.<sup>75</sup> The Board has two reasons for this objective. One is that in negotiations with any farmer, the Board has to credibly commit not to offer higher prices to others with similar properties. Failure to do so would make it very difficult to complete negotiations with any owner. The second is that the Board would not want to re-open negotiations once it had reached agreement on price. Doing so and adjusting prices to reflect recent higher payments would push the Board's payments higher, along a marginal supply cost curve  $MSC$  in the Figure, more quickly exhausting its bond revenues, perhaps without filling the aqueduct, which was its objective.

If farmers in the region  $A_M A^*$  successfully colluded, then bi-lateral monopoly conditions would prevail, making final prices indeterminate, higher than  $S_2$  and generally higher than  $S_T$ , but lower than  $S_1$ , depending on the relative bargaining power of the two parties.

This framework yields the following testable implications about the time of purchase, reflecting hold out actions, and prices paid for land:

- A. Farmers with more productive land will hold out for prices higher than those offered by the Board and hence, purchase will be delayed.
- B. The Board will attempt to buy the most productive lands with the most water, earliest since these fill the aqueduct.
- C. Accordingly, the timing of purchase of the most productive lands with the most water will be indeterminate, depending on the ability of land owners to hold out successfully.
- D. Land owners with the most productive land, the most water, and who collude will hold out, delaying purchase to receive higher prices.
- E. Land owners with the least productive land and least water will receive the lowest prices and have their properties purchased last.
- F. Collusion success will depend upon the “tightness” of the cartel as measured by the Herfindahl index.
- G. Farmers who hold out longest will receive the highest prices per acre, all else equal.
- H. Negotiations with land owners who have the most productive land, most water, and who collude, will be the most contentious.

A related bargaining implication is that in negotiations with farmers, the WaterBoard would seek to adhere to a pricing rule that paid the *same* price for all similar properties.

These implications are used to guide the empirical analysis. The data include a). final sales price/acre; b). cultivation share of total farm land—an indication of inherent fertility and access to water because cultivation in this semi-arid region depends upon soil quality, water, and local growing conditions; c). acre feet of water/acre transferred with the land; d). existence of riparian water rights; e). location—whether or not the farm is part of an organized ditch, f). membership in a sellers’ pool, and g). the organizational tightness of the pool (Herfindahl index).

#### **IV. Empirical Analysis of Bargaining for the Transfer of Land and Water Rights: Year of Purchase and Price Paid Per Acre.**

The data set of farm properties purchased between 1916 and 1934 by the Los Angeles Water Board includes 869 observations. Dropping those properties under ten



acres as not being farms, but town lots (analyzed separately elsewhere) as well as dropping incomplete entries leaves 595 observations. Of those 367 farms were on ditches and 228 were not on ditches, but scattered throughout Owens Valley. Table 2 provides mean values for farm property owners in Owens Valley by various classifications.

Table 2

As indicated by the mean values in the table, farms on ditches sold for higher prices per acre than did those that were not on a ditch. They included a larger share of more fertile, cultivated land, carried more water per acre sold, were more likely to have riparian claims, and were more likely to be in a sellers' pool. Those farmers who were in the Keough pool also commanded the highest prices; sold the latest (held out the longest); and had more water per acre to offer Los Angeles. Non-ditch properties sold for less. They typically had less productive land, carried fewer water rights, and were unorganized. Land owners not along ditches were more fragmented with no coordinating organization, and they negotiated individually with the Water Board. These results are consistent with the implications presented in Section III.

Table 3 provides descriptive statistics for the variables used in the analysis and Table 4 reports 2SLS regression analysis of the year of sale and sale price per acre. Because some of the exogenous variables affecting year of purchase also likely influenced the final per acre sales price, the year of purchase variable is estimated first and then included in the price equation to better control for simultaneity. The three instrumental variables that most likely affected purchase time rather than price are lagged precipitation deviation in Los Angeles (generally negative), lagged Los Angeles population change from the previous year, and currently available bond funds. Past

drought conditions and population growth pressured the Water Board to subsequently acquire land and water rights, but likely had little impact on the actual price paid per acre for farm properties. Similarly, available bond funds allowed the Board to acquire land in any year, but would have had little impact on price. The amount paid for any particular property was very small relative to bond funds.<sup>76</sup>

Following the implications listed above, the year-of-sale analysis is aimed at determining the characteristics of those farms that held out the longest to secure higher prices (especially, the role of sellers' pools). The sale-price-per-acre analysis is aimed at determining the factors that influenced the price paid, again with concern on the impact of the pools.

As suggested above, the productivity of a farm as indicated by the share in cultivation will delay purchase for two reasons: Farms with more productive lands and success in agriculture had the option to delay agreement with the Water Board if they were dissatisfied with the offer price. Additionally, valuation conflicts were greater for such farms because farmers and appraisers for the Water Board often had different assessments of the value of agricultural potential of the farms. Farms with higher cultivation shares will receive higher prices, all else equal. By contrast, low productivity farms were less controversial because their limited cultivation could be observed. Owners of such properties often were anxious to sell and would do so at lower prices. The Water Board, however, will delay purchase of such lands because of their limited water.

Since the Water Board was interested ultimately in water, the amount of water acre feet per acre associated with the farm, as well as any riparian water rights will speed sale and raise the price paid for the land, all else equal. Membership in sellers' pools will

delay sale, because the pools were formed to coordinate negotiations and to hold out for higher prices. Drought conditions, as reflected in annual precipitation deviation from the mean in Los Angeles, also will speed sale because of demands on the Water Board to secure Los Angeles' water supply. Because drought conditions were more likely to manifest by late summer, motivating the agency to more aggressively buy lands during the next year, the variable is lagged. During the period of negotiations, the population of Los Angeles was growing more rapidly than expected, forcing the agency to buy more water-bearing lands. Because population data became available at the end of the year, this variable also is lagged. Availability of bond funds to purchase lands will be an important factor in completing purchase agreements, speeding sales. Farm size is included in the price-per-acre analysis as an additional control variable. It should reduce the per-acre-sale price because smaller farms tended to have more valuable improvements, including buildings and specialty crops, such as orchards, that will drive up the price on small properties.

Table 3

Table 4

As shown in panel 4a, as expected, farms with greater portions of their land in cultivation were sold later. An additional 10 percent of land in cultivation delayed sale by .1 year, relative to the mean year of purchase in the sample. Controlling for ditch location and pool membership, farmers with more water associated with their lands sold somewhat earlier, with every additional 10 acre feet of water per acre of land reducing sales time by about .5 of a year or 6 months. Riparian rights may have delayed sales, but the variable is not significant. Unfortunately, the effect of riparian rights on purchase

time is not well captured in the regression because data on the amount of riparian water is not available. Only a dummy variable is used to indicate whether there were also riparian claims associated with the farm. Among the sellers' pools, members of the Keough pool on average held out 1 year longer than did those farmers not on ditches, who comprise the baseline. Members of the Watterson and Cashbaugh pools, however, sold to the city at about the same time on average as non-ditch farmers. Farmers who were on ditches, but not in pools, sold about .6 of a year earlier than the baseline, reflecting the aggressive actions of the Water Board to buy such properties before they joined any pool. For example, the Water Board bought virtually all of the farms on the McNally and Big Pine Ditches in 1923 and 1924 for \$1,000,000 and \$1,100,000, respectively to forestall their joining pools associated with the proposed Owens Valley Irrigation District.<sup>77</sup> Previous precipitation shortfalls in Los Angeles below normal also speeded sales as did last year's population change and available bond monies. A 10-inch deviation in rainfall from normal speeded sales by about .5 years. During the drought of 1924, for example, precipitation was almost 9 inches below normal. An additional 100,000 people moved up sales by .7 of a year, and an additional \$1,000,000 in bonding shortened purchase time by .3 of a year.

Panel 4b reports regression estimates of the determinants of the price of land per acre. As shown in the table, as predicted the price paid per acre increased over time, with each year adding an average of over \$19 per acre, reflecting the effects of hold outs. Farmers with a higher portion of their land in cultivation also earned more, gaining about \$1.09 per acre for every percentage point increase in share of cultivated acreage. The available water acre feet/acre transferred with the property raised the sale price by \$26.61

per acre. Farm size reduced the per acre sale price. Location of the farm on a mutual irrigation ditch and hence, shareholder in a ditch company raised sale prices relative to farms not so located. Among ditch properties, members of the Keough pool earned about \$209 more per acre than did the 228 non-ditch property owners and \$134 more per acre than those farmers who were on ditches but not in pools. Members of the Watterson and Cashbaugh pools earned approximately \$85 and \$74 more per acre respectively than non-ditch farmers, with those in the Watterson pool earning \$10 more per acre than non-pool ditch farmers, but those in the Cashbaugh pool receiving approximately the same as those farmers. Holding riparian water rights also appears to have had a positive effect on sales prices, although the variable is not significant.

All told, the analysis of the year of purchase and the purchase price per acre is consistent with the implications drawn from the analytical framework outlined above. It explains which properties were purchased first, which held out, and which received the most per acre. It also indicates which properties would involve the most contentious negotiations in addressing valuation disputes and bi-lateral monopoly conditions in Owens Valley. The negotiations over these properties helped to give the Owens Valley water transfer its contentious history.

#### **V. Impact of the Water Transfer: Preliminary Assessments.**

Los Angeles spent more than \$18,580,000 through 1934 for agricultural properties, and more than \$5,800,000 for town parcels.<sup>78</sup> As Owens Valley lands were purchased by the Water Board and their water was sent down the aqueduct to Los Angeles, irrigated agriculture was replaced by livestock raising. Farms and ranches were leased from the Water Board and consolidated into larger ranches. The evidence suggests

that land owners in Owens Valley did well in selling their water, in contrast to the usual view of the water and land sale as one of “theft” by Los Angeles.

Census data reveal that between 1900, before the aqueduct was planned or had delivered any water, and 1930, when most farms were purchased, land values in Owens Valley rose by around a factor of 11, increasing from an average of \$13 per acre to \$143.<sup>79</sup> By contrast, land values in Lassen County, California, a similar Great Basin agricultural county, rose by a modest 2 times over the same 30-year period, from \$10 per acre to \$21. These data suggest that most of the rise in land values in Inyo County (Owens Valley) was due to land purchases by Los Angeles and not due to changes in agricultural commodity and livestock prices.

Census data also provide further evidence of the gains from trading Owens Valley water. Between 1900 and 1930 the value of agricultural land and buildings in Los Angeles County rose by \$407,051,000, an increase of nearly 600 percent, all due to the increased migration and development opportunities made possible by arrival of Owens Valley water. During that same time period, the value of agricultural land and buildings in Inyo County rose by \$11,568,000, also an increase of approximately 600 percent. By contrast, farm property values in Lassen County increased by \$6,306,000, or 172 percent from 1900.<sup>80</sup> Again, the baseline Great Basin region does not do as well. The per capita gains are more startling. The per capita gain in the value of agricultural land values in Los Angeles County in 1930 were \$184 whereas those in Inyo County were \$1,652. Ignoring distributional effects, the residents of Owens Valley benefited from the water trade relative to both the residents of Los Angeles County and their counterparts in Lassen County, who remained in agriculture.

An alternative way of assessing the impact of Owens Valley land sales is to consider the counterfactual of no Los Angeles purchase or export of Owens Valley water, the expansion of farm acreage in Inyo County at the same rate as occurred in Lassen County, and the same increase in land prices in Inyo as occurred in Lassen. Under this plausible counterfactual, farm land values would have been \$4,553,120 in 1930 in Owens Valley.<sup>81</sup> But this value is \$7,000,000 *less* than what actually occurred.

Regardless of how the gains are measured, Owens Valley land owners did better by selling to Los Angeles than remaining in irrigated agriculture, using Lassen County as a baseline. Owens Valley land owners captured part of the aggregate gains of trade as did property owners in Los Angeles. These data are indicative of the dramatic size of the aggregate benefits of this early water exchange, even when none of the increase in urban land values in Los Angeles is included.

A broader comparison of the economic history of Inyo County with four other Great Basin counties also is instructive for examining the impact of the water transfer from Owens Valley to Los Angeles. These counties were chosen because they have similar agricultural characteristics common to the Great Basin (Figure 3): short growing seasons, relatively high transportation costs, alkaline soil, and limited rainfall. Livestock raising and alfalfa growing are the principal agricultural crops. All four of the other counties have retained their water, and two, Churchill and Lyon, Nevada have received additional irrigation water from the Newlands Project, constructed between 1903 and 1917. Lassen County, like Inyo, was denied a Bureau of Reclamation irrigation project.<sup>82</sup>

Table 5 provides summary census data for four census periods, 1910 prior to the Owens Valley water transfer, 1930, when most of the farm transactions had been

completed, and 1950 and 1978, well after the water transfer had taken place. As indicated in the table the purchase of farms by the Los Angeles Water Board and the export of water clearly reduced the number of farms in Inyo County and increased farm size, relative to the other counties. Between 1910 and 1978 the total population of the county grew, although less rapidly than in the other four counties. Given the decline in farm numbers, the population growth was based on recreation and other sources of income, a pattern encouraged by Los Angeles. The small, 6 percent decline in population between 1910 and 1930 (7 percent between 1920 and 1930) tends to support the claims of town lot owners that the purchase of farm property depressed the local economy, but the magnitude seems small compared to the allegations of economic collapse.

#### Table 5

Of most interest is the value of land and buildings per farm acre. Notice the run up in prices in Inyo County between 1910 and 1930 compared to what occurred elsewhere. For instance, in 1930, per farm and per farm acre land values in Inyo County were \$62,200 and \$143, respectively, up almost 5 fold from 1910 for per farm values and almost 3 fold for 1910 per acre values. No other county had anything close to this increase in value.<sup>83</sup> This pattern most certainly reflects the purchases of farm properties by the Water Board, since there are no other indications of productivity change. This evidence supports the claim of the Board that it was paying well above market rates for Owens Valley properties. These mean values also reflect the effects of the holdout strategies of the sellers' pools. With city-owned property dominating the county after 1930 and farm consolidation, per acre values tended to decline and be more in line with those observed elsewhere in the Great Basin by 1950 and less than three of the other four



counties by 1978. Even so, after 1910 values per farm far exceeded those found elsewhere due to the sharp decline in the number of farms in Inyo County. In terms of the value of farm production, crop and livestock production, Inyo clearly grew less rapidly than the other counties, and shifted more dramatically early from crops to livestock raising, a pattern consistent with a movement from irrigated agriculture. By 1978 the value of production per farm in Inyo County was comparable to that in two Great Basin counties (Douglas and Lyon) and greater than that in two others (Churchill and Lassen).

In total, the census data suggest a more positive agricultural condition than is commonly suggested for Owens Valley. The export of water reduced crop production as a share of overall agricultural output and encouraged a shift toward livestock. But this pattern also took place in the other counties. The comparative advantage of the Great Basin ultimately was in livestock, so there would have been a gradual shift from crops in Owens Valley, even had the aqueduct not been built. Owens Valley was not left a wasteland as is sometimes alleged. Nor would its small orchards and other crops that were grown through 1920 likely to have remained competitive for the longer term had the water remained in the valley. The export of water did change agriculture and life in Owens Valley, but it was not dominantly a negative change, nor was it decidedly different from that which occurred in agriculture throughout the Great Basin.

#### **V. Concluding Remarks: Lessons of Owens Valley for Understanding the Transaction Costs of Water Transfers.**

The largest voluntary water exchange from agriculture to urban uses was the Owens Valley water transfer to Los Angeles, negotiations for which began almost 100 years ago. The purchase of private land and water rights by the city of Los Angeles took

about 30 years to complete after hotly-contested negotiations, periodic episodes of violence, and occasional intervention by the California Governor's office and the State Legislature, all of which attracted national and international attention. The benefits to Los Angeles of the exchange included an increase in the value of agricultural land alone of over \$400 million with aggregate urban land values likely rising several multiples of this amount. Owens Valley water certainly made the subsequent growth of Los Angeles possible. The benefits to Owens Valley land owners in terms of the increase in agricultural land values were approximately \$12 million, about \$7 million more than they likely would have received had the region stayed in irrigated agriculture. And on a per capita basis, Owens Valley residents received about 10 times per person from the water and land exchange as did the residents of Los Angeles County (\$1,652 per person, compared to \$184).

Nevertheless, the legacy of the transfer has been a very negative one, so much so that Owens Valley has become a metaphor for opposing water markets and the transfer of water from agriculture to urban and environmental uses.<sup>84</sup> One reason for the legacy is the imbalance in the distribution of the total, if not per capita, returns that underscores the "theft" claim. The overall gains to Los Angeles were 40 times or more those of Owens Valley from the redistribution of water. When the gains from trade are unexpectedly enormous, distributional issues move to the forefront. Although the Los Angeles aqueduct was constructed to augment the city's water supply, no one in 1913 could have anticipated the population growth that subsequently took place. The reallocation of Owens Valley water was a huge windfall, with its magnitude perhaps unexpected. While Owens Valley farmers were made better off than they otherwise would have been had

they remained in irrigated agriculture, as a group they did not capture the major portion of the aggregate gains from trade. *Ex post* many of their advocates were bitter about this distributional outcome. In general, it may be that trades are smooth when the gains are generally known and the resulting returns reasonably equal. But they are less likely to be completed, or result in real acrimony, when the gains turn out to be much larger than anticipated with a distribution that is very skewed toward one party.<sup>85</sup>

The bargaining framework also suggests why the Owens Valley negotiations were so rancorous, with such a negative legacy. The lands were heterogeneous and there were intense debates over valuation and hence, individual shares of the observed potential gains from trade described above.<sup>86</sup> The most contentious negotiations took place within bi-lateral monopoly conditions. Neither party could leave the exchange, but both had sharply different prices in mind, with the most valuable properties, carrying the most water, holding out for higher prices than initially offered by the Water Board. The price gaps also were not easily narrowed because of information limits and uncertainties about the value of water in Owens Valley and Los Angeles, about the amount of water Los Angeles ultimately would require, and about how much irrigated agriculture could be sustained in the valley. Further, the gaps could not be quickly narrowed because of a lack of trust between the parties that made them suspicious of the offers of both sides with little means of resolving the suspicion. And there were third-party effects on the towns and uncertainty about their significance and the legality of purchases of those properties by Los Angeles. Given the overall decline in agriculture in the Great Basin and the country in the 1920s and 1930s, as well as the countering impact of Los Angeles' investments in highways and recreation facilities, these third-party effects may have been

comparatively small in fact, although they played an important role in bargaining posturing.

The economic surpluses that new water generated in Los Angeles County were so large that the Water Board might have taken a more liberal approach in its pricing policies, allowing for more active use of binding arbitration. This of course, would have driven the agency from its strict pricing rule and required additional bond issues. Had the Board purchased farm and town properties more rapidly and at higher prices, the Owens Valley transfer might not have the harmful reputation it enjoys today. But such a counterfactual supposes that Los Angeles taxpayers would have supported higher bond issues and that the Board agents could have resisted even higher price demands from Owens Valley land owners, especially those with the greatest water to offer. Neither was likely.

To improve their bargaining position relative to that of the Los Angeles Water Board, Owens Valley land owners appealed to the press and to the California legislature. The image of rural farmers battling large urban interests fit well within the tradition of progressive, muckraking news reporting, and it sold papers even if the story was not a balanced or necessarily factual one. Further, political representatives of other rural communities with a stake in the bargaining outcome, as well as those who represented northern California jurisdictions with concerns about a political shift toward a rapidly growing southern California, provided ready allies in condemning the negotiating tactics of the Water Board.

Allegations of water theft and desolation of Owens Valley began to take lives of their own after 1930. They were repeated in Mayo's 1933 history of Los Angeles, novels,

and later in the 1950s in other works on western water.<sup>87</sup> Additionally, there were environmental controversies beginning in the 1970s due to the drawdown of the water levels of Mono Lake after the aqueduct was extended north to the Mono Basin in 1940 and from dust storms originating from the (now) dry Owens Lake bed.<sup>88</sup> In these environmental disputes critics of Los Angeles repeatedly returned to the ‘theft’ of Owens Valley water as the source of the problem. All of these factors help explain the notoriety of the Owens Valley water transfer and why the prevailing negative assessment of it casts such a pall over current efforts to reallocate water to urban uses from agriculture.

**Table 1**  
**Chronology of Los Angeles-Owens Valley Land and Water Negotiations**

<b>Year</b>	<b>Events</b>
<b>1898-1902</b>	Concern about the water supply as a break on the growth of Los Angeles. Los Angeles population 250,000
<b>1903-09</b>	Los Angeles Water Board quietly buys 22,670 acres of land in southern Owens Valley. Later purchases more lands, mostly from federal government in southern Owens Valley. Owns 82,000 acres. Little controversy.
<b>1903-07</b>	Reclamation Service considers and then abandons irrigation project in Owens Valley. Los Angeles obtains federal right of way for aqueduct.
<b>1907-10</b>	Bond issues approved for aqueduct and power generation. Los Angeles population 319,187
<b>1913-20</b>	Aqueduct completed; most water directed to San Fernando Valley, which is annexed. Land values jump. Limited impact on agriculture in Owens Valley.
<b>1920</b>	Los Angeles population 576,637.
<b>1922</b>	Drought. Bond issue passes. Water Board begins buying land in northern Owens Valley.
<b>1923-24</b>	Conflict over price. Sellers' prices reflect water value in LA, not local appraised values. Board's offers based on local use. Sellers' pools form: Keough Pool on Owens River Canal, and Cashbaugh and Watterson Pools on Bishop Creek Canal. Board focuses on non-pool lands, seeks defectors. Aqueduct dynamited; spillway opened, releasing water to desert; risk to water supply. State and national press coverage of "California's Little Civil War." Owens Valley and Big Pine Reparations Associations form to demand compensation as the agricultural economy declines. Appeal to state and national press
<b>1925</b>	Los Angeles population 1,192,000. When flowing, aqueduct at half capacity due to drought.
<b>1925-29</b>	Contentious negotiations for land and water rights continue. Board retains 4 times appraisal rule for setting prices and paying same price for comparable lands. Sellers object that properties are dissimilar and that prices do not reflect city water values. Aqueduct and city wells dynamited. Periodic diversion of city water. Board halts purchases of additional property in Owens Valley in 1927. Two sellers' pools sell out, one remains. Taxpayer concerns about high payments for land in Owens Valley.
<b>1930</b>	Los Angeles population 2,208,492.
<b>1931-33</b>	Board begins to purchase town properties. Aqueduct dynamited. Los Angeles owns 95% of farm properties and 85% of town properties. Keough Pool purchases completed.

**Table 2**  
**Owens Valley Farm Property Characteristics, Mean Values**

Property Type	Price/acre	Mean Year of Purchase	% Cultivated Land	Water Acre feet/acre	Size (acres)	Riparian Rights %	#
<b>All Properties*</b>	\$198.22	1926	.17	3.66	154	.35	595
<b>Farms on Ditches</b>	\$270.65	1926	.21	5.18	121	.37	367
<b>Farms Not on Ditch</b>	\$81.62	1927	.09	1.19	207	.31	228
<b>Keough Pool<sup>1</sup></b>	\$443.42	1928	.20	5.74	79	.96	23
<b>Cashbaugh Pool<sup>1</sup></b>	\$241.80	1927	.14	4.42	126	.19	43
<b>Watterson Pool</b>	\$237.00	1926	.21	3.86	147	.25	20

\*Properties 10 acres or larger purchased by Los Angeles between 1916 and 1934. Smaller properties were not farms, but town lots and addressed separately: "Tabulation Showing Status of Ranch Land Purchases Made by the City of Los Angeles in the Owens River Drainage Area from 1916 to April 1934," Prepared in Right of Way and Land Division by Clarence S. Hill, Right of Way and Land Agency, Compiled by E.H. Porter, April 16, 1934, LADWP Archives.

<sup>1</sup>Records in the LADWP Archives indicate that the Keough pool had 30 members and the Cashbaugh pool, 48, but not all are in the data set for analysis because of missing information.

**Table 3**  
**Descriptive Statistics**

Variable (595 observations)	Mean	Standard Deviation	Minimum	Maximum
<b>Land Price/acre</b>	\$198.22	\$163.38	\$3.00	\$954.90
<b>Year of Purchase</b>	1926	1.87	1917	1932
<b>Cultivation Fraction</b>	0.17	0.26	0	1.00
<b>Farm Size (acres)</b>	154	267	10	3,502
<b>Water/acre (acre feet/acre)</b>	3.66	3.10	0	16.5
<b>Riparian Rights (Y/N)</b>	0.35	0.48	0	1
<b>Keough Pool (Y/N)</b>	0.04	0.19	0	1
<b>Cashbaugh Pool (Y/N)</b>	0.07	0.26	0	1
<b>Watterson Pool (Y/N)</b>	0.03	0.18	0	1
<b>Other Ditch (non pool) (Y/N)</b>	0.47	0.50	0	1
<b>LA Annual Population Change (000) 1916-1934</b>	123	75	23	283
<b>LA Annual Precipitation Deviation from Mean in inches (1910-40)</b>	0.11	4.98	-8.51	4.25
<b>Bond Monies (000)</b>	\$6,300	\$2,571	-\$755	\$8,947

**Table 4**  
**Determinants of Year of Purchase and Price Received Per Acre**

**a.) First Stage Results**

**DV = Year of Purchase**

Variable	Coefficient	SE
Constant	1929.72*	0.21
% of Farm Cultivated <sub>t</sub>	1.07*	0.22
Water Acre Feet /Acre <sub>t</sub>	-0.05**	0.02
Total Farm Acres <sub>t</sub>	-0.0002	0.0002
Riparian Rights <sub>t</sub>	0.13	0.12
Member of Keough Pool <sub>t</sub>	1.05*	0.32
Member of Cashbaugh Pool <sub>t</sub>	0.14	0.24
Member of Watterson Pool <sub>t</sub>	0.20	0.32
Farms on Ditches but not in Pool <sub>t</sub>	-0.58*	0.16
Precipitation Deviation <sub>t-1</sub>	0.05*	0.01
LA Annual Population Growth <sub>t-1</sub>	-0.01*	0.001
Bond Funds <sub>t</sub>	-0.0003*	0.00
595 obs. , R <sup>2</sup> = .50, F(11,583) = 54.48		

\*significant at the 1% level or better.

\*\*significant at the 5% level

**b.) Second Stage Results**

**DV = price per acre**

Variable	Coefficient	SE
Constant	-35,761.42*	7,456.01
Estimated Year of Purchase <sub>t</sub>	18.58*	3.87
% of Farm Cultivated <sub>t</sub>	108.82*	18.01
Water Acre Feet /Acre <sub>t</sub>	26.61*	1.83
Total Farm Acres <sub>t</sub>	-0.05*	0.02
Riparian Rights <sub>t</sub>	2.98	9.38
Member of Keough Pool <sub>t</sub>	209.11*	24.13
Member of Cashbaugh Pool <sub>t</sub>	74.16*	17.83
Member of Watterson Pool <sub>t</sub>	85.24*	24.26
Farms on Ditches but not in Pool <sub>t</sub>	75.02*	12.34
595 obs. , R <sup>2</sup> = .62, F(9,585) = 103.31		

\*significant at the 1% level or better.



**Table 5**  
**Census Data for Five Great Basin Counties**

	Number of Farms				Average Farm Size (acres)				Population			
County	1910	1930	1950	1978	1910	1930	1950	1978	1910	1930	1950	1978
<b>Inyo</b>	438	218	193	80	251	434	1,146	4,944	6,974	6,555	11,658	17,895
<b>Lassen</b>	502	472	420	340	589	1,003	1,624	1,601	4,802	12,589	18,474	21,661
<b>Churchill</b>	354	614	642	464	320	144	236	729	2,811	5,075	6,161	13,917
<b>Douglas</b>	132	135	139	131	638	1,084	1,632	819	1,895	1,840	2,029	19,421
<b>Lyon</b>	208	339	331	288	508	554	718	881	3,568	3,810	3,679	13,594
	Value of Land and Buildings/ Farm (Current \$)				Value of Land and Buildings/Acre (Current \$)				Total Value of Production (\$000)			
County	1910	1930	1950	1978	1910	1930	1950	1978	1910	1930	1950	1978
<b>Inyo</b>	13,172	62,200	67,586	1,108,563	52	143	59	224	1,070	1,179	1,370	5,043
<b>Lassen</b>	14,138	21,109	43,848	372,058	24	21	27	243	1,896	2,992	3,388	12,476
<b>Churchill</b>	8,498	11,565	24,323	309,920	27	80	103	441	574	3,066	3,810	23,234
<b>Douglas</b>	23,171	44,658	84,884	525,659	36	41	52	659	860	2,136	2,246	9,241
<b>Lyon</b>	15,559	21,891	52,401	548,056	32	40	73	613	847	2,863	3,602	20,007
	Livestock Production (\$000)				Crop Production (\$000)				Value of Farm Products/Farm (Current \$)			
County	1910	1930	1950	1978	1910	1930	1950	1978	1910	1930	1950	1978
<b>Inyo</b>	342	444	1,104	4,500	533	465	116	541	2,442	5,407	7,100	63,038
<b>Lassen</b>	816	1,211	2,719	9,004	898	1,023	377	3,459	3,777	6,338	8,067	36,694
<b>Churchill</b>	123	452	2,112	19,397	357	1,516	813	3,834	1,621	4,994	5,935	50,073
<b>Douglas</b>	195	886	1,768	8,272	528	853	150	968	6,514	15,825	16,156	70,542
<b>Lyon</b>	177	792	2,363	14,005	500	1,363	871	6,002	4,071	8,444	10,881	69,469

Source: U.S. Census, Land and Building Values/ Acre from Barnard and Jones (1987).

**Figure 1**  
**Owens Valley**



**Figure 2**  
**The Bargaining Framework**

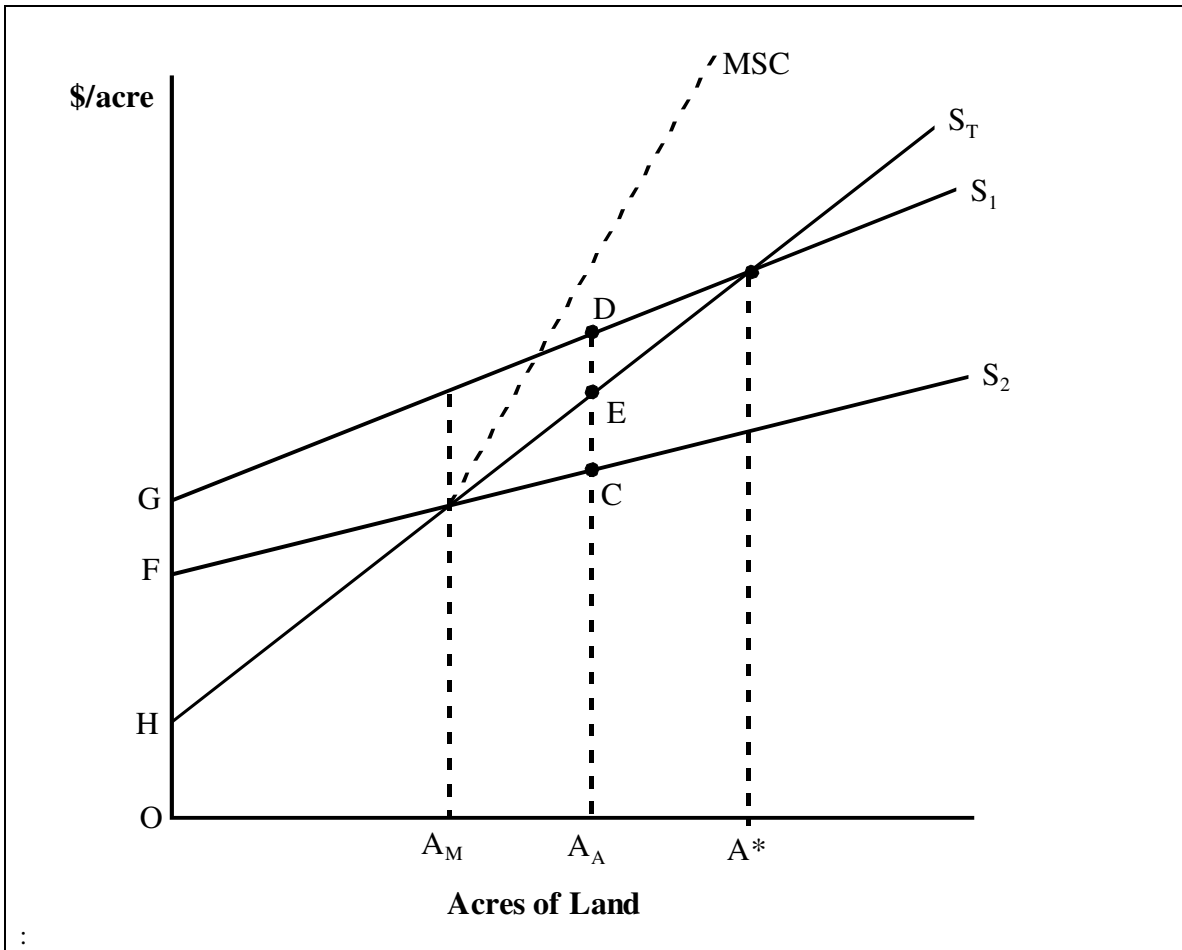
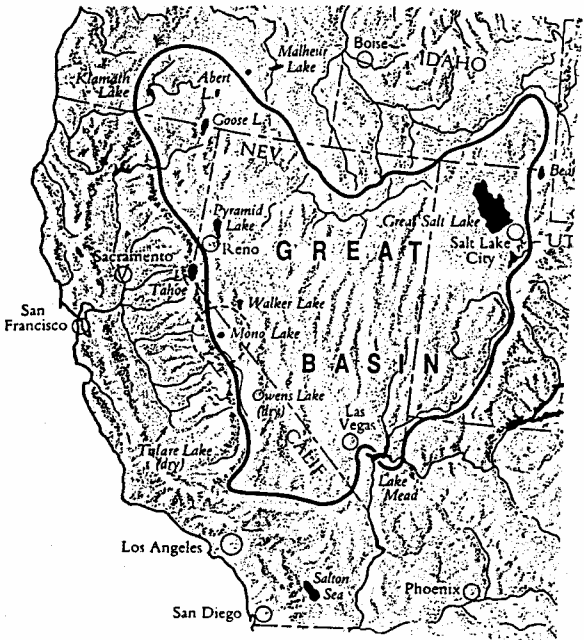


Figure 3  
The Great Basin



Source: Hart, 1996, 9.

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<sup>1</sup> Letter, September 22, 1924 to the Grand Jury of Inyo County from WW. Yandell and Ione Seymoure of the Farmers Ditch Company regarding Los Angeles purchase of McNally Ditch. Tape GX0007, Town Properties File, LADWP Archives

<sup>2</sup> For discussion of contemporary water problems, especially groundwater drawdown, see Glennon (2002).

<sup>3</sup> Ostrom (1953, 127).

<sup>4</sup> See for example, article by Henry Osborne in the *Scientific American* 1913, as well as Nadeau (1950, 45-60), Ostrom (1971, 447-8), Department of Public Service, 1916, Complete Report on Construction of the Los Angeles Aqueduct. 17-29.

<sup>5</sup> Ostrom (1953, 23).

<sup>6</sup> Los Angeles' growth might have occurred later with advent of Colorado River water beginning in the early 1940s. But with a much smaller Los Angeles, the political negotiations behind construction of Hoover Dam and the California and Colorado Canals, bringing Colorado River water to California, might have been quite different.

<sup>7</sup> For discussion of the impact of Owens Valley water on Los Angeles, see Kahrl (1982, 227-230).

<sup>8</sup> Kahrl (1982, 230).

<sup>9</sup> A search of the Westlaw "ALLNEWS" data base of Owens Valley provides large and negative press accounts, generally repeating assertions of transforming a verdant agricultural valley into a waste land. The articles are usually in the context of more recent environmental conflicts between Los Angeles and advocates for more water for Mono Lake.

<sup>10</sup> Throughout the discussion the reference is to the Los Angeles Water Board. The Board had several designations over the period, ranging from the Water and Public Service Commission to the Water and Power Commission to the Department of Water and Power. The analysis also relies on the existing literature, especially Hoffman (1982), Kahrl (1982), Ostrom (1953), Miller (1977), Nadeau (1950), Walton (1992) and Sauder (1994).

<sup>11</sup> The Los Angeles Board of Water Commissioners in its Annual Report for 1904 noted that local sources beyond the Los Angeles river were too limited to be of much help and that the city would have to find more remote supplies of water (1904, 25).

<sup>12</sup> Mean precipitation for Los Angeles, 1921-2002 from

[www.nwsla.noaa.gov/climate/data/cqt\\_monthprecip\\_cy.txt](http://www.nwsla.noaa.gov/climate/data/cqt_monthprecip_cy.txt) and mean for Chicago, 1871-2003 from [home.att.net/~chicago\\_climo/CHIPRCP.gif](http://home.att.net/~chicago_climo/CHIPRCP.gif).

<sup>13</sup> Ostrom (1953, 23) provides data on the various sources of water for Los Angeles, 1920-1950.

<sup>14</sup> Miller (1977, 49-50).

<sup>15</sup> 1920 U.S. Census.

<sup>16</sup> 1925 U.S. Agricultural Census; Ostrom (1953, 118) for irrigation acreage in 1910. See also, Walter Packard, "The Future Agricultural Development of Owens Valley," January 22, 1925, Tape GX0004, Special Owens Valley File, LADWP Archives.

<sup>17</sup> Miller (1977, 53-55). The agricultural potential of Owens Valley generally is exaggerated in the literature. Kahrl (1982, 38) for example, inappropriately compares it to the Imperial Valley, which has good soil, better drainage, and at sea level, virtually year-round growing conditions.

<sup>18</sup> "Classified Acreage of Lands Under Ditch, Bishop-Big Pine Region of Owens Valley, Based on Surveys by City of Los Angeles, 1922 to 1926" Tape GX0004, Misc. File, LADWP Archives. Water was apportioned among farmers on a ditch in proportion to their shares in the ditch company. For discussion of ditch companies, see Israelsen, Maughan, and South (1946). Mutual ditch companies were organized by farmers who held stock in them and the companies generally held the water rights of the stockowners. Expenses were met by annual assessments. See also By-laws of the McNally Ditch Company, GX0008, McNally Ditch File, LADWP Archives.

<sup>19</sup> Tape GX0004, Miscellaneous File, "Classified Acreage of Lands Under Ditch...1922-1926." LADWP Archives.

<sup>20</sup> Miller (1977, 44-56).

<sup>21</sup> Tape GX0007, Owens Valley Lands file, Report to Ralph Criswell of Owen Valley Lands, August 6, 1927 from John T. Martin, Right of Way and Land Agent and "Tabulation Showing Status of Ranch Land Purchases Made by the City of Los Angeles in the Owens River Drainage Area from 1916 to April 1934," Prepared in Right of Way and Land Division by Clarence S. Hill, Right of Way and Land Agency, Compiled by E.H. Porter, April 16, 1934, Tape GX0004, LADWP Archives.



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- <sup>22</sup> Hoffman (1982, 141-54), Kahrl (1982, 90-103), Ostrom (1953, 149-54) describes bond issues in 1907, sources of opposition, outrage over land speculation in San Fernando Valley, conflict over annexation, and disputes between the city and private power and water companies over compensation for their properties.
- <sup>23</sup> As dramatized in the movie, "Chinatown. A short summary of the scandal over insider land purchases is provided in Ostrom (1953, 58,149-51), Kahrl (1982, 195) and Nadeau (1950, 29-41).
- <sup>24</sup> Nadeau (1950, 29) noted that property values in much of Los Angeles doubled in price in 1905 when the Owens Valley project was announced.
- <sup>25</sup> Kahrl (1982, 170), Hoffman (1982, 154-53), and Ostrom (1953, 149-51) describe early water distribution.
- <sup>26</sup> Sauder (1994, 122), Ostrom (1953, 148). Quinton, Code, and Hamlin outlined the proposed distribution of Owens Valley water (Los Angeles Board of Public Service Commissioners (1911).
- <sup>27</sup> Hoffman (1981, 50-71).
- <sup>28</sup> This apparent deception is stressed in all historical discussions of the Owens Valley controversy, for instance, see Ostrom (1953, 116-18).
- <sup>29</sup> Details on Lippincott's alleged conflict of interest are provided in Hoffman, 1982, 68-79, 136-41) and Kahrl (1982, 39-79, 85-140).
- <sup>30</sup> Conflict of interest is charged by Nadeau (1950, 28-31). Miller (1977, 66-79) reported concerns about high water table, need for drainage, and high elevation in Owens Valley. Pisani (1984, 302) describes the problems with Owens Valley relative to other more promising sites in the West.
- <sup>31</sup> See for example the lingering resentment on this issue in a letter, September 22, 1924 to the Grand Jury of Inyo County from WW. Yandell and Ione Seymoure of the Farmers Ditch Company regarding Los Angeles purchase of McNally Ditch, Tape GX0007, Town Properties File, LADWP Archives. See also discussion of the legacy of the Reclamation Service project cancellation in Hoffman (1982, 105, 112-19). Details on the Owens River watershed are provided in Ostrom (1953, 11).
- <sup>32</sup> "Tabulation Showing Status of Ranch Land Purchases Made by the City of Los Angeles in the Owens River Drainage Area from 1916 to April 1934," Prepared in Right of Way and Land Division by Clarence S. Hill, Right of Way and Land Agency, Compiled by E.H. Porter, April 16, 1934, LADWP Archives.
- <sup>33</sup> Memo by land agent, AJ Ford for the Investigation file, March 11, 1931, Tape GX0002, Investigating Committee File, LADWP.
- <sup>34</sup> Hoffman (1982,252), Ostrom (1953, 14, 49,50, 61, 63).
- <sup>35</sup> Ostrom (1953, 59-62).
- <sup>36</sup> Ostrom (1953, 50, 63).
- <sup>37</sup> Tape GX0003 Owens River and Big Pine Canal File, Transcript of Proceedings, August 13, 1926 Ladies Committee to Board of Water and Power Commissioners, testimony by Mrs. Wallace. LADWP Archives.
- <sup>38</sup> Tape GX0004, Sale of Lands File, Letter from Board of Public Service Commission to land owners, C.P. Crowell and S.F. Zombro, LADWP Archives.
- <sup>39</sup> Testimony from Mrs. G.L. Wallace, Transcript of Proceedings, August 13, 1926, Ladies Committee to Board of Water and Power Commissioners, Tape GX0003, Owens River and Big Pine Canal File, LADWP Archives.
- <sup>40</sup> Tape GX0004 Special Owens Valley Committee File, Resolution, July 20, 1925, Board of Water and Power Commissioners. LADWP Archives.
- <sup>41</sup> Tape GX0004, Special Owens Valley Committee File, Memo July 21, 1926 Board of Water and Public Service Commissioners, LADWP Archives.
- <sup>42</sup> Tape GX0003 Owens River and Big Pine Canal File, letter to the Owens Valley Appraisal Committee from E.F. Leahey, September 10, 1926, LADWP Archives.
- <sup>43</sup> Tape GX0003 Owens River and Big Pine Canal File, Transcript of Proceedings, August 13, 1926 Ladies Committee to Board of Water and Power Commissioners, testimony by Mrs. R. C. Clapp. LADWP Archives.
- <sup>44</sup> Tape GX0003 Owens River and Big Pine Canal File, Transcript of Proceedings, August 13, 1926 Ladies Committee to Board of Water and Power Commissioners, testimony by Mrs. Wallace. LADWP Archives.
- <sup>45</sup> Tape GX0004, Special Owens Valley Committee file, telegram 7/22/25 to W.B. Mathews, Special Counsel, from the Keough Pool committee and telegram from Board President R.F. Del Valle to Karl Keough, 7/28/25. LADWP Archives.
- <sup>46</sup> Tape EJ00086, Correspondence June to September 1927, letter John A Merrill to Board of Public Service Commissioners, August 15, 1927, LADWP Archives.

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- <sup>47</sup> Tape GX0001, Clippings File, Hollywood Daily Citizen editorial, n.d. probably late 1929. LADWP Archives.
- <sup>48</sup> The land purchase data set used here has 23 farmers in the Keough pool, 43 in Cashbaugh, and 20 in the Watterson pool. Other files, however, indicate somewhat larger numbers of members, but details on those farms are not included.
- <sup>49</sup> Tape GX0004, Special Owens Valley Committee File, Letter 9/15/25 to WB Mathews, EF Leahey, and HA Van Norman, from Bishop Cr Committee regarding complaints about commissions charged landowners from pool. LADWP Archives.
- <sup>50</sup> Herfindahl indices based on water acre feet give similar relative values.
- <sup>51</sup> Tape GX0001, Fish Slough File “Cashbaugh Pool,” LADWP Archives.
- <sup>52</sup> Memo, July 21, 1926 by Board of Water and Public Service Commissioners, Tape GX0004, Special Owens Valley Committee File, “Owens River Canal Properties,” Tape GX0004, Sale of Lands File, and Letter, July 21, 1925 to the Board of Water and Power Commissioners from the Purchasing Committee, Tape GX0003, Owens River and Big Pine Canal File, LADWP Archives.
- <sup>53</sup> “Owens River Canal Properties” and “Letter,” February 24, 1926 from various individuals to F. Del Valle, President, Los Angeles Water Board, Tape GX0004, Sale of Lands File and “Tabulation Showing Status of Ranch Land Purchases Made by the City of Los Angeles in the Owens River Drainage Area from 1916 to April 1934,” Prepared in Right of Way and Land Division by Clarence S. Hill, Right of Way and Land Agency, Compiled by E.H. Porter, April 16, 1934, LADWP Archives.
- <sup>54</sup> Wood (1973, 30-37), Ostrom (1953, 121-27).
- <sup>55</sup> *Literary Digest* December 6, 1924, 13-4. Tape GX00086, Letter May 9, 1924 from land agent John Martin to William Mulholland claiming that the dynamiting was an effort to force the city to buy at “exorbitant prices.”
- <sup>56</sup> Tape GX0001, Miscellaneous File, “The Dynamite Holdup,” Statement by the Board of Water and Power Commissioners, LADWP Archives.
- <sup>57</sup> Tape GX0004, Sale of Lands File, Letter from LADWP to two land owners, C.P. Crowell and S.F. Zombro reporting on the status of land purchases in Owens Valley. “Tabulation Showing Status of Ranch Land Purchases Made by the City of Los Angeles in the Owens River Drainage Area from 1916 to April 1934,” Prepared in Right of Way and Land Division by Clarence S. Hill, Right of Way and Land Agency, Compiled by E.H. Porter, April 16, 1934, LADWP Archives.
- <sup>58</sup> Miller (1977, 164); Mrs. G.L. Wallace and Mrs. J.H. Stofflet in “Transcript of Proceedings, August 13, 1926, Ladies Committee to Board of Water and Power Commissioners,” Tape GX0003, Owens River and Big Pine Canal File, LADWP Archives. Miller (1987) discusses the spillover effects among ditch users when some parties sell their water for export, raising the costs for remaining ditch members. Concerns about these costs may have motivated owners to sell.
- <sup>59</sup> Nadeau (1950, 96).
- <sup>60</sup> Miller (1977, 164, footnote 20).
- <sup>61</sup> Kahrl (1982, 144, 297) claimed that the economy had been devastated but presents the city’s counter claims.
- <sup>62</sup> Ostrom (1953, 123-27).
- <sup>63</sup> Hoffman (1982, 176-202).
- <sup>64</sup> Statement to Mayor’s Advisory Committee Prepared by the Special Owens Valley Committee of the Board of Public Service Commissioners, December 16, 1924, Tape GX0004, Special Owens Valley Committee.
- <sup>65</sup> Hoffman (1982, 284-301), August 30, 1927 Report of the Special Owens Valley Committee to the Board of Directors of the Los Angeles Chamber of Commerce, Tape GX0086, Correspondence, June-October, 1927 File,
- <sup>66</sup> Chapter 109 of the Statutes and Amendments to the Codes of California, 1925.
- <sup>67</sup> Ostrom (1953, 126). Town representatives ask that 1929 town lot appraisals be increased by 45 to 50% for Laws and Independence, 120 percent for Bishop and 60% for Big Pine to compensate for depreciation due to the city’s farm purchase program. A compromise is reached and LA pays \$2,975,833 for Bishop lots, \$772,635 for Big Pine, \$730306 for Independence, \$102,446 for Laws, and \$1,217,560 for Lone Pine for a total of \$5,798,780.

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<sup>68</sup> Tape GX0002, Investigating Committee File, see demands by Senators Joe Riley and Dan Williams from Inyo County regarding their properties, and resolution by Senator Herbert Johnson Evans, March 9, 1931, Chair of the Conservation Committee, LADWP Archives.

<sup>69</sup> Ostrom (1953, 126), Tape EJ0086, Correspondence January-March 1929 File, "Owens Valley Situation, Synopsis," Tape GX0002, Investigating Committee File, Memo by A.J. Ford, land agent for the investigating file, March 11, 1931, LADWP Archives.

<sup>70</sup> Nadeau (1950, 125-130).

<sup>71</sup> Hoffman (1982, 253). Of the May 20, 1930 bond issue of \$38,800,000, \$19,181,000 to buy up remaining properties, \$7,400,000 to build tunnel from Mono Basin and rest for dam construction in Long Valley and other places.

<sup>72</sup>  $S_T = F_A / F_M \cdot S_2$ , where  $F_A$  = actual fertility and  $F_M$  = mean fertility for land in the area.

<sup>73</sup>  $S_1 = S_2 \cdot V_L / V_O$ , where  $V_L$  = value of water in Los Angeles and  $V_O$  = value of water in Owens Valley.

<sup>74</sup> The land owner with property at  $A_M$  is indifferent to selling at the offer price or holding out for more.

<sup>75</sup> Oligopsony is discussed by Just and Chern (1980). For problems facing a monopolist when the product is durable, see Coase (1972). See also Kennan and Wilson (1993) for other discussions of bargaining problems.

<sup>76</sup> The 1923 bond issue, for example, was \$5,000,000. For the 595 observations in the data set, the mean price per acre was \$198 and the mean farm size was 153 acres or \$30,294 per sale. Annual precipitation data from 1910 to 1940 are for Long Beach from <http://climvis.ncdc.noaa.gov/cgi-bin/ghcn/precip.chcncgi>. Long Beach data are virtually the same as those for Los Angeles for which the data were more limited. Annual Los Angeles population is estimated and provided at <http://www.laep.org/target/science/population/table.html>. The estimations are based on decennial census data and estimates provided by the California Taxpayers Association, the Los Angeles Chamber of Commerce, and those compiled by the Los Angeles County Regional Planning Commission. Data on available bond monies are incomplete. Ostrom (1953, 14, 49-50, 61, 63) describes various bond issues and amounts. There was a \$5,000,000 issue passed in 1922 and reference to 4 others between 1923 and 1926. In 1930 there was a \$38,800,000 bond issue, part of which was used for Owens Valley land purchases. Because total purchases between 1922 and 1929 exceeded \$5,000,000, the other bond issues must have covered them. Accordingly, the bond variable is assigned \$500,000 in 1916, sufficient funds to cover the limited land purchases that took place between 1916 and 1922 (about \$95,000— "Tabulation Showing Status of Ranch Land Purchases Made by the City of Los Angeles in the Owens River Drainage Area from 1916 to April 1934," Prepared in Right of Way and Land Division by Clarence S. Hill, Right of Way and Land Agency, Compiled by E.H. Porter, April 16, 1934, Tape GX0004, LADWP Archives). Expenditures are debited each year from this amount. In 1922 \$5,000,000 is added reflecting that year's bond issue, and then \$2,000,000 annually in 1923-26 to cover documented expenditures on land, which are debited. From May 1927 through January 1929 the Board did not purchase lands due, at least in part, to a lack of bond funds. Accordingly, no new monies are added during 1927-29. With purchases, available bond funds become negative by 1928. In 1930 the \$38,800,000 bond issue was passed, adding \$6,600,000 for Owens Valley purchases. This amount is included in the bond data in 1930 to cover expenditures between 1930 and 35 and the shortfall in 1928 and 1929.

<sup>77</sup> The role of the purchase of the McNally and Big Pine Ditches in thwarting the effective organization of the Owens Valley Irrigation District is described in a letter, September 22, 1924 to the Grand Jury of Inyo County from W.W. Yandell and Ione Seymoure of the Farmers Ditch Company regarding Los Angeles purchase of McNally Ditch. Tape GX0007, Town Properties File. Tape GX0001, Ditches File, "Percentage of Water Stock Owned by City of Los Angeles in Private Ownership in the Following Ditch Companies," LADWP Archives. See also, Kahrl (1982, 279), Nadeau (1950, 95), Sauder (1994, 140-43).

<sup>78</sup> "Tabulation Showing Status of Ranch Land Purchases Made by the City of Los Angeles in the Owens River Drainage Area from 1916 to April 1934," Prepared in Right of Way and Land Division by Clarence S. Hill, Right of Way and Land Agency, Compiled by E.H. Porter, April 16, 1934, LADWP Archives. Memo by land agent, AJ Ford for the Investigation file, March 11, 1931, Tape GX0002, Investigating Committee File, LADWP Archives.

<sup>79</sup> Inyo County. Barnard and Jones (1987, 10-12).

<sup>80</sup> Census data are from <http://fisher.lib.virginia.edu/cgi-local/censusbin/census/cen.pl>. These figures are only representative of the actual gains from trade. The data for Los Angeles do not include increases in urban land values and the amount of agricultural land in Los Angeles declined by 369,000 acres between

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1900 and 1930. Similarly, the amount of farm land in Inyo County declined by 46,000 acres, whereas in Lassen County, farm land grew by 94,000 acres. Nevertheless, the data are indicative of the values involved.

<sup>81</sup> These values are calculated as follows: Using census data for 1900 and 1930, Inyo County had 141,059 acres in farms in 1900 and Lassen 381,109 acres. In 1930, Lassen had 473,268 acres, an increase of 24%. Had Inyo farm acreage grown in the same way, then in 1930 there would have been 175,120 farm acres. Lassen farm acreage values doubled over the 30 years, and 1900 Inyo per acre values were \$13. Using the Lassen increase, gives a 1930 per acre value in 1930 of \$26 and multiplying this times the 1930 estimated acreage gives a value of farm acreage of \$4,553,120.

<sup>82</sup> Pisani (1984, 303).

<sup>83</sup> For example, 1910 per acre land and building values were \$52 in Inyo, \$24 in Lassen, \$27 in Churchill, \$36 in Douglas, and \$32 in Lyon County. By 1930 the relative values were \$143, \$21, \$80, \$40, and \$41. 1930 per farm values were \$62,200 for Inyo, \$21,109 for Lassen, \$11,565 for Churchill, \$44,658 for Douglas and \$21,891 for Lyon. Source, U.S. Agricultural Censuses.

<sup>84</sup> For discussion of water markets, see Anderson and Snyder (1997), Colby and Bush (1987).

<sup>85</sup> P.J. Hill made this point in assessing the results of the Owens Valley transfer.

<sup>86</sup> This is similar to efforts to define unitization shares in oil fields. See Wiggins and Libecap (1985).

<sup>87</sup> See discussion on the persistence of the notion of water theft in Hoffman (1982, 208-42). Another discussion of the myth of Owens Valley is by John Walton "Film Mystery as Urban History: The Case of Chinatown" [http://sociology.ucdavis.edu/jt.walton/walton\\_pdf/Dublin\\_paper.pdf](http://sociology.ucdavis.edu/jt.walton/walton_pdf/Dublin_paper.pdf) See also Williams (1951) and Mayo's (1933, 220-46) chapter, "The Rape of Owens Valley." One novel is *Golden Valley* by Gragg and Putnam (1950). One reason that the negative allegations were never challenged is that once Los Angeles had the water, it was not in the Board's interest to mount a rebuttal. Allegations regarding Owens Valley water theft are presented in web searches regarding environmental concerns, issues of urban sprawl, rural versus urban values, etc.

<sup>88</sup> Nadeau (1950, 132); Hart (1996); Gill and Cahill (1991).